

ENVIRONMENT MASTER PLAN NATURAL RESOURCE MANAGEMENT (ENVIRONMENT & SOCIAL GUIDELINES)



**GOVERNMENT OF HIMACHAL PRADESH
DEPARTMENT OF ENVIRONMENT, SCIENCE & TECHNOLOGY**

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Chapter 1: Introduction

Introduction: Develop Sectoral

Guidelines: These would aim to ensure that sectoral development has minimal adverse environment impacts, and would typically include the following:

- Typical environment issues for each sector and an impact matrix.
- Guidance on carrying out Environment Assessments (EAs),
- Terms of Reference (ToR) for carrying out Environment Assessments (EAs)
- Good practice examples to illustrate innovative solutions for identified issues while balancing economic, social and ecological considerations

Typical environment issues for each sector and an impact matrix.

Predicated on baseline data, environment and social issues have been identified. The identified issues, causes and impacts/risk have been addressed in the Sectoral guidelines by way of proposed actions, type of response and inter-sectoral responsibilities.

Guidance on carrying out Environment Assessments (EAs)

The Environment Impact Assessment in India is being done as per Environment Impact Assessment (EIA) notification, 2006 and subsequent amendments namely 1. SO 1737(E), dated the 11th October, 2007, 2. SO 3067 (E), dated the 1st December, 2009, 3. SO 695 (E), dated the 4th April, 2011, 4. SO 2896 (E) dated the 13th December 2012 and 5. SO 674 (E), dated the 13th March, 2013 and 6. amendment dated August 22, 2013 [File no. 21-270/2008-IA.III].

Stages in the Prior Environmental Clearance (EC) Process for New Projects

and Activities as per EIA notification, 2006 (and subsequent amendments) are described below:

The following projects or activities shall require prior environmental clearance from the concerned regulatory authority, which shall hereinafter referred to be as the Central Government in the Ministry of Environment and Forests for matters falling under Category 'A' in the Schedule and at State level the State Environment Impact Assessment Authority (SEIAA) for matters falling under Category 'B' in the said Schedule, before any construction work, or preparation of land by the project management except for securing the land, is started on the project or activity:

- (i) All new projects or activities listed in the Schedule to this notification;
- (ii) Expansion and modernization of existing projects or activities listed in the Schedule to this notification with addition of capacity beyond the limits specified for the concerned sector, that is, projects or activities which cross the threshold limits given in the Schedule, after expansion or modernization;
- (iii) Any change in product - mix in an existing manufacturing unit included in Schedule beyond the specified range.

Categorization of projects and activities:-

(i) All projects and activities are broadly categorized in to two categories - Category A and Category B, based on the spatial extent of potential impacts and potential impacts on human health and natural and man made resources.

(ii) All projects or activities included as Category 'A' in the Schedule, including expansion and modernization of existing projects or activities and change in product mix, shall require prior environmental clearance from the Central Government in the Ministry of

Environment and Forests (MoEF) on the recommendations of an Expert Appraisal Committee (EAC) to be constituted by the Central Government for the purposes of this notification;

(iii) All projects or activities included as Category 'B' in the Schedule, including expansion and modernization of existing projects or activities as specified in sub paragraph (ii) of paragraph 2, or change in product mix as specified in sub paragraph (iii) of paragraph 2, but excluding those which fulfill the General Conditions (GC) stipulated in the Schedule, will require prior environmental clearance from the State/Union territory Environment Impact Assessment Authority (SEIAA). The SEIAA shall base its decision on the recommendations of a State or Union territory level Expert Appraisal Committee (SEAC) as to be constituted for in this notification. In the absence of a duly constituted SEIAA or SEAC, a Category 'B' project shall be treated as a Category 'A' project;

Screening, Scoping and Appraisal Committees:-

The same Expert Appraisal Committees (EACs) at the Central Government and SEACs (hereinafter referred to as the (EAC) and (SEAC) at the State or the Union territory level shall screen, scope and appraise projects or activities in Category 'A' and Category 'B' respectively. EAC and SEAC's shall meet at least once every month.

- (a) The composition of the EAC shall be as given in Appendix VI. The SEAC at the State or the Union territory level shall be constituted by the Central Government in consultation with the concerned State Government or the Union territory Administration with identical composition;

- (b) The Central Government may, with the prior concurrence of the concerned State Governments or the Union territory Administrations, constitutes one SEAC for more than one State or Union territory for reasons of administrative convenience and cost;
- (c) The EAC and SEAC shall be reconstituted after every three years;
- (d) The authorised members of the EAC and SEAC, concerned, may inspect any site(s) connected with the project or activity in respect of which the prior environmental clearance is sought, for the purposes of screening or scoping or appraisal, with prior notice of at least seven days to the applicant, who shall provide necessary facilities for the inspection;
- (e) The EAC and SEACs shall function on the principle of collective responsibility. The Chairperson shall endeavour to reach a consensus in each case, and if consensus cannot be reached, the view of the majority shall prevail.

Application for Prior Environmental Clearance (EC):-

An application seeking prior environmental clearance in all cases shall be made in the prescribed Form 1 annexed herewith and Supplementary Form 1A, if applicable, as given in Appendix II, after the identification of prospective site(s) for the project and/or activities to which the application relates, before commencing any construction activity, or preparation of land, at the site by the applicant. The applicant shall furnish, along with the application, a copy of the pre-feasibility project report except

that, in case of construction projects or activities (item 8 of the Schedule) in addition to Form 1 and the Supplementary Form 1A, a copy of the conceptual plan shall be provided, instead of the pre-feasibility report.

Stages in the Prior Environmental Clearance (EC) Process for New Projects:-

The environmental clearance process for new projects will comprise of a maximum of four stages, all of which may not apply to particular cases as set forth below in this notification.

These four stages in sequential order are:-

Stage (1) Screening (Only for Category 'B' projects and activities)

Stage (2) Scoping

Stage (3) Public Consultation

Stage (4) Appraisal

I. Stage (1) - Screening:

In case of Category 'B' projects or activities, this stage will entail the scrutiny of an application seeking prior environmental clearance made in Form 1 by the concerned State level Expert Appraisal Committee (SEAC) for determining whether or not the project or activity requires further environmental studies for preparation of an Environmental Impact Assessment (EIA) for its appraisal prior to the grant of environmental clearance depending up on the nature and location specificity of the project. The projects requiring an Environmental Impact Assessment report shall be termed Category 'B1' and remaining projects shall be termed Category 'B2' and will not require an Environment Impact Assessment report. For categorization of projects into B1 or B2 except item 8 (b), the Ministry of

Environment and Forests shall issue appropriate guidelines from time to time.

II. Stage (2) - Scoping:

"Scoping" refers to the process by which the Expert Appraisal Committee in the case of Category A projects activities, and State Expert Appraisal Committee in the case of category 'B1' projects or activities, including applications for expansion or modernization or change in product max of existing projects or activities, determine detailed and comprehensive Terms of Reference (TOR) addressing all relevant environmental concerns for the preparation of activity for which prior environment (EIA) Report in respect of the project or activity for which prior environmental clearance is sought and the Expert Appraisal Committee or State level Expert Appraisal Committee concerned shall determine the terms of reference on the basis of the information furnished in the prescribed application Form 1 or Form 1A including terms of reference proposed by the applicant, site visit by a sub-group of Expert Appraisal Committee or State level Expert Appraisal Committee concerned only if considered necessary by the Expert Appraisal Committee or State Level Expert Appraisal Committee concerned, terms of reference suggested by the applicant if furnished and other information that may be available with the Expert Appraisal Committee or State Level Expert Appraisal Committee concerned:

Provided that the following shall not require Scoping

all project and activities listed as Category 'B' in item 8 of the Schedule (Construction or Township or Commercial Complexes or Housing) all Highway expansion projects covered under entry (ii) of column (3) and column (4) under sub-item (f) of item 7 of the Schedule:

Provided further that-

the projects and activities referred to in clause (i) shall be appraised on the basis of Form I or Form IA and the conceptual plan;

The projects referred to in clause (i) shall prepare EIA and EMP report on the basis of model TOR specified by Ministry of Environment and Forests;

(ii) The Terms of Reference (TOR) shall be conveyed to the applicant by the Expert Appraisal Committee or State Level Expert Appraisal Committee as concerned within sixty days of the receipt of Form 1. In the case of Category A Hydroelectric projects Item 1(c) (i) of the Schedule the Terms of Reference shall be conveyed along with the clearance for pre-construction activities. If the Terms of Reference are not finalized and conveyed to the applicant within sixty days of the receipt of Form 1, the Terms of Reference suggested by the applicant shall be deemed as the final Terms of Reference approved for the EIA studies. The approved Terms of Reference shall be displayed on the website of the Ministry of Environment and Forests and the concerned State Level Environment Impact Assessment Authority.

(iii) Applications for prior environmental clearance may be rejected by the regulatory authority concerned on the recommendation of the EAC or SEAC concerned at this stage itself. In case of such rejection, the decision together with reasons for the same shall be communicated to the applicant in writing within sixty days of the receipt of the application.

III. Stage (3) - Public Consultation:

(i) "Public Consultation" refers to the process by which the concerns of local affected persons and others who have plausible stake in the environmental impacts of the project or activity are ascertained with a view to taking into account all the material concerns in the project or activity design as appropriate. All Category 'A' and Category B1 projects or activities shall undertake Public Consultation, except the following:-

- (a) Modernization of irrigation projects (item 1(c) (ii) of the Schedule).
- (b) All projects or activities located within industrial estates or parks (item 7(c) of the Schedule) approved by the concerned authorities, and which are not disallowed in such approvals.
- (c) Expansion of Roads and Highways (item 7 (f) of the Schedule) which do not involve any further acquisition of land.
- (d) All Building /Construction projects/Area Development projects and Townships (item 8).
- (e) All Category 'B2' projects and activities.
- (f) All projects or activities concerning national defence and security or involving other strategic considerations as determined by the Central Government.

(ii) The Public Consultation shall ordinarily have two components comprising of:-

- (a) A public hearing at the site or in its close proximity- district wise, to be carried out in the manner prescribed in Appendix IV, for

- ascertaining concerns of local affected persons;
- (b) Obtain responses in writing from other concerned persons having a plausible stake in the environmental aspects of the project or activity.
- (iii) the public hearing at, or in close proximity to, the site(s) in all cases shall be conducted by the State Pollution Control Board (SPCB) or the Union territory Pollution Control Committee (UTPCC) concerned in the specified manner and forward the proceedings to the regulatory authority concerned within 45 (forty five) of a request to the effect from the applicant.
- (iv) in case the State Pollution Control Board or the Union territory Pollution Control Committee concerned does not undertake and complete the public hearing within the specified period, and/or does not convey the proceedings of the public hearing within the prescribed period directly to the regulatory authority concerned as above, the regulatory authority shall engage another public agency or authority which is not subordinate to the regulatory authority, to complete the process within a further period of forty five days.
- (v) If the public agency or authority nominated under the sub paragraph (iii) above reports to the regulatory authority concerned that owing to the local situation, it is not possible to conduct the public hearing in a manner which will enable the views of the concerned local persons to be freely expressed, it shall report the facts in detail to the concerned regulatory authority, which may, after due consideration of the report and other reliable information that it may have, decide that the public consultation in the case need not include the public hearing.

(vi) For obtaining responses in writing from other concerned persons having a plausible stake in the environmental aspects of the project or activity, the concerned regulatory authority and the State Pollution Control Board (SPCB) or the Union territory Pollution Control Committee (UTPCC) shall invite responses from such concerned persons by placing on their website the Summary EIA report prepared in the format given in Appendix IIIA by the applicant along with a copy of the application in the prescribed form, within seven days of the receipt of a written request for arranging the public hearing. Confidential information including non-disclosable or legally privileged information involving Intellectual Property Right, source specified in the application shall not be placed on the web site. The regulatory authority concerned may also use other appropriate media for ensuring wide publicity about the project or activity. The regulatory authority shall, however, make available on a written request from any concerned person the Draft EIA report for inspection at a notified place during normal office hours till the date of the public hearing. All the responses received as part of this public consultation process shall be forwarded to the applicant through the quickest available means.

(vii) After completion of the public consultation, the applicant shall address all the material environmental concerns expressed during this process, and make appropriate changes in the draft EIA and EMP. The final EIA report, so prepared, shall be submitted by the applicant to the concerned regulatory authority for appraisal. The applicant may alternatively submit a supplementary report to draft EIA and EMP addressing all the concerns expressed during the public consultation.

IV. Stage (4) - Appraisal:

(i) Appraisal means the detailed scrutiny by the Expert Appraisal Committee or State Level Expert Appraisal Committee of the application and other documents like the Final EIA report, outcome of the public consultations including public hearing proceedings, submitted by the applicant to the regulatory authority concerned for grant of environmental clearance. This appraisal shall be made by Expert Appraisal Committee or State Level Expert Appraisal Committee concerned in a transparent manner in a proceeding to which the applicant shall be invited for furnishing necessary clarifications in person or through an authorized representative. On conclusion of this proceeding, the Expert Appraisal Committee or State Level Expert Appraisal Committee concerned shall make categorical recommendations to the regulatory authority concerned either for grant of prior environmental clearance on stipulated terms and conditions, or rejection of the application for prior environmental clearance, together with reasons for the same.

(ii) The appraisal of all projects or activities which are not required to undergo public consultation, or submit an Environment Impact Assessment report, shall be carried out on the basis of the prescribed application Form 1 and Form 1A as applicable, any other relevant validated information available and the site visit wherever the same is considered as necessary by the Expert Appraisal Committee or State Level Expert Appraisal Committee concerned.

(iii) The appraisal of an application shall be completed by the Expert Appraisal Committee or State Level Expert Appraisal Committee concerned within sixty days of the receipt of the final

Environment Impact Assessment report and other documents or the receipt of Form 1 and Form 1 A, where public consultation is not necessary and the recommendations of the Expert Appraisal Committee or State Level Expert Appraisal Committee shall be placed before the competent authority for a final decision within the next fifteen days.

Prior Environmental Clearance (EC) process for Expansion or Modernization or Change of product mix in existing projects:

All applications seeking prior environmental clearance for expansion with increase in the production capacity beyond the capacity for which prior environmental clearance has been granted under this notification or with increase in either lease area or production capacity in the case of mining projects or for the modernization of an existing unit with increase in the total production capacity beyond the threshold limit prescribed in the Schedule to this notification through change in process and or technology or involving a change in the product –mix shall be made in Form I and they shall be considered by the concerned Expert Appraisal Committee or State Level Expert Appraisal Committee within sixty days, who will decide on the due diligence necessary including preparation of EIA and public consultations and the application shall be appraised accordingly for grant of environmental clearance.

Analysis of Sectors, Sub-Sectors and departments identified for preparation of Environment Master Plan of Himachal Pradesh in relation to projects or activities requiring prior environmental clearance as identified in the EIA Notification 2006, under Environment Protection Act, 1986, MoEF, Government of India is given below in table. The specific

recommendations and activities for engaging with public and other stakeholders related to sectors/ subsectors and which do not require public hearing as per EIA notification is given below in table. For sectors/ subsectors as identified for Environment Master Plan, which do not require public hearing as per EIA notification, progressive levels of Public Participation can be followed to engage with public and consult with stakeholders at large. These could also be

dovetailed in the existing mechanism of public hearing for projects/ activities as mandated by EIA notification.

Analysis of Sectors and Sub-Sectors identified for Environment Master Plan of Himachal Pradesh in relation to projects or activities requiring prior environmental clearance and public hearing and those which do not require public hearing as per EIA notification

Natural Resource Management (NRM) Sector

Subsectors	Corresponding project/ activity and no. as per EIA notification and need for Public Consultation	Recommended Public Consultation mechanism and activities in the context of Himachal Pradesh and Environment Master Plan for sectors not requiring Public hearing as per EIA notification, 2006
10 Agriculture	Public hearing not required.	All sectoral policies, plans, programmes projects, schemes, mission mooted by the State Agriculture Government should be discussed with concerned departments and communities at PRIs and ZP level Integrate all activities with District Planning process and integration with Comprehensive District Agriculture Plans
11 Horticulture	Public hearing not required.	All sectoral policies, plans, programmes projects, schemes, mission mooted by the State Agriculture Government should be discussed with concerned departments and communities at PRIs and ZP level Integrate all activities with District Planning process and integration with Comprehensive District Agriculture Plans
12 Animal Husbandry Livestock	Public hearing not required.	All sectoral policies, plans, programmes projects, schemes, mission mooted by the State Agriculture Government should be discussed with concerned departments and communities at PRIs and ZP level Integrate all activities with District Planning process and integration with Comprehensive District Agriculture Plans
13 Forests, Wildlife and Wetlands	Public hearing not required.	All sectoral policies, plans, programmes projects, schemes, mission mooted by the State Forest and Wildlife Department Government should be discussed with concerned departments and communities at PRIs and ZP level Integrate sectoral policies, plans, programmes projects, schemes, mission with District Planning process and integration with Wildlife Management plans, Wetlands Management Plan, Management Plan of National Parks and Sanctuaries working area
14 Fisheries	Public hearing not required.	All sectoral policies, plans, programmes projects, schemes, mission mooted by the State Agriculture Government should be discussed with concerned departments and communities at PRIs and ZP level

Subsectors	Corresponding project/ activity and no. as per EIA notification and need for Public Consultation	Recommended Public Consultation mechanism and activities in the context of Himachal Pradesh and Environment Master Plan for sectors not requiring Public hearing as per EIA notification, 2006
		Integrate all activities with District Planning process and integration with Comprehensive District Agriculture Plans

Terms of Reference (ToR) for carrying out Environment Assessments (EAs)

As per EIA notification 2006, Ministry of Environment and Forests has issued ToR of sectors for 8 broad categorization of projects or activities requiring prior environmental clearance as given in Schedule for the purpose of scoping required for EIA.

Ministry of Environment and Forests, 2009 issued Terms of Reference of 8 sectors for Environmental Impact Assessment of 1. Ports and harbours, 2. Airport development/ expansion / modernization, 3. Highway projects, 4. Building construction, Township and area development, 5. Mining of minerals, 6. Mineral beneficiation, 7. Asbestos based industries and 8 Coal washeries. Sector wise detailed ToR can be accessed on: http://envfor.nic.in/sites/default/files/so2561-050913_2.pdf

Development activity-specific ToR of Twelve sectors namely Cement Plants, Chemical Fertilizers, Chemical Effluent Treatment Plants, Common Municipal Solid Waste Management Facility, Distilleries, Industrial Estates, Offshore and onshore oil and gas exploration development and production, Pulp and Paper industry, Ship Breaking Yards, Sugar Industry and Thermal Power Plants for EIA studies have been prepared by IL&FS for MoEF. Sector wise detailed ToR can be accessed on: <http://environmentclearance.nic.in/writereaddata/Form->

1A/HomeLinks/12%20Model%20TORs.pdf

Besides, MoEF has issued Model ToR for River Valley and Hydel Projects, Guideline Manual for River Valley Project sector, Coal sector and general instructions for submission & consideration of ToR/EC applications of coal sector projects which can be accessed on <http://environmentclearance.nic.in/writereaddata/Form-1A/HomeLinks/ommodel.html>

Besides, 37 sectoral manuals under EIA Notification, 2006 has been prepared for providing guidance to the project proponent and developers seeking environment clearance. MOEF has issued 10 sectoral manuals for sectors namely Mining, Mineral Beneficiation, Ports and Harbours, Airports, Building and Townships Construction, Asbestos, Highway, Coal Washery, Aerial Ropeways, Nuclear Power Plants, Nuclear Fuel Processing plants and Nuclear Waste Management Plants. Besides, IL&FS (for MoEF) has prepared 27 EIA manuals for Thermal Power, Cement, Ship Breaking Yards, Chemical Fertilizers, Sugar, Distilleries, Leather/Skin/Hide Processing Industry, Offshore and On-shore Oil & Gas Exploration, Development & production, Common Effluent Treatment Plants (CETPs), Industrial Estates, Pulp & Paper, Common Municipal Solid Wastes, Petroleum Refineries, Petrochemical

Plants, Pesticides and Pesticide Intermediates, Chlor Alkali Industry, Synthetic Organic Industry, Petrol-chemical based production, Coke Oven Plants, Soda Ash, Integrated Paints, Man-made Fibre, Oil & Gas Transportation pipe-line, Isolated Storages and handling of hazardous chemicals, Metallurgical Industries, Induction/Arc Furnaces and Common Hazardous Waste Treatment, Storage and Common Hazardous Waste Treatment, Storage and Disposal Facilities

Good practice examples to illustrate innovative solutions for identified issues while balancing economic, social and ecological considerations.

The Environment and Social guidelines includes existing and documented good practices (relating to identified issues, threats and impacts) from Himachal Pradesh, Himalayan and other regions, including relevant international good practices to address and mitigate negative impacts and strengthen the services in the sector through awareness programmes, training and capacity building.

Background

The Government of Himachal Pradesh (HP) has decided to prepare an Environment Master Plan (EMP) to mainstream environmental concerns into the State development agenda in the next three decades and beyond. The preparation of EMP entailed numerous tasks including development of 18 sector specific guidelines other than collection of baseline environmental data related to the sector, conducting spatial vulnerability assessment, developing public consultation and communication strategy, institutional mechanism, establishing training and capacity

enhancement, developing monitoring and evaluation protocol for implementation of EMP.

It is expected that sector specific guidelines will be either guided by or will get influenced by State level EMP (see Figure 1). Vulnerability assessment of different environmental components will guide the preparation of State level EMP. There is a possibility that all the environmental and social issues are sector specific or are of cross-sectoral nature and might not be addressed in the EMP. The sector specific guidelines will aid in mainstreaming such gaps and strengthening of the EMP. In practice, the guidelines will also encourage inter-sectoral coordination between various State Departments and other relevant agencies to ensure enhanced outcomes.

Finally, the guidelines will address sector specific environmental and social issues and their management. The guidelines will also delineate good practices and measures to mitigate the negative impacts and strengthen the services in the sector through awareness programmes, training and capacity building.

1.1 Forests & Wildlife

Need for the present guidelines

The forests and other natural ecosystems constitute two-third of the geographical area of the State and are crucial for its environmental (ecological) and economic well-being. The influence of the State's forests transcends well beyond its boundaries, significantly impacting on the ecology and economy of the Indo-Gangetic plains. The forests of the State are rich in biodiversity and play a vital role in preserving the fragile Himalayan ecosystem while also being a primary source of livelihood for the

rural population and the prime source of fresh water for both urban and rural population. Forests, besides performing important ecological and watershed functions, provide essential services, such as food, fuel wood, fodder, timber and raw material for forest based industries and non-timber forest products.

As per land use data India State of Forest Report 2011, 66.52% of the total geographical area of the State is recorded forest areas; however, the extent of actual forest cover on all categories of land is only 26.37% which include Very Dense Forest (5.79%), Moderately Dense Forest (11.46%), Open forest (9.11%) & Scrub (0.59%). Himachal Pradesh has 13.65% of its area under two National Parks and 33 Wildlife Sanctuaries, which are home to some rare and endangered fauna and floral species such as the snow leopard, musk deer, pheasant and Himalayan yew. The cold desert region of the State comprising Spiti sub-division of Lahaul and Spiti District and Pooh sub-division of Kinnaur District is a distinct biome and manifests remarkable ecological and biological diversity with unique characteristics of isolation and marginality.

Latitudinally, the State falls in the tropical zone, but its geographical location and good forest cover have enriched it, both biologically and economically. During the immediate post-Independence period, planners identified the forests of the State primarily as a source of timber and other forest products. This led to large-scale felling and clearing of forest areas. Excessive pressure on forests to meet the timber needs of industries in the plains and of the flourishing horticulture industry in the State resulted in diminished supply of goods and services for public at large which ultimately created public consciousness in favor of conservation of forests rather than its

excessive use for economic consideration.

A vast majority of the population of the State is rural and largely depends for its livelihood, either directly on forest products or indirectly on the Products made from produce forest. Therefore, it is desirable to protect & conserve the forests so as to harness goods and benefits for longer terms by adopting sustainable forest management till perpetuity. Unsustainable practices, often due to excessive anthropogenic pressure create conditions inimical for sustainable development of forest resources. This leads to forest degradation and diminished forest benefits. There is also a loss of suitable habitats for the growth of indigenous and endemic species which are important components of bio-diversity. The consequent environmental deterioration led to unsuitable conditions to sustain the traditional fruit plants and as a result, the farmers are now switching over to alternative land use practices. Thus, the forest degradation in higher reaches has had adverse ecological impacts on lower hill agriculture and horticulture. This has gradually been affecting the economy of the hill people.

The forests of Himachal Pradesh are not only of importance to the State, but also have a strong influence on the climate, ecology and consequent bio-resources of then eight neighbouring States. Glaciers flowing from the Tibetan hills (China) and the melting snows on the hill slopes feed the rivers originating in the State and provide water to other States. The forest cover of Himachal Pradesh therefore, not only regulates the rainfall in the neighboring areas but also ensures snowfall in the high mountains. Although there may not be any direct visible impact of forest degradation and glacier formation, indirectly

melting of snow in the higher hills cause flash floods both in the hills and plains of the neighboring States. In the absence of dense forest cover, the Himalayan slopes are subject to desiccation and consequently resulting in melting of snow and flash floods in the rivers down below.

The life supporting systems in the State are now under great stress due to the impact of unsustainable development, on the pretext of economic development. Growth in human and cattle population is also contributing to depletion of forest cover. According to the National Forest Policy, 1988, at least two-thirds of the geographical area should be under forests in mountainous States like Himachal Pradesh. The recorded forest area of the State as per Indian State of Forest Report 2011 is 37,033 sq km. Reserved forests constitute 5.13%, protected forests 89.27% and unclassified forests 5.41% of the total forest area. As per land use statistics, Ministry of Agriculture, Government of India, 2008-09, 1,101,000 ha forest was recorded which was 24.21% of the total geographical area of the State. However, there is a potential to increase the forest cover up to 35.5 % of the total available area, which can be brought under forest and tree cover as the remaining area is inaccessible, under permanent snow cover and above the tree limit.

The forests are still contributing to about 2% to the National Domestic Product, while in Himachal Pradesh their share in the State GDP is about 8%. This does not include the value of services resulting from extension of ecological influences in the form of water flow and consequent production downstream.

Forest resources of Himachal Pradesh play an important role in the development of the economy and preserving the environment. Population growth has caused increasing pressure on the limited land available for agriculture and the forests remain the principal source of grazing, fuelwood, fodder

and other Non Timber Forest Products. Non-wood forest products constitute an important source of livelihood for the poor and especially the forest fringe dwellers. The question of timber distribution rights has also been cited as one of the reasons for forest degradation in case the regulations are not properly implemented and monitored. Therefore, in the light of the increasing demand placed on the forest with its diminished capacity to meet the forest needs of the people, sustainability has become the major challenge which is being felt at all levels.

The Forest Department concerns itself mostly with the conservation and sustainable management of forests and afforestation. The forest sector has to meet many diverse demands for forest products and services as the country has experienced three policy phases since Independence that is Industrial Forestry, Social Forestry and Protection/Regeneration. While forest degradation cannot be fully controlled or reversed, there is a limit to increasing the extent of forest area in the State. As per the National Forest Policy, mountainous States like Himachal Pradesh are required to have two-third of the total land area under forest cover (the State Forest Policy stipulates 50% forest area); the availability of resources, mostly land is a big challenge. Although 66.52% of the geographical area of the State is the recorded forest area, the extent of actual forest cover on all categories of land in the State is only 26.37% as per India State of Forest Report 2011. The only way out appears to involve farmers to plant trees by offering them fiscal as well as non fiscal incentives. While forest cover per se may not see any drastic increase in forest area of the State, the tree cover may make up for forest cover. Growing of trees with horticulture and agriculture is not only economically remunerative but also have carbon in centives when ever the country decides to include this in Clean Development Mechanism paradigm.

Therefore it should, be imperative in the forest sector policy to make investments on Sustainable Forest Management and Bio-diversity Conservation on one hand and on the other, involve local people and prospective tree farmers on large-scale tree planting. In order to implement these policy prescriptions, the State should make rules on tree planting to make its harvesting more facilitative.

Wild life conservation is a function of natural habitat protection. Wildlife conservation may receive boost once the ecological management improves and communities are sensitized towards the protection of natural habitats. Communities can and should play an active and useful role against poaching.

As per Himachal forest Statistics 2010, The existing network of Protected Areas (PA) has 33 wildlife sanctuaries (5732 sq kms) and 2 National Parks (1429 sq kms) covering a total geographical area of 7161 sq kms. These protected areas are managed as per specific management plans. It is necessary to have new management plans incorporating the new concepts of bio-diversity conservation and wild life management.

It may not be rational to calculate the tangible value of forests through sale of timber obtained from salvaged felling or through timber distribution rights. The actual forest value is in tangible such as watershed functions and other ecological services valued many more times than the direct forest revenues. Therefore, it is not possible to meet out the sustainable forest development investments purely from revenues realised from sale of timber and non-timber products. The State should allocate a proportionate budget for forest development activities as the gain from it have a great influence on agriculture, horticulture, environment and the overall sustainable development goal of the State.

Objectives

The objectives of the guidelines are as follows:

- Develop awareness about the issues related to forests and wildlife conservation governance.
- Provide information on key policy, plans and regulations.
- Introduce good practices to manage forests and wildlife.
- Encourage coordinated planning within the State Departments.
- Address vulnerability related aspects.

Target Audience

The key players for the guidelines include the following:

- State and Local Self Government (including Panchayati Raj Institutions) to offer incentives/subsidies to adopt good practices related to forests and wildlife conservation management.
- Department of Forests, Department of Environment Science & Technology, H.P. State Council for Science, Technology & Environment, H.P. State Pollution Control Board, Department of Tourism and Civil Aviation Department of Fisheries, Department of Irrigation and Public Health (IPH).
- NGOs, CBOs, Students groups and other training institutions for awareness on forest and wildlife conservation.

1.2 Wetlands

Need for the present guidelines

Wetlands are among the most productive ecosystems known to play a significant role in carbon sequestration. In Himachal Pradesh occupy 1% of the total geographical area coverage an area of 2.25 hectare. These are 92

wetlands in the State, out of which 7 are man-made and 85 are natural wetlands. In addition, 176 wetlands smaller than the minimum mapping unit belonging to natural type also exist. Natural wetlands mainly comprise lakes/ponds whereas manmade wetlands are reservoirs constructed mainly for irrigation or generation of hydro-electricity. Pong dam, Renuka and Chandratol which have been identified as Ramsar sites are wetlands of international significance.

Wetlands in India are disappearing at a rate of 2% to 3% every year. Increasing human inhabitation in the catchments, urbanisation and various anthropogenic activities have resulted in over exploitation of wetland resources, leading to degradation and perishing of result, wetland ecosystems.

In Himachal Pradesh, increasing developmental pressure for residential, industrial and commercial facilities due to reclamation of wetlands and low lying areas for construction purposes and dumping of waste is leading to the deterioration of wetlands.

Anthropogenic activities like unplanned urban and agricultural development, industries, road construction, impoundments, resource extraction and dredge disposal are leading to deterioration of wetlands.

Agricultural activities like conversion of wetlands for agriculture use, construction of reservoirs, canals and dams, diversion of streams and rivers to provide for irrigation is leading to the deterioration of wetlands.

Deforestation and removal of vegetation in the catchment of wetlands leads to soil erosion and siltation.

Illegal dumping of sewage, solid wastes, toxic chemicals from industries, and unrestricted dumping by households and tourist destinations lead to pollution of wetlands.

Objectives

The objectives of the guidelines are as follows:

- Develop awareness about the environment issues related to wetland and its conservation and management.
- Provide information on key policies, plans and regulations related to wetlands.
- Introduce good practices for conservation and management of wetlands.
- Encourage integrated management planning within State departments.
- Address vulnerability aspects related to wetlands on the basis of limnological investigations.

Target Audience

The target audience is supposed to be educated regarding the structural functioning of these systems in order to conserve wetlands ecologically.

The key players for the guidelines include the following:

- State and Local self Government (including Panchayati Raj Institutions) to adopt good practices related to wetland conservation and management.
- H.P. Forest Department, Department of Tourism & Civil Aviation, Tourist Development Councils, Department of Fisheries, Irrigation and Public Health (IPH), Urban Local Bodies, Urban Development Department and other related departments for coordinated future planning.
- NGOs, CBOs, CSOs and other training institutes for awareness.
- People of HP to adopt and practice wetland conservation and management practices.

1.3 Fisheries

Need for the present guidelines

Fishery industry in the State provides livelihood for the fishermen generate revenue for the State and fish farms are foundation stones of fisher's development. The service providers in the sector are fish ponds, rivers, lakes, reservoirs etc. Fisheries support services are provided through 12 fish seed farms under the control of other water bodies of Himachal Pradesh's Fisheries Department. Out of 12 fish seed farms, 6 are trout farms and another 6 are carp farms. The average annual production of fish from the trout farms is about 77 tonnes while seed production from carp fish farm is about 20 million per annum.

The streams of Himachal Pradesh fall under two categories; general water and trout water, with an estimated length of 600 and 2400 kms respectively. The major fish species available in these streams are Trout, Mahseer and other species like Nemacheilus, Barilus, Glyptothorax, Schizothoracids, Crossocheilus, etc.

As per, "An Evaluation Study of Community Fish Pond in Himachal Pradesh, 2009", the types of construction of ponds were found to be kutchha, pucca & semi pucca. Amongst the three types of ponds, 22 (68.75%) out of 32 are kutchha ponds, 6 (18.75%) are pucca ponds and 4 (12.50%) ponds are semi pucca. The majority of ponds i.e. . 46.88% are rain water based, 43.75% have natural drain and only 9.37% are based on artificial rain.

About 53.12% ponds are maintained by the Panchayat while the remaining 46.88% ponds are maintained by Panchayat through individuals on a lease basis. The procurement of fish seeds for majority of ponds (66.67%) is been done from government source and for remaining 33.33% ponds from private source.

Percentage of non functional ponds is on a higher side in Mandi Distt. 75%, followed by Shimla 66.67% and Solan 66.67%. Majority of ponds i.e. 56.25% are functional while remaining 43.75% ponds are non functional. About 7 ponds out of 14 are non-functional due to non-availability/lack of water supply, besides other reasons like leakage of water, damages due to rain/flood, due to lack of proper training/lack of responsibility, non-completion/non introduction of fish seed. It has been observed that 7 out of 14 ponds are non-functional due to improper source of water while 6 ponds are non functional due to low rains. It has been reported that two ponds in Chamba District and 1 pond in Hamirpur District are non-functional due to poor construction quality. 1 pond in Shimla is non-functional due to lack of repair. One pond in Chamba and 2 ponds in Mandi are non-functional due to other reasons like absence of responsibility of Panchayat and non-completion of ponds.

As per census 2001, the State has 5580 registered fishermen. During the same period, approximately 3851 MT fish production was recorded in the State. The Department of Fisheries data indicates that the highest production of fisheries comes from the river. The production of fish from river in the year 2007 was 4027.2 MT, which slightly increased to 4170.1 MT in the year 2009. The pond production was 2013.1 MT in 2007 which increased to 2268.2 MT in the year 2009. The Carp production continuously decreased from the year 2007 to 2009.

Gobind Sagar Reservoir and Pong Reservoir of Himachal Pradesh have mean water spread of 25,000 ha. A total of 51 species belonging to nine families (Cyprinidae, Cobitidae, Bagridae, Schilbeidae, Sisoridae, Belonidae, Ophiocephalidae, Mastocem belidae and Salmonidae) have been encountered in the Gobind Sagar Reservoir. During 2009-10 alone, a total of 1515.27 tonnes of fish valued at Rs. 841.90 lakhs was harvested by 3586

fishermen from Gobind Sagar & Pong Reservoir. The Department's income from fish harvesting from these reservoirs during 2009-10 was Rs. 228.59 lakhs. Gobind Sagar has been maintaining a unique distinction of highest per hectare fish production (over 48 to 100 kgs/ha.) for over a decade. The Pong Reservoir fishermen are getting highest per unit price for their catch at landing sites (Rs. 41-83/ kg.) in the country. The production of *L. rohita* was 3.46 tonnes during 2009-10, silver carp was 737 tonnes while the mirror carp was 215.33 tonnes. The landing of carnivore fish during 2009-10 has been recorded as 13.63 tonnes. Due to concrete efforts from the Department during the year 2009-10, the fish production from Gobind Sagar reservoir recorded at 1090.89 tonnes is the highest during the last five years. There are 3881 fishermen recruited from 5500 oustees settled near the Gobind Sagar Reservoir. On an average, 40% of the fishermen are educated. The monthly income of the fishermen ranges from Rs. 800 to Rs. 3000. Besides, direct employment to approximately 1000 families, the State provided livelihood to about 1000 additional families engaged in helping the fishermen e.g. carrying/ transportation, packing of fish, fishing crafts/gears, repair, sale of fish etc.

Pong Reservoir has a catchment area of 1256 sq kms and mean water spread of 15662 ha. A total of 27 species belonging to eight families (Cyprinidae, Cobitidae, Bagridae, Siluridae, Sisoridae, Belonidae, Ophiocephalidae and Mastocembelidae) have been encountered in the Pong reservoir. The reservoir catches are now dominated with catfish like Singhara. However, the catches have plummeted to 246 tonnes during 2009-10. During 2009-

10, the percentage composition of indigenous carps, cat fish, mirror carp, mahseer and others was 25.4% (107 tonnes), 58% (246 tonnes), 5.9% (24 tonnes), 9% (38.31 tonnes) and 1.08% (4.58 tonnes) respectively. During the year 2009-10, the mirror carp catches has

been recorded as 24 tonnes. During 2009-10, total landing of mahseer was 28 tonnes i.e. 9% of the total catch. The average yield during 2009-10 was 26.34 Kg/ha. The department's revenue from the reservoir during 2009-10 was recorded as 63.18 lakhs. There are 2825 active fishermen recruited from 4000 oustees settled near the reservoir. These fishermen are organized into 15 cooperative societies. Besides direct employment to over 2014 fishermen, the fishing activities provide indirect job to over 1000 families engaged in helping fishermen, carrying/transportation, packing of fish, weaving and mending of gears, marketing etc. On an average, 30% of the fishermen have education up to primary level. The monthly income of the fishermen has gone upto Rs. 1500 per month during 2009-10.

Dams alter water flow characteristics downstream and thus may affect aquatic stocks in many different ways including: water velocity; volume of discharge; water chemistry; temperature, turbidity and the stream's ability to purify its waters. There may be alterations in the amount of living space for fish, including the extent of spawning, nursery, and feeding grounds.

Effects of Flooding and Siltation

A common feature of man-made lakes & reservoir is that the historic spawning grounds for certain fish are drowned. These grounds may be the riffles of streams or quiet backwater areas of specific depth, bottom and cover types that took a long time to evolve. Water level control during spawning seasons can offset the drowning of spawning grounds and stranding of nest sites. This is particularly important for such fish as bass and sunfish of the family Centarchidae, various species of tilapia, and many kinds of catfish.

Effects of Drainage, dredging and other Engineering Practices

Commonly included among the secondary engineering practices required for reservoir development are drainage, dredging and modification of stream courses and banks. All of these have some bearing on fisheries and public health. Even though drainage of swamps and marshes, dredging to ensure open channels, ditching of streams and straightening of their banks may be assets for engineering and public health purpose, they are sometimes also known to be liabilities. Effects of Pollution as regards for fishery and wildlife production.

Fisheries is one of the assets created from man-made lakes and reservoir that can be destroyed or seriously reduced by pollution. Forms of pollution that have been found to be damaging to aquatic production include silt, sewage, nutrient inputs from sewage treatment plants, fertilisers washed from agricultural land and toxic chemicals released from industry or pesticides.

As per Central Pollution Control Board Data for 19 locations in the State (surface water quality criteria, Designated Best Use (DBU), pH was found both exceeding and low as per the permissible limit, while Dissolve Oxygen was found below 4 mg/l in 35 locations from April, 2005 to January 2008.

The guidelines provide directions to target audience for addressing and managing identified environmental and social issues in order to strengthen efforts to reduce the burden of surface water pollution. The guidelines delineate various good practices and measures to overcome the present issues related to the sector in the State.

Objectives

The objectives of the guidelines are as follows:

- Develop awareness about the issues related to fisheries' sector particularly with regard to shrinking of wetland/waterbody/reservoir area due to change in land use, human & livestock activities, pollution, deforestation/removal of vegetation/grazing in the catchment is leading to soil erosion and siltation of the wetland/water body/reservoir. Agriculture-horticulture activities in the wetland/reservoir/water body buffer zone, fringe areas and catchment areas, poor surface water quality due to unrestricted dumping of sewage, solid wastes and toxic chemicals from households, tourists' destination and industries leading to water pollution and eutrophication of wetlands/waterbody/reservoir, depletion of benthic flora and fauna in wetlands/reservoir/water body due to dredging/desilting. Poor enforcement of regulated activities due to jurisdiction issues on account of unclear land tenure, change in natural flow/hydrology and water dynamics of the reservoir/wetland/water body and uncontrolled/unregulated tourism in the buffer zone leading to disturbance of fish feeding and breeding habitat.
- Provide information on key policy, plans and regulations.
- Introduce good practices to enhance sector development & associated services.
- Encourage coordinated planning within State departments.
- Address vulnerability related aspects.

Target audience

The key audience for the guidelines include the following:

- State and Local self Government (Panchayati Raj Institutions) including Department of Fisheries, Department of

Forest, Department of Irrigation & Public Health (IsPH), Municipalities, Department of Industries, State Pollution Control Board (SPCB) and private sector stake holder for future planning.

- NGOs, fisherman co-operative societies, reservoir management committee and other training institutes for awareness development.
- People of Himachal Pradesh who are directly or indirectly associated with fishing activities and fisheries management.

1.4 Horticulture

Need for the present guidelines

Himachal Pradesh is endowed with rich natural resources and varied agro- climatic conditions suitable for growing different varieties of fruits and flowers. At present more than thirty types of fruit species are being grown in the State; maybe on a large or small scale but they are available within the State. Major fruit varieties grown– apple, apricot, peach, pear, plum, almond, walnut, pecan nut, mandarin, sweet orange, Kagzilime, hillemon, mango, guava, papaya, litchi, kiwi fruit, olive and strawberry.

Fruit production, has increased from 1200 metric tonnes during the year 1950-51, to 0.28 lakhs metric tonnes during the year 2010-11. Which is about 857-terms increase in during these production sixty years.

Sub- tropical fruits such as mango, litchi, guava, citrus etc., mature about one month later than in the plains thus fetching better prices. Temperate fruits cover about 64% of the total cultivated area of the State, of which more than 40% is under apple cultivation. The area under fruits more than doubled in the last two decades. Similarly, the productivity of apple has almost doubled to 4500 kgs per ha till the year 2000-01, but the

productivity of nuts and dry fruits, citrus and other sub-tropical fruits has decreased even though the area under these crops increased. The production of apple crop during the year 1988-1990 was at its peak.

Nuts and dry fruits cultivation showed an increase in area from 231 ha in 1960- 61 to 11,022 ha in the year 2010-11, citrus and other sub tropical fruits have increased from 1,225 ha and 623 ha in 1960-61 to 22,305 ha and 49,391 ha in 2010-11, respectively. Unfortunately, the production of other fruits has not steadily increased over the years.

Due to heavy production and less price in the markets, a total of 111087.12MT apple has been procured by Horticulture Produce Marketing and Processing Corporation Ltd (HPMC) and HIMFED (65508.060 MT & 45579.060 MT) under Market Intervention Scheme (MIS) during the year 2010-11, out of which 10489 MT of apple was processed, 27936MT was consigned to markets/auction yard, Parwanoo for sale to the private processor and the remaining apple crop was used for making vermi-compost. The HPMC and HIMFED did not receive any mango fruits from the growers due to good return from the open market and also procured 16 MT of citrus fruits from the growers till date under the scheme.

About one-seventh of the fresh fruit trees are non-bearing while in case of dry fruits, the proportion of non-bearing trees is about one-eighth of the total plantation. The total plantation covers about 16% of the area under fruit. Tree District Shimla and Kinnaur have the largest number of non-bearing fresh taint trees as well as dry fruits. Favorable agroclimate conditions provides excellent opportunities for cultivation of large varieties of Horticulture products as economic cash crops. For the development of Flori culture in the State seven Floriculture Nurseries and a model Horticulture can be in various part of the State has been established.

Due to inadequacy of irrigation facilities, the production of fruits which was 4,820 MT in 1990-91 declined to 3,105 MT during 1998-99 in Bilaspur.

Plants grown on clonal rootstock are distinguished from other trees by low height, uniformity in fruit size, colour and early fruiting. The trees do not survive beyond 40 years against trees grown from seeds that live up to 70 years.

So far no regular walnut orchard has been planted in the State by any fruit grower. The reasons for slow expansion of walnut cultivation in the State are: the non-availability of grafted plants of superior cultivars due to inadequacy of effective propagation techniques and the walnut plants raised by seeds show high variability and trees assume very large size whereas the farmers have very limited land holdings.

Horticulture sector deal with a complex set of Natural Resource Management and environmental issues which include: declining production of apples and other fruits due to inadequate chilling period in winters; premature fruit fall/dropping due to unscientific practices of horticulture activities; soil erosion due to structure of soil and inadequacy of knowledge about soil erosion resistant plant species; environment and public health risk due to indiscriminate & wide spread use of chemicals; human and animal health risk due to decline in agro-eco environment; change in land use pattern; lack of awareness about new technology and their use; in adequacy of post harvest management and threat from invasive and alien plants and animals damaging crops.

Objectives

The objectives of the guidelines are as follows:

- Develop awareness about the issues related to horticulture sector, considering risks due to social and environmental issues like water pollution, soil erosion, inadequate of chilling period due to climate change, air pollution, reduced productivity of horticulture produce, access of road and transportation facilities, change in land use pattern, use of pesticides/fungicides/insecticides, organic farming & bio-fertilisers.
- Provide information on key policy, plans and regulations.
- Introduce good practices to enhance sectoral development & associated services.
- Encourage coordinated planning among State Departments.
- Address vulnerability related aspects.

Target audience

The key players for the guidelines include the following:

- State and Local Self Government including Department of Horticulture, Department of Agriculture, HP Horticulture Produce Market & Processing Corporation (HPMC), HP State Cooperative Marketing & Consumer Federation Limited, Department of Transport, Department of Environment, Science and Technology, private registered nurseries & private related sectors for future planning and plant protection centres.
- NGOs, Civil Society Organisations (CSOs) CBOs demonstration and other training institutes for awareness development.
- Bonafide People and farmers of Himachal Pradesh who adopt management practices.
- Plant Health Clinics, Biological Control Laboratories & Plant Tissue Analysis Laboratories.

1.5 Agriculture

Need for the Present Guidelines

Agriculture is the main occupation of the people of Himachal Pradesh. It has an important place in the economy of the State. It provides direct employment to 69% of the total workers of the State. The prime land available for agriculture lies in Palam, Balh, Paonta Valleys and small strips in Nalagarh, Chachyot, Kangra, Spiti and Saproon Valleys which contribute to less than 5% of the total geographical area. Total area available for agriculture is less than 17%.

The topography of the State is largely hills where cultivation is mainly done on terraces. The cultivation in hills is subjected to soil erosion since crop cultivation is practiced on 5% to over 30% slopes. This also affects the soil fertility status and there are changes in pH values as well. Cultivation is mainly (81.5%) rain dependent. The size of land holdings of one or less than one ha covers 68.17% farming community. The small and marginal farmers put together account for 87.03% and cover an area of 51.96%. The medium farmers with land holding ranging from 2 ha to 10 ha cover an area of 41.84%.

The State of Himachal Pradesh has been divided into four agro-climatic zones. This indicates a vast potential for growing diverse crop plant species. These major zones are:

- (i) Shivalik Hill Zone
- (ii) Mid Hill Zone
- (iii) High Hill Zone
- (iv) Cold Dry Zone

The net cultivated area constitute only 17.2% of the total area (2001). The cropping

intensity was 176.0% during 2005-2006. In the past, diversity in agriculture had been such that it fitted well in the prevailing agro-ecological conditions. For instance, cultivation of crops and varieties with good tolerance of drought conditions in the rain fed agriculture ensured minimum production levels. Truly, these were low yielding but were tolerant to particular soil conditions, insect-pest incidences, disease epidemics and climatic adversities and thus complete crop failures were rare.

At present, high yielding varieties demand high input, better crop protection and good agronomic management to deliver in accordance with their potential. Moreover, some crops or varieties not finding favour with the changed life style of people have gone out of cultivation. The agriculture in hills is and will remain the mainstay of 66.7% of the people in the years to come. The challenges in agriculture to meet food demands and increase livelihood scope to people have raised several issues.

Agriculture is the main occupation of the people of HP. It has an important place in the economy of the State. It provides direct employment to 69% of the total workers of the State. About 16% of the total GSDP comes from agriculture and its allied sectors. Out of the total geographical area of 55.67 lakhs ha, the area of operational holdings is about 9.68 lakhs ha and is operated by 9.33 lakhs farmers. The average holding size comes to 1.04 ha. Distribution of land holdings according to 2005-06 Agricultural Census shows that 87.03% of the total holdings are of small and marginal farmers, 12.54% of holdings are owned by semi medium/medium farmers and only 0.3 % by large farmers.

Table 1: Distribution of Land Holdings

Size of Holdings (ha)	Category (Farmers)	No. of Holdings in (Lakhs)	Area (lakhs ha)	Av. Size of holding (ha)
1	2	3	4	5
Below 1.0	Marginal	6.36 (68.17%)	2.58(26.65%)	0.41
1.0-2.0	Small	1.76(18.86%)	2.45(25.31%)	1.39
2.0-4.0	Semi Medium	0.88(9.43%)	2.40(24.79%)	2.73
4.0-10.0	Medium	0.29(3.11%)	1.65(17.05%)	5.69
10.0-Above	Large	0.04(0.43%)	0.60(6.20%)	15.00
Total		9.33	9.68	1.04

Source: - Economic Survey of HP-2011-12

The use of fertilizers has increased the production in the State to a great extent since the late fifties and early sixties when the use of fertilizers was introduced in Himachal Pradesh. The use of fertilizers has constantly increase since then: Consumption of chemical fertilizers has increased from 2000 metric tonnes (1966-67) to 23664 metric tonnes (1985-86). The consumption of fertilizers in 1995-96 was 34000 MT which increased to 57363 MT in 2008-09. During 2001-02, Department of Agriculture promoted the use of bio-fertilisers in 1600 acres of land.

The consumption of pesticides in 1977-78 was 50.63 MT which increased to 232 MT in 2000-01. Data clearly indicates that pesticide consumption has increased to four and half times since 1977-78.

Growth in Food Grains Production: There is limited scope of increasing production through expansion of cultivable land. Like the whole country, Himachal Pradesh too has almost reached a plateau as far as cultivable land is concerned. Hence, the emphasis has to be on increasing productivity levels besides diversification towards high value crops. Due to an increasing shift towards commercial

crops, the area under food grains is gradually declining as the area which in 1997-98 was 853.88 thousand ha is likely to be declined to 785.18 thousand ha in 2010-11. Increase in production thus reflects gain in productivity.

Increase in Irrigation facilities: As a result of irrigation facilities, significant shift has taken place in cropping pattern. There has been a major shift from cereal crops to vegetables. In addition, multiple cropping has been introduced in irrigated areas.

Agro-forestry in Hill Agriculture: The agro-forestry systems have been an essential component in the traditional farming systems. However, in the present time without realizing its significance, farmers are removing fast the tree components from their farming lands because of small damage done by birds, shade etc. This has encouraged damage by rodents, wild beasts and insect- pests. Birds were also feeding on insect-pests.

Present Status & Irrigation Potential: Total geographical area of H.P. is 55.67 ha, of which only 5.83 lakhs ha is sown while 1,07,749 ha is the net irrigated area (2006-07).

Table 2: Net Irrigated Area (ha)

Agricultural year	Canals	Tanks	Wells & tube wells	Other sources	Total
2001-02	3,666	257	12,899	85,284	1,02,106
2002-03	3,510	267	11,764	1,08,377	1,23,918
2003-04	3,520	3	13,569	87,989	1,05,081
2004-05	3,379	28	15,512	85,571	1,04,490
2005-06(P)	4,010	654	16,200	83,163	1,04,027
2006-07(P) 4107		701	15,744	86,997	1,07,549

Source: Statistical Outline-HP, 2008-09

Watershed Development: Nearly 70-75% rain occurs during monsoons which flow as run-off without conservation. As a result, all areas without assured irrigation suffer from water stress & low productivity. So, development of watersheds has been emphasized for water conservation. For which schemes like IWMP, DPAP and DDP are under execution.

1.6 Animal Husbandry & Livestock

Need for the Present Guidelines

Himachal Pradesh has a flourishing livestock population, which not only caters to milk, meat and other requirements of the population. But also provide major additional to agriculture. Livestock plays an important role in the economy of the State which is mainly agrarian. Animal husbandry constitutes a subsidiary occupation for 90% of the rural population in the State.

Animal products such as milk, meat and eggs provide daily cash income to agriculture to meetees along with required nutrition to rural population. The per capita availability of eggs per annum in Himachal Pradesh is much lower than the India average. In Himachal Pradesh, the per capita availability of eggs in 2005-06 was 15 as against 42 in India. Based on projected population and demand of eggs, the State needs 1536 lakhs eggs per annum in 2011 followed by 1854 lakhs in 2021, 2238 lakhs in 2031 and 2701 lakhs in 2041. To fulfill the projected demand of eggs, the State needed 19.2 lakhs hens by 2011, 23.18 lakhs by 2021, 27.98 lakhs till 2031 and 33.77 lakhs by 2041.

The milk production in the State during the year 1991-92 was 59,6860 MT per annum, which increased to 88,4000 MT during in 2008-09. The availability of milk per person per day during the same years was 313 gm and 365 gm respectively. The data shows that the State has surplus milk production and the

availability of milk per person per day is higher than the Country's average of 258 gms during 2008-09.

The average milk requirement is 133.23 liters per person per annum. Based on the population projection, the demand for milk supply was expected to rise to 974569 MT per annum by the year 2011, 11,76,235 MT per annum by 2021, 14,19,819 MT per annum by 2031 and 17,14,071 MT per annum by 2041.

The livestock population in Himachal Pradesh is around 53 lakhs. About 43 lakhs tonnes green and 40 lakhs tonnes dry fodder are required for the survival of these livestock but the availability of fodder is only 16 lakhs tonnes green and 30 lakhs tonnes dry, which is very less as per the requirement. About 0.5 ha. per livestock grazing/pasture land is required but only 0.18 ha. is available in the State to sustain one livestock unit. Approximately, 2.55 tonnes of fodder is required per livestock per annum. The projected population of livestock in 2012-13 is expected to be 5.294 million which is likely to increase to 5.858 by 2042-43. The fodder requirement to sustain the livestock during the same year would be 135 lakhs tonnes and 149 lakhs tonnes respectively and the area required would be 13.7 lakhs ha. in 2012-13 and 15.2 lakhs ha in 2042-43. Based on the total projected livestock population, approximately 2117 million liter biogas will be generated per day in 2012-13 on the basis of a national estimate whereby a cattle generates about 8-9 kgs dung per day. The gas consumption for cooking per person lies between 300 - 900 liters per day. The gas consumption per 5-member family for 2 cooked meals ranges between 1500 - 2400 liters per day. The projected gas potential can take care of about one million population.

Livestock keeping is very common in Himachal Pradesh. 19 out of every 20

households keep at least one species of livestock. Bovines are the most common livestock of the total household in the State. 91.39% of the total households have bovine. Goat is the next important livestock.

Nearly one-fourth of the households keep goats. Similarly, two out of each five keep sheep. Rearing of pig is rare. However, households keeping poultry accounts for 5.54% of the total household in the State. Rearing of livestock is an integral component of the economy of the State providing source of livelihood to most of the people, especially those inhabiting the border districts of Lahaul-Spiti, Kinnaur, Pangi and Bharmour sub divisions of Chamba and Bara Bangahal area of Kangra. In the remaining areas, livestock rearing is practiced generally within the framework of mixed farming. The State has a total livestock population of 50.93 lakhs against a total human population of 51.11 lakhs living in 16,807 inhabited villages. A total of 5.2 million livestock was estimated by the livestock census of 2007. This number was close to that of human population in the State. It accounted for 1% of the total livestock population in the country. The composition of the State's livestock population underwent some change during 1972-97. While the percentage share of cattle declined from 46.3 to 41.6, buffaloes increased from 11.6 to 14.3. Similarly, while the percentage share of sheep went down from 21.1 to 20.7, goats experienced a rise from 19.3 to 22.4. Poultry recorded a 4.6 times multiplication from 1, 87,000 in 1972 to 8,64,000 in 1997. While there is a general increase in livestock population of the State during 1982-97 period, five out of twelve districts registered an absolute decline. These districts are Hamirpur, Kullu, Lahaul & Spiti, Shimla and Una. Nearly 20 percent of the total livestock was concentrated in Mandi. It was followed very closely by Kangra District. According to 18th Livestock Census - 2007, total livestock population of H.P. is 52.26 lakhs which include 22.78 lakhs cattle, 7.61

lakhs buffaloes, 9.01 lakhs sheep, 12.40 lakhs goats and 0.13 lakhs horses and ponies. Number of Veterinary Institutions in the State as per February 2010 is 2203, (Vet. Dispensaries 1760, Vet. Hospitals 284, Sub Divisional Vet. Hospitals 45, Central Vet. Dispensaries 30, Poultry Extension Centres 11, Pool Stores 11, Sheep & Wool Extension Centres 9, Semen Banks 7, Vet. Polyclinics 7, Vet. Check Posts 6, Sheep Breeding Farms/Ram Center 5, Clinical Labs 4, Go Sadans 4, Wool Analysis Lab 3, Cattle Breeding Farms 3, Rabbit Farms 2, Sperm Stations 2, Poultry Farms/ Hatcheries 2, Training Centres 2, Epidemiology Lab 1, State Vet. Hospital 1, Horse & Yak Breeding Farm 1, Quality Control Lab 1).

The contribution of major livestock products during the year 2008-09 was 8.84 lakhs tonnes of milk, 1,617 tonnes of wool, 98.00 million eggs and 3,309 tonnes of meat which is expected to reach 8.90 lakhs tonnes of milk, 1,665 tonnes of wool, 105.00 million eggs and 3,400 tonnes of meat during 2009-10.

The total meat production in 1990-91 was 4049 MT per annum which has increased to 3548 MT per annum in 2001-02. As compared to the per capita demand of meat, the meat production is also higher in Himachal Pradesh. Based on the average meat demand, the projected goat meat demand to would be, 19494 MT per annum by the year 2021, 23531 MT per annum by 2031 and 28408 MT per annum by 2041. Chicken meat demand would be 3496 MT per annum by 2021, 4220 MT per annum in 2031 and 5094 MT per annum in 2041. To fulfill the projected meat demands, the State needed 5.9 lakh goats by the year 2011, 7.3 lakhs by the year 2021, 8.7 lakhs by the year 2031 and 10.5 lakhs by the year 2041. The poultry demand would be 34.9 lakhs by the year 2021, 42.2 lakhs by the year 2031 and 50.9 lakhs by the year 2041 with increased economy consumption & demand meat and animal products has grown manifolds. As per United

Nation food and agriculture report, the livestock sector generates more GIG emissions than transport and is also a major source of land and water degradation over grazing, compaction and erosion are other environmental issues associated with livestock. It is estimated - that livestock accounts for 9% of Co₂, 65% Nitrous oxide, 37% of methane and 64% of ammonia contribution to green house gases.

The guidelines provide directions to the target audience for addressing and managing identified environmental and animal husbandry issues in order to augment their efforts to reduce burden on their surroundings. The guidelines delineate various good practices and measures to overcome the present issues in the State.

Objectives

The objectives of the guidelines are as follows:

Develop awareness about the environmental issues related to animal husbandry and livestock sector, considering risks due to environmental pollution, soil erosion, overgrazing, degradation of vegetation resources, deterioration of soil fertility and physical characteristics, effect on human health, increase in animal disease, inadequate animal health infrastructure, inadequacy of

animal fodder, animal waste disposal issues, dead animal management issues and issues related to slaughter houses.

- Provide information on key policy, plans and regulations.
- Introduce good practices to enhance sector development & associated services.
- Encourage coordinated planning within State departments.
- Address vulnerability related aspects.

Target audience

The key players for the guidelines include the following:

- State and Local Self Government (Panchayati Raj Institutions) including Department of Animal Husbandry, Department of Forest, Department of Agriculture, Department of Horticulture, Department of Fisheries, H.P. State Pollution Control Board and other line departments for future planning.
- NGOs, Civil Society Organisations (CSOs) CBOs and other training institutes for awareness development.
- People of Himachal Pradesh, who are directly or indirectly, associated with Animal Husbandry and Livestock management practices.

Chapter 2: Key Environmental and Social Policies/Regulations

2.1 Forests & Wildlife

The Indian Constitution has laid down a new important point in the section on Directive Principles of State Policy by assigning the duties for the state and all citizens through article 48A and article 51A(g) which states that, “The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife in the country” and “to protect and improve then atural environment including forests, lakes, rivers and wildlife, and to have compassion for the living creatures”.

National Level Policies / Regulations

Indian Forests Act, 1927: The Indian Forest Act, 1927 was enacted mainly to enable the State to govern and manage the forests and their produce and to facilitate and regulate timber trade. It's an Act to consolidate the law relating to forests, the transit of forest-produce and the duty leviable on timber and other forest-produce. The Act encourages conservation of forest biodiversity only by way of controlling and restricting the uses to which the forests can be put, and by restricting access of people to certain categories of forest. However, for participation of people in forest management, the State has enacted H.P. Participatory Forest Management rules, 2001 under section 80 read with section 81 of Indian Forest Act, 1927. It also empowers the State Governments to bestow forests rights to the people on timber and other forests produce in the forests.

The Forest (Conservation) Act, 1980: The Forest (Conservation) Act, 1980 as amended 1988, checks the indiscriminate diversion of forest land for non-forest purposes. It is a

regulatory Act dealing with diversion of forestlands for non-forestry purpose. It requires State Governments to obtain the approval of the Central Government before it denotifies, any forest, leases forestland to a private person or corporation, or clears it, even for the purpose of reforestation.

Prior clearance of projects requiring diversion of forests for non-forest purpose is needed under the Forest (Conservation) Act 1980. The State Government/Union Territories are required to submit formal proposals to the Central Government (Ministry of Environment and Forests) for diversion of forest land for non-forestry purposes in the prescribed proforma along with details such as flora, fauna, map of the area, compensatory afforestation proposed etc. However, in view of growing pressure of development projects on forest lands for diversion, as far as possible, non- forest land should be selected for projects.

As per the amended Forest (Conservation) Rules in force now, the Regional Chief Conservator of Forests has the power to decide proposals involving forest land up to 5 ha. Proposals involving forest land between 5-40 ha shall be processed by the Regional Chief Conservator in consultation with a state advisory group consisting of representatives of the concerned State Government. Proposals involving more than 40 ha of forest land are required to be placed before the MoEF, Government of India.

Some important guidelines laid down in Forest (Conservation) Act and Rules for diversion of forest land for non-forest purposes as may be relevant for Himachal Pradesh are given below.

- These guidelines ensure that ecological considerations are in no way undermined while examining investment proposals. The State Government or the Union Territory administration concerned is required to envisage at the initial stage itself, the different likely impacts of the proposed project, starting with the proposed site. The guidelines specify certain criteria for the siting of an industry. It states that no projects should be in the vicinity of National Parks, Wildlife Sanctuaries and Core areas of the Biosphere Reserves. Further, the project needs to consider scenic landscapes, areas of geomorphological significance, unique and representative biomes and eco-systems, heritage sites/structures and areas of cultural heritage and importance. It also includes fragile eco-systems such as mountains; areas rich in coral formations as well as desert, wetland, riverine eco-systems; areas rich in biological diversity, gene pool and other natural resources.
- Investors in industrial projects involving forest land are required to undertake detailed Environmental Impact Assessment Studies of their projects with respect to physical resources, hydrology, and water quality, socio-economic aspects, human use values, etc.
- Wild varieties of animals and plant species are not to be disturbed.
- Emphasis should be given to the adoption of indigenous and endemic species in afforestation programme, as per the prescriptions of Working Plans of the area.
- Investigations and surveys carried out in connection with hydro- electric projects, transmission lines, seismic surveys, exploration for oil drilling or mining will not attract the provisions of the Forest Act provided these surveys are restricted to only clearing of bushes and lopping of tree branches and do not involve clearing of forests or cutting of trees.

- Such surveys, investigations and explorations are prohibited in Sanctuaries, National Parks, Biosphere Reserves and in the preservation and sample plots under the Wildlife (Protection) Act, 1972.
- The permission to survey, explore or prospect does not imply any commitment on the part of the Central Government for any subsequent use of the forest land.

The Environment (Protection) Act, 1986: The Environment (Protection) Act, 1986, is a comprehensive legislation on environment that empowers the Central Government to take appropriate measures for the purpose of protecting and improving the environment. It provides for laying down standards for controlling emissions and effluent discharges of environmental pollutants; to regulate industrial locations; to prescribe procedures for managing hazardous substances; to establish safeguards for preventing accidents; and to collect and disseminate information regarding environmental pollution. In accordance with this Act, the Central Government has issued a number of regulations affecting sectors such as hazardous and chemical wastes, genetically engineered micro-organisms and industrial development of coastal zones.

Environment (Protection) Rules, 1986: The Environment (Protection) Rules, 1986 were notified vide S.O.844 (E), [19/11/1986]. The power conferred by the Environment Protection Act are followed under the heads of Coastal Regulation Zone; Delegation of Powers; Eco-marks Scheme; Eco-sensitive Zone; Environmental Clearance-General; Environmental Labs; Environmental Standards; Hazardous Substances Management; Loss of Ecology; Noise Pollution; Ozone Layer Depletion; Water Pollution; and 2-T Oil.

Def: An act provide for the protection and improvement of environment and for matters connected there with.

National Environmental Appellate Authority Act, 1997: National Environmental Appellate Authority Act, 1997 provides appellate forum for cases relating to site restrictions, developmental schemes and projects so as to balance development and environment.

Biological Diversity Act, 2002 and Biodiversity Rules, 2004: This act was enacted in 2002. Section 36 of this Act empowers the Central Government to develop national biodiversity action plan. This act primarily aims at giving effect to the provisions of the Biological Diversity Convention (CBD), including regulating access to biological resources and associated traditional knowledge so as to ensure equitable sharing of benefits arising out of their use, in accordance with the provisions of Article 15 of the CBD. Biological Diversity Rules were subsequently notified in 2004.

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 and its Rules: The Act recognizes the rights/duties - if these were not recognized in the past - of forest dwelling Scheduled Tribes and other traditional forest dwellers over the forest areas inhabited by them and provides a framework for the same. The Act grants four types of rights/duties:

- Title rights - i.e. ownership of land that is being farmed by tribals or forest dwellers as on December 13, 2005, subject to a maximum of 4 ha;
- Use rights - to minor forest produce (also including ownership), to grazing areas, to pastoralist routes, etc
- Relief and development rights - to rehabilitation in case of illegal eviction or forced displacement and to basic

amenities, subject to restrictions for forest protection

- Forest management rights - to protect forests and wildlife.

The Foreign Exchange (Development and Regulation) Act, 1992: The Foreign Exchange (Development and Regulation) Act, 1992, is designed to stimulate and sustain economic growth. Provision of the convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is also implemented through this Act.

National Level Policies

National Forest Policy Resolution of 1952 and National Forest Policy of 1988: The National Forest Policy (1988) establishes a principal aim 'to ensure environmental stability and ecological balance including atmosphere equilibrium which are vital for substances of all life forms, human, animal & plant, and directs that the domestic requirements of poor and marginalized forest users should be the first charge on forest produce. The policy calls for the enhancement of income and employment through improved and increased production of non-wood forest products (NWFPs), and proposes that a massive people's movement with the involvement of women should be launched to achieve the objectives.

In pursuance of the objectives of the National Forest Policy mentioned above, the Ministry of Environment and Forest issued a circular on (01) June 1990 to various State Forest Departments vide no.6-21/89-F.P) encouraging the involvement of village communities and voluntary agencies for regeneration of forest land. Almost all the states of India have now issued Joint Forest Management (JFM) resolution in subsequent years. Subsequently GOI issued further amendments and clarifications on JFM pointing out that it can be extended even in

good forest areas and should not be restricted to degraded forests alone.

As outlined in the National Forest Policy (1988), the main action points are as follows:

- Maintenance of environmental stability through preservation and, where necessary, restoration of the ecological balance that has been adversely disturbed by serious depletion of the forests of the country;
- Conserving the natural heritage of the country by preserving the remaining natural forests with the vast majority of flora and fauna, which represent the biological diversity and genetic resources of the country;
- Increasing substantially the forest/tree cover in the country through massive afforestation and social forestry programmes, especially on all denuded, degraded and unproductive lands involving the local people in this endeavour by giving them tangible economic motives and employment opportunities;
- Meeting the rights and concessions for requirements of fuel wood, fodder, minor forest produce and small timber of the rural and tribal population with due cognizance of the carrying capacity of forests;
- Increasing the productivity of forests to meet the essential national needs;
- Encouraging efficient utilization of forest produce;
- Restriction on diversion of forest lands for non-forest uses and
- compensatory afforestation in case where diversion is unavoidable;
- Afforestation on common lands by the local communities through usufruct-sharing schemes;
- Motivation of farmers/land owners to resort to tree farming in similar manner of crop based farming;
- Substitution of wood by other materials, alternative sources of energy and fuel efficient stoves;
- Permission to forest-based enterprises

after a thorough scrutiny regarding the availability of raw materials;

- Supply of forest produce to the industrial consumers only at its true market value and not at concessional prices;
- Involvement of local people and dedicated grass roots non-governmental organisations, in the afforestation programme and for protection of existing forests; and
- Creation of land banks for compensatory afforestation.

National Conservation Strategy and Policy Statement on Environment and Development, 1992: The National Conservation Strategy and the Policy Statement on Environment and Development are in response to the need for laying down the guidelines to address environmental considerations into development process.

Section 2.6 of this document states, that forest wealth is dwindling due to over-grazing, over-exploitation both for commercial and house-hold needs, encroachments, unsustainable practices including certain practices of shifting cultivation and developmental activities such as roads, buildings, irrigation and power projects. The recorded forest cover in the country is 75.01 million ha which works out to 19.5% of the total geographical area against the broad national goal of 33% for the plain areas and 66% for hilly regions.

Section 3.4 on Conservation of Forests and Wildlife refers to adoption of a new Forest Policy (1988) with the principal aim of ensuring ecological balance through conservation of biological diversity, soil and water management, increase of tree cover, meeting the requirements of the rural and

tribal population, increase in the productivity, efficient utilization of forest produce, substitution of wood and people's involvement for achieving these objectives.

Further, Section 3.4 outlines the following measures to be taken up for conservation of forests and wildlife.

- Adoption of National Forest Policy (1988) with the principal aim of ensuring ecological balance through conservation of biological diversity, soil and water management, increase of tree cover, meeting the requirements of the rural and tribal population, increase in productivity, efficient utilization of forest produce, substitution of wood and people's involvement for achieving these objectives.
- Under the Forest (Conservation) Act, 1980 stringent provisions for preventing diversion of forest land for non forestry purposes.
- Setting up of the National Wastelands Board to guide and oversee the wastelands' development programme by adopting a mission approach for enlisting people's participation, harnessing the inputs of science and technology and achieving interdisciplinary co-ordination in programme planning and implementation.
- Formulation of a National Wildlife Action Plan.
- Preparation of a National Forestry Action Programme.
- Establishment of national parks and sanctuaries covering about 4% of the country's area.
- Eco-development plans for sanctuaries and national parks.
- Identification of bio-geographical zones in the country for establishing a network of protected areas including seven Biosphere Reserves set up so far.
- Management plans for identified wetlands,

mangrove areas and coral reefs.

- Formulation of "National River Action Plan".

Section 3.6 refers to environmental impact assessment. It mentions about establishment of procedures for environmental impact assessment and clearance with regard to selected types of projects requiring approval of the Government of India. It states that prior clearance of projects is needed for diversion of forests for non-forest purpose under the Forest (Conservation) Act 1980. It also states about the formulation of "Environmental Guidelines" for projects in various sectors.

Section 4.0 refers to constraints and agenda for action. The agenda for action in this regard will be to conserve and nurture the biological diversity, gene-pool and other resources through environmentally sustainable development and management of ecosystems with special emphasis on mountain, marine and coastal, desert, wetlands, riverine and island ecosystems.

Section 5.2 refers to conservation of natural resources. Further sub-sections under section 5.2 are described below.

Sub-section 5.2.1.2 describes amelioration of water-logged and salt affected lands, command area development, protection of good agricultural land against diversion to urban and other uses, prevention of land fragmentation, maintenance of sustained productivity of soil and conservation of lands with forests and vegetal cover as the integral components of sustainable management.

Sub-section 5.2.3 on Biodiversity: Conservation of biodiversity through a network of protected areas including Biosphere Reserves, Marine Reserves, National Parks, Sanctuaries, Gene

Conservation Centres, Wetlands, Coral Reefs and such other natural habitats of biodiversity. This should include taxonomic and ecological studies on the flora and fauna with adequate emphasis placed on the lower vertebrate, invertebrate and micro-flora which are important in contributing to the healthy maintenance of ecosystems.

Sub-section 5.2.3.1 on maintenance of corridors between national parks, sanctuaries, forests and other protected areas.

Sub-section 5.2.4 on Biomass: Devising ways and means by which local people can conserve and use the resources of the common lands and degraded forests, so that they have a stake in the continuing productivity of the resources.

Concerted efforts should be made for increasing the forest cover and for conservation of existing forests, which constitute an essential life support system and is an important source of food, fiber, fodder, fuel, medicines etc. For attaining the goal of having at least one third of land area under forest cover, intensified measures on a mission mode are required to be taken along with commensurate mobilization of resources for this purpose.

Section 6.5 mentions about Industrial Development. It states that clearance by Ministry of Environment & Forests is required for all projects above a certain size and in certain fragile areas.

Section 8.2 refers to natural resource accounting. It states that the Government will prepare, each year, a natural resources budget which will reflect the state and availability of resources like land, forests, water etc. and which will rationally allocate these resources in keeping with the principles of conservation and sustainable development.

Section 8.7 refers to role of Non-Governmental organisations. It states that Non-Governmental organisations, citizen groups and village level institutions like forests organisations, Panchayats, and gram sabha should be empowered with locus standi and support for mobilization of public opinion and participation in developmental activities.

National Biodiversity Action Plan 2008: The National Biodiversity Action Plan (NBAP) is a framework for taking action by the multitude of stakeholders in biodiversity for achieving the three objectives of the CBD, namely conservation of biodiversity, sustainable use of its components and fair and equitable sharing of benefits arising out of their use. The NBAP draws upon the main principle in the National Environment Policy (NEP) that human beings are at the centre of concerns of sustainable development and they are entitled to a healthy and productive life in harmony with nature.

Taking cognizance of the existing legislations, implementation mechanisms, strategies, plans and programmes, action points have been designed in the NBAP, so as to integrate biodiversity concerns into various other sectors. NBAP is consistent with the ecological, social, cultural and economic mosaic of the country, and provides a focus and impetus to the current efforts towards biodiversity conservation.

Compensatory Afforestation Fund Management and Planning Authority (CAMPA) under this Act: On July 10th, 2009, the Honourable Supreme Court passed an order on the CAMPA issue in response to an affidavit filed by the Ministry of Environment & Forests, along with a report by the Ad Hoc CAMPA Committee and endorsed by the Central Empowered Committee (CEC). The Supreme Court order directs the following:

- That the State CAMPA guidelines prepared by the MoEF for utilizing CAMPA funds should be notified and implemented. These guidelines envisage: (i) A State-level CAMPA Governing Body under the chairmanship of the Chief Minister; (ii) A State-level CAMPA steering committee under the chairmanship of the Chief Secretary; and (iii) A State-level CAMPA Executive Committee under the chairmanship of the Principal Chief Conservator of Forests.
- There will be a National CAMPA Advisory Council under the chairmanship of the Union Minister of Environment & Forests for monitoring, technical assistance and evaluation.
- That as an interim arrangement to get CAMPA going, 10% of the accumulated principal amount will be released per year (for the next five years) by the Ad Hoc CAMPA Authority set up by the Supreme Court Order of May 2006 under the chairmanship of DG-Forests to State CAMPAs. This money will be used for projects identified by the State CAMPA that form part of the State forest department's Annual Plan of Operations (APOs).

Wildlife Conservation

Wildlife protection has been included in Article 51-A of the constitution of India as a fundamental duty of citizens of the country. In pursuance of this constitutional directive, in 1983, the Government of India through the National Wild Life Action Plan of the Ministry of Environment laid down several sets of actions by which wild life should be conserved. These are contained in the Prime Minister's statement to the Indian Board of Wild Life in 1982 which listed aims of wildlife conservation as: i) There should be a network of protected areas to cover representative samples of all major wild life eco-systems and with adequate geographic distribution; ii)

Degraded habitats in these protected areas should be restored to their natural state; iii) Rehabilitation of endangered species including restoration to former habitat and pastures; iv) Development of adequate corridors for genetic continuity in production forests and pastures; v) Development of appropriate management system, protected areas, longtermconservation of wild life based on the scientific principles of evolution of genetics.

In 1988, the Government introduced a new Forest Policy which contained a number of statements on wild life and on bio-diversity for conserving the natural heritage of the country. It states that for the conservation of total biological diversity, the network of national parks, sanctuaries, biospheres, reserves and other protected areas should be protected and strengthened adequately.

Wildlife Protection Act, 1972: The Government of India enacted Wild Life (Protection) Act, 1972 with the objective of effectively protecting the wild life and to control poaching, smuggling and illegal trade in wildlife and its derivatives. It extends to the whole of India, except the State of Jammu and Kashmir which has its own Wildlife Act. The Act was amended in January 2003 and punishment and penalty for offences under the Act have been made more stringent. The Ministry of Environment and Forests has proposed further amendments in the law by introducing more rigid measures to strengthen the Act. The objective is to provide protection to the listed endangered flora and fauna and ecologically important protected areas. In order to ensure effective wildlife conservation in the country, Government of India initiated rationalization of Protected Area (PA) boundaries. Often the exercise resulted in to shrinking of PA boundaries. The State of Himachal Pradesh took bold initiatives to rationalize the boundaries of national parks and sanctuaries

in such a way that ultimately the area under PAs registered substantial increase.

The Act established schedules of protected plant and animal species, hunting or harvesting these species was largely outlawed. It has six schedules which give varying degrees of protection. Schedule I and part II of Schedule II provide absolute protection and offences under these are prescribed the highest penalties. Species listed in Schedule IV are also protected, but the penalties are much lower. Enforcement authorities have the power to compound offences under this Schedule (i.e. they impose fines on the offenders). Penalties are prescribed in section 51. Enforcement can be performed by agencies such as the Forest Department, the Police, the Customs and the Central Bureau of Investigation (CBI). Charge sheets can be filed directly by the Forest Department.

Amendment in the Wildlife Protection Act was done in 1993 and 2002. Various rules under this act include (1) Recognition of Zoo Rules, 2009; (2) S.O.1092(E), [22/9/2003] - The National Board for Wild Life Rules, 2003; (3) S.O.445(E), [18/4/2003] - The Declaration of Wild Life Stock Rules, 2003; (4) G.S.R.350(E), [18/4/1995] - The Wildlife (Specified Plant Stock Declaration) Central Rules, 1995; (5) G.S.R.349(E), [18/4/1995] - The Wildlife (Specified Plants - Conditions for Possession by License) Rules, 1995; (6) G.S.R.348(E), [18/4/1995] - The Wildlife (Protection) Rules, 1995; (7) Recognition of Zoo Rules, 1992; (8) G.S.R.328(E), [13/4/1983] - The Wildlife (Protection) Licensing (Additional Matters for Consideration) Rules, 1983; (9) G.S.R.29(E), [25/1/1973] - The Wildlife (Stock Declaration) Central Rules, 1973; and (10) G.S.R.198(E), [9/4/1973] - The Wildlife (Transaction and Taxidermy) Rules, 1973.

Environment Impact Assessment (EIA) Notification, September 14, 2006 and subsequent amendments: Forests and Wildlife

are covered in EIA and Environment Management Plan process as part of the EIA notification. Form 1 A of EIA notification, 2006 covers Forests under section II Activity 1. This includes construction, operation or decommissioning of the project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.); Item no 1.2, clearance of existing land, vegetation and buildings; Item, no 1.3, creation of new land uses; Item no. 1.29 "Introduction of alien species" and Item no 1.30 "Loss of native species or genetic diversity"

Section II activity covers use of natural resources for construction or operation of the project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply)." Point 2.5 solicits information on forests and timber (source – MT) and point 2.7 on any other natural resources.

Section III activity covers use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health. Item no 3.1 solicits information on use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna and water supplies).

Under the said notification, APPENDIX II, form IA for construction projects requires project proponents to provide full information and wherever necessary, attach explanatory notes with the form and submit along with proposed environmental management plan & monitoring programme. These include information on land environment, vegetation and fauna. FORM IA specifically addresses details required to be submitted by the project proponent.

Further, in the said notification, forests are covered under “Environmental Sensitivity” in Section III, FORM 1A item no.1. It is covered as “areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value”; item no 2 “areas which are important or sensitive for ecological reasons - wetlands, watercourses or other water bodies, coastal zones, biospheres, mountains, forests”; item no. 3 “areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration”; item no.6 “routes or facilities used by the public for access to recreation or other tourist, pilgrim areas”; item no 10 “Areas containing important, high quality or scarce resources (ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)”; item no.11 “areas already subjected to pollution or environmental damage. (Those where existing legal environmental standards are exceeded)”.

Significantly, wetlands are implicitly covered as General Condition (GC) of the said notification. “Any project or activity specified in Category ‘B’ will be treated as Category A, if located in whole or in part within 10 km from the boundary of: (i) Protected Areas notified under the Wild Life (Protection) Act, 1972, (ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time, (iii) Notified Eco-sensitive areas, (iv) inter-State boundaries and international boundaries”.

State Policies/Acts/Regulations

The Indian Forest Act (H.P. Second Amendment Act) 1991: The latest enactment of this Act vide which sub- section 52(A) has been added in order to check smuggling of forest produce. The penal clauses have also been amended where the punishment under sections of the Act has been enhanced from 6

months and fine of Rs 500 to 2 years and fine of Rs 5000.

H P Land Preservation Act, 1978: Himachal Pradesh Land Preservation Act, 1978 has been enacted for regulating the felling of trees on private lands.

Himachal Pradesh Forest Produce (Regulation of Trade) Act, 1982: This act prohibits sale of restricted/nationalized species by any private owner to anyone except through Himachal Pradesh State Forest Corporation.

Himachal Pradesh Specific Corrupt Practices Act, 1984: This act deals firmly against the unscrupulous individuals and officials indulging in corrupt practices.

The Himachal Pradesh Kulehar Forest (Acquisition Of Management) Act, 1992: It's an act to provide for the acquisition of management, supervision and control of the Kulehar Forest and other ancillary matters.

Himachal Pradesh Public Premises & Land (Eviction and Rent Recovery) Act, 1999: Vide Himachal Pradesh Government Notification No. 1-2/71- LSG dated 8.6.1994, Divisional Forest Officer (DFOs) in the State have been empowered under this Act to deal with detection and eviction of encroachment on the forest lands.

Himachal Pradesh Panchayati Raj Act, 1994: The Constitution (73rd Amendment) Act, 1992 mandates decentralization through the three tier system of local self Government known as Panchayati Raj Institutions (PRIs). The Government of Himachal Pradesh gave effect to this initiative through the Himachal Pradesh Panchayati Raj Act, 1994. The forest sector policy supports this initiative by strengthening and working through the local Government institutions at all levels, and actively pursuing the integration of State Government department's activities through

the PRIs. Similarly the 'scheduled areas' have a new mandate through the Provisions of Panchayats (Extension to Scheduled Areas) Act, 1996 (PESA) and the conforming State amendments in 1997. This policy will support and benefit from these actions and amendments by pursuing change within Government departments and strengthening PRIs.

It includes forests in its list of 29 activities. GoHP Order in 1997 entrusted supervision and monitoring responsibilities relating to fifteen departments including Forest Department to PRIs. It includes social and farm forestry, minor forest produce, watershed development, land improvement and soil conservation, fuel and fodder.

The HP Government put these guidelines into action in 1994 by amending its Panchayati Raj Act and holding elections in 1995. The significant policy directions issued include: 15 line Departments directed to work through PRIs; LDs to design schemes and programmes for PRIs; Field level staff of some departments placed under the PRIs, the administrative structure under PRI is strengthened; Gram Panchayat to make Panchayat Micro Plans through participatory processes involving natural resource based planning.

Himachal Pradesh Municipal Corporation Act, 1994: The said Act lays prohibition on felling, cutting, damage and destroying any tree in any urban area whether included in a private holding or within the jurisdiction of the Municipal Corporation, except with prior permission obtained from the State Government. Chapter-12 of the Act contains provisions regarding prevention of soil erosion and hill side safety. No person can fell any tree except under a permit obtained from the prescribed authority. If there is breach of provision of the Act regarding felling of trees, an officer especially empowered, can seize the tree, fuel or timber in respect of which such

breach has been committed. Chapter 20 of the said Act regulates felling and planting of trees.

The Himachal Pradesh Forest Produce Transit (Land Routes) Rule, 1978: Under these rules Pradhans of the Gram Panchayats in Himachal Pradesh have been appointed as forest officers to carry out the purpose of Rule 11 for the issuance of pass for transport of minor forest produce collected from the forests in the concerned Panchayats. Government of HP further ordered that the forest guard of the area shall make recommendations to issue pass after verifying that the species for which such pass is to be issued are not banned for export and that the species are extracted from the prescribed area in the approved extraction cycle and that the extraction has been done in a sustainable manner and has not caused any ecological or environmental damage.

List of medicinal herbs and other non timber minor forest produce on which control is proposed to be decontrolled and given to the concerned Panchayats vide Government notification no. FFE-B-G (9)- 9 / 94- ii dated 28.2.2003 consists of 38 species/items: *Anselia aptra*; *Picrorhiza kurroo*; *Jurinea macrocephala*; *Angelica glauca*; *Viola odorata*; *Valeriana wallichii*; *Thalictrum* spp.; *Thymus sephyllum*; *Morchella esculenta*; *Potentilla nepalensis*; *Pistachia integerima*; *Polygonatum verticillatum*; *Salvia moorcroftiana*; *Bunium persicum*; *Selinum vaginatum*; *Tinospora cordifolia*; *Orchis latifolia*; *Valeriana hardwickii*; *Acorus calamus*; *Pinus wallichiana*; *Adiantum lunulatum*; *Lichens*; *Abies webbiana*; *Hedychium acuminatum*; *Heracleum* spp.; *Gerardianab eterophylla*; *Cedarrosette*; *Birchpine*; *Cedrella* spp.; *Pyrus pashia*; *Colebrookea oppositifolia*; *Rhododendron* spp.; *Coleus aromaticus*; *Lichens* and *Mosses*; *Hypericum patulum*; *Curcuma* spp.; *Juniper recurva*; and dry pine needles.

The amendment mentions that "the export permit fee levied on all 51 species in this

agreement will be applicable irrespective of the fact whether the above species are collected from the forest or are grown domestically except that the above fee will not be levied on item No. 22 *Bunium persicum* (Kala Zira) and item No. 38 *Saussurea lappa* (Kuth) in case they have been grown on private land. However, export permit fee will be chargeable in cases these two species have been collected from the forests.” The list of 51 species/items consists of *Ainsliaea aptera*; *Aconitum chasmanthum*; *Picrorhiza kurrooa*; *Jurinea macrocephala*; *Podophyllum hexandrum*; *Angelica glauca*; *Viola odorata*; *Valeriana wallichii*; *Rheum emodi*; *Dioscorea deltoidea*; *Thalictrum*; *Artemisia brevifolia*; *Thymus sephyllum*; *Atropa acuminata*; *Morcbellaesculenta*; *Potentillanepalensis*; *Pistaciaintegerrima*; *Polygonatum verticillatum*/ *P. cirrbifolium* (meda/mahamed) (Rs 40-50/ kg); *Aconitum heterophyllum*; *Aconitum violaceum*; *Salvia moorcroftiana*; *Bunium persicum*; *Selinum vaginatum*; *Taxus baccata*; *Rhododendron campanulatum*; *Tinospora cordifolia*; *Orchis latifolia*; *Valeriana hardwickii*;

Acorus calamus; *Lupinus wallichiana*; *Berberis aristata*; *Berberis asiatica*; *Berberis vulgaris*; *Berberis lycium*; *Swertia chirata*; *Adiantum lunulatum*; *Nardostachys jatamansi*; *Lichens Abies webbiana*; *Ephedra gerardiana*; *Saussurea lappa*; *Hedychium acuminatum*; *Hyoscyamus niger*; *Heracleum* spp.; and *Gerardiana heterophylla*.

An amendment was made as an addition to “Annexure-D” to the Himachal Pradesh Forest Produce Transit (Land Routes) Rules, 1978, after item No. 42, following new items were added, namely *Cedrella* spp.; *Pyrus pashia*; *Colebrookea oppositifolia*; *Rhododendronspp.*; *Colensaromaticus*; *Lichens* and *Mosses*; *Hypericum patulum*; *Curcuma* spp.; *Juniperus recurva*.

Himachal Pradesh Forests (Protection from Fire) Rules, 1999: Forest fires are reported to be causing damage to forests of the State. The Government of Himachal Pradesh has therefore taken recourse to legislation to protect forests from fire as it derails the

success of sustainable forest management. These rules are applicable through out the year except for the period from 1st of July to 13th of September which is supposed to be a wet season and therefore fire is less likely (there are reported stray cases of fire in prolonged dry spell where there is a thick layer of undecomposed humus). The purpose of this rule is to discipline the adjoining area agriculturists to take precautions in burning agricultural fields. The rules specify prohibition of kindling of fire. This includes (1) Kindling of fire within one hundred meters from a forest without permission of the Divisional Forest Officer, or his authorized representative shall be prohibited; (2) Any person lighting a fire even beyond one hundred meter from the boundary of a forest shall take precautions, by clearing a fire path, not less than 10 meters in width between such place and such boundary, or by employing watchers or otherwise, to prevent the fire from spreading; Rules specify precautions to be taken in burning agriculture residue bushes or “ghasnies” near forests.

No person shall ignite agricultural residue or set fire to “ghasnies”, or clear by fire any land, within a distance of one hundred meter from the boundary of the forest, unless; (a) he gives notice of his intention to burn or clear the land by fire, at least one week before doing so, to the nearest Forest Range Officer under whose jurisdiction such land lies; and (b) there is between such boundary, and the spot on which such materials are ignited, a space at least ten meters in width, which is clear of all vegetation capable of carrying fire from such spot to the forest.

Rules specify restrictions on the collection and stacking of inflammable forest produce of inflammable material outside the boundary of or in the forest. Any person collecting such inflammable material, e.g., forest produce such as grass, dried leaves and pine needles, firewood, timber, bamboo and resin, on a land adjoining a forest, or a holder of a pass

or permit issued by a Forest Officer, or a person exercising his privilege or right to collect such forest produce from a forest, shall stack it at, as the case may be, in an open space in the forest as the Divisional Forest Officer may, by general or special order, specify, and shall isolate such stacks in such manner that, if it catches fire, the fire shall not spread to the surrounding area to endanger the forests.

Rules specify precautions to be taken at camping places. These include (1) No person shall camp in a forest, except in a camping place specially cleared and set apart and duly notified for the said purpose by the Divisional Forest Officers; (2) A person camping at such camping place may light fire for the purpose of cooking or for any other purpose in such a manner as to not endanger the forest or any building, shed and property at the camping place; and (3) A person camping at the camping place shall, before vacating it, collect in the centre of the camping place all inflammable material, which is to be left behind, and shall carefully extinguish all fires at the site.

Himachal Pradesh Forest (Timber Distribution to the Right Holders) Rules, 2010: The said rules defined: 'Timber Distribution' as the policy of distribution of timber to the right holders as per record of rights recorded in the Forest Settlement Reports; and 'Timber Distribution Rights' as a right of a right holder having cultivable lands for grant of timber for construction of residential house and cow shed etc. for bonafide domestic use of the right holder, recorded in the Forest Settlement Report of the area concerned.

The rules specify that timber shall be granted to the right holders who have their recorded rights in the concerned forest settlement reports for grant of timber distribution for construction/maintenance of residential house, cow sheds etc. for bonafide domestic

use provided that: (i) No timber distribution shall be granted in urban area; (ii) No timber distribution shall be granted if trees to meet the requirement of timber for construction of residential house, cowshed etc. are available on the land holdings of the right holder concerned. However, he shall have the right to fell trees from his own land as per the provisions of the Himachal Pradesh Land Preservation Act, 1978 and rules made there under; (iii) No timber distribution shall be granted for 10 years if the right holder has sold trees yielding timber for construction of houses from his private landholding; (iv) In case right holder has landholding at more than one place, he shall have option of getting timber distribution at one place only. For this purpose a right holder shall submit an affidavit clarifying therein his rights of timber distribution at different places and his place of option for getting timber distribution. (v) No timber distribution shall be granted to a land owner who has purchased land after obtaining the permission of the Government under section 118 of the Tenancy and Land Reforms Act, 1972, irrespective of the date of purchase of such land; (vi) Timber distribution shall be granted only to the head of the family as per the revenue records; (vii) Timber distribution shall not be granted for the construction/maintenance of buildings to be used for commercial and hiring purposes; (viii) Timber distribution shall not be granted to the Right Holders, if trees for the purpose are not available silviculturally in the forest where concerned right holders have timber distribution right; (ix) Timber distribution right shall be subject to co-operation and participation of right holders in forest conservancy. In case any right holder fails to perform his duties for apprehending of fenders, extinguishing fire or commits any forest offence as contained in the forest settlement report, his right of timber distribution shall be suspended upto 10 years; and (x) Timber distribution right of a right holder shall be suspended upto 10 years if he

is found to have misutilised the timber. The process of timber distribution as per these rules will start from the resolution of Gram Sabha of the Panchayat and would be done through the time frame indicated therein.

Linkage of HP Forest Management Regulations and Panchayati Raj Legislation: The structure of linking Participatory Forest Management (PFM) with Panchayati Raj Institutions has been provided in the Himachal Pradesh Participatory Forest Management Regulations 2001 issued under Sections 80 and 81 of the Indian Forest Act, 1927. The 'Village Forest Development Society' or "Gram Van Vikas Samiti" will be registered under Section 3 of the Societies Registration Act, 1860 for Participatory Forest Management (PFM). The Panchayat ward will be the basic unit for setting up the Village Development Committees (VDC). The salient features of HP Participatory Forest Management Regulation 2001 are that: It is applicable to all forest areas, and any Government forest and Government land including common land may be brought under participatory forest management, based on an application made to the Divisional Forest Officer signed by at least 50% of the voters of a Gram Panchayat ward; In accordance with the wider objectives and plans of Government for sustainable forest management, the Village Forest Development Society and the Forest Department will manage the selected area jointly.

Himachal Pradesh Forest (Van Thaana) Rules, 2010: In exercise of the powers conferred by section 76(d) of Indian Forest Act, 1927 (16 of 1927), the Governor of Himachal Pradesh vide notification No. FFE-B-C (1)-13/2008, dated 24-09-2010 made Himachal Pradesh Forest (Van Thaana) Rules, 2010. The Rules have made a provision for establishment of Van Thaana, powers of Forest Officers of Thaana, procedure for functioning of Thaana, procedure regarding up keeping of Arms and Ammunitions and

their use, etc. The following amended upto date Acts, rules and regulations shall be kept in the Van Thaana for day to day consultation, namely Indian Forest Act, 1927, Wildlife Protection Act, 1972, Indian Penal code, 1860, Code of Criminal Procedure, 1973 and Civil Procedure Code, 1908.

Participatory Forest Management is recognized as a key strategy for sustainable forest management. The provisions of HP PFM have been discussed in great details in Section 128-131.

State Level Policies

The Government of Himachal Pradesh has adopted a National Forest Policy, National Conservation Strategy and National Wildlife Action Plan to tackle various biodiversity related issues. The State Government has also imposed a complete ban on the hunting of wild animals and a moratorium on the felling of trees in all protected areas.

State Forest Policy, 1980: The first State Forest Policy for Himachal Pradesh was adopted on 3rd September 1980 in furtherance of the National Forest Policy resolution of 1952. Participatory Forest Management was promoted across the entire State through Sanjhi Van Yojna [SVY] and other projects in line with national forest policy 1988 that recognised the relationship between rural poverty and environmental protection. In order to improve upon and remove difficulties of various programmes and projects on forestry especially their economic viability and institutional sustainability, a need has arisen to develop participatory management approach further to a more sustainable model that involves the forest sector as a whole effectively.

The Forest Sector Policy 2005: This policy seeks to achieve sustainable forest management in Himachal Pradesh i.e. forests, watersheds, wildlife, biodiversity and habitats,

for the maintenance and rehabilitation of its environment and strive for enhanced livelihoods of the people of the State, especially women and other resource poor groups.

Within the framework of the National Forest Policy, 1988, the basic objectives of this policy are given below.

- Conserve and improve the status of natural resources in the State, especially forests, wildlife and biodiversity through effective watershed management practices.
- Conserve and manage forests scientifically, contemporarily and incorporating the best practices from within and outside the State, for the present and future generations, and to increase their values – historical, cultural, religious, economic and aesthetic – for communities and the environment on a sustainable basis.
- Strive for livelihood security of forest dependent communities through protection of rights to forest goods and services.
- Establish and support an integrated governance system that effectively involves all stakeholders in protecting, conserving, using, managing and restoring forests and other natural resources of the State.
- Fulfill obligations under various national policies and laws, international instruments including covenants, agreements and protocols related to the forest sector.
- Strive towards an appropriate land use in the State especially in the context of sustainable forest management, focusing on other primary land use sectors such as agriculture, horticulture, animal husbandry and those related to infrastructure development
- Strengthen the capacity for research, training, extension, education and

awareness of Government and Non-Government institutions, related to the forest sector.

- Apply the best scientific information, resources, management practices and strategies available to implement the forest sector policy and create a mechanism to periodically review the policy keeping in view the changing circumstances and needs.

Some of the broad strategies outlined in the forest sector policy are given below;

- The Himachal Pradesh Forest Department (HPFD) in consultation with other stakeholders will devise criteria and mechanisms to assess and categorise the State's forests into four functional classification viz. conservation, production, community and urban forests. Necessary modifications in the working plan code will have to be made to accordingly reorganise these forests in a time bound manner and make provisions for periodically reviewing of such categories. Separate set of management prescriptions for each category will have to be made.
- The rationale of protected areas network (PAN) in the state including the extent of area required will be reviewed, taking into account the representation of the various biodiversity resources of the state and the livelihood requirements of the people.
- An enabling legal framework including review of the PFM Rules, 2001 will be made for the management and control of community forests.
- The establishment and maintenance of green belts in urban areas as part of urban land use planning will be promoted by establishing linkage with urban authorities and town and

country planning department of the State Government.

- The uniqueness of Himachal Pradesh as a hill State and its unique physical and ecological status especially those areas that are uncultivable needs to be explained in reference to the national forest policy for justifying the extent of forest and tree cover and will be taken up with the Central Government.
- A co-ordinated and collaborative effort from all land using sectors will be made to achieve and enhance the target of 35.5 % forest and tree cover through measures such as reforestation and afforestation, agro forestry, farm forestry and utilising marginal and private lands for fodder development.

Section 6.1 defines classification of forests. While classification by vegetation and ecological types is relevant for silvicultural purposes and legal categorization is based on degree of control, the functional classification of forests is important in the context of this policy to promote appropriate land use for increased productivity, providing enhanced livelihood opportunities and improved conservation. This is key to the development of the forestry sector in the State and its consequent influence on related sector of development.

- (a) Conservation Forest: This category has been delineated from the existing reserved protected forests in the State having little biotic interference and which shall be controlled and managed by the Forest Department primarily for physical, climatic, hydrological and ecological considerations for environmental and biodiversity conservation. This category of forests shall also include Protected Area Network, which constitutes more than twelve percent of the State's area,

which is one of the highest in the country. Such areas shall be managed as per established principles of Protected Area Management. While fulfilling the functions of this category, the existing rights of the local communities in these forests are safeguarded or duly compensated through ecological and economic development in the adjoining areas.

- (b) Production Forests: This category delineates the appropriate areas from Reserved/Protected Forests to be managed primarily for sustained production of timber and non timber forest products while incorporating the rights of the people and environmental services. This category of forests was supposed to be the main source of revenue to the State Government as well as to meet the construction and industrial requirement of timber and timber forest products. However, much of the concept of production forestry has been diluted due to blanket ban on green felling in mountainous region imposed by an order of Honourable Supreme Court in 1996. Most of the forests of the State are restricted for silvicultural fellings on account of the above order. Only salvage felling i.e. felling and removal of dead and fallen trees, is permitted. The Silvicultural operations required to be carried out as per working plan prescriptions are banned in most of the forest areas. Thus the source of supply of timber for industry and construction work has therefore to be managed through imports. This has impact on local economy and development. This also throws challenge on Forest Protection which is key to sustainable forest management.
- (c) Community Forests: This category of forests shall be carved out from the protected forests and village common lands and managed by village

communities through the PRI system or other enabling village level institutions, in harmony with the provisions of the Participatory Forest Management Rules. The category will be introduced in a phased manner, beginning with villages and Panchayats with strong, expressed commitment for managing these forests. These forests shall primarily be managed to meet the livelihood needs especially of the resource poor sections of the community in addition to providing environmental services. The HPFD will play a supportive and facilitative role in the management of community forests.

- (d) Urban Forests: These forests shall be managed for improving the urban landscape for aesthetic values and environment services.

In addition to above major functional classification of forests there are enabling policy measures to administer the forest governance, management, harvesting and use. This also interfaces with other land departments like industry, mining, hydel projects, agriculture and forestry interface etc. For all this there is guideline for human resource development, forestry research, development and extension, use of information technology in forestry, planning, evaluation, legal requirements etc. In other words, it embraces on extra-sectoral policy influences and inter-sectoral co-ordination, financial support to the sector etc.

State Policy on Development of Eco-tourism-2005 of H.P. Forest Department: The said policy mission is to make “Himachal Pradesh a leading Eco-tourism destination in the country by 2010”. Through the policy, the State intends to “preserve and protect the natural heritage, both flora and fauna, of Himachal Pradesh and attract discerning tourists and visitors to the State; and in the bargain provide opportunities to enhance livelihood of the local people and alongside

generate revenue for the sustainable development of its resources through the creation of a special purpose vehicle (SPV).

The Eco-Tourism Policy would encourage a partnership between the SPV on the one hand and the civil society (local communities, NGOs, academic institutions and private enterprises/businesses) and the State (Forest, Tourism and Fisheries Department) on the other.”

The revised Eco-Tourism policy aims to bring the wilderness of Himachal Pradesh closer to the tourist visiting the State and at the same time attempts to put in place adequate safeguards and systems leading to the preservation of these natural resources. By involving the local communities, the policy would help improve their prosperity through increased livelihood opportunities. It would also ensure adequate economic returns to the State which would be ploughed back into the environmental system for its proper up keep and maintenance.

The strategies outlined in the policy are creating a special purpose vehicle for anchoring the Eco-Tourism activities; creating awareness and capacity building of the principal actors; co-ordination with partner departments in the Government; community based Eco-Tourism (CBET) the corner stone of the policy. Members of the local community will be represented in the committee/society of the project/site and identification of projects and sites.

As per this policy, specific areas within the State that are endowed with unique qualities will be promoted as ‘Hot Spots’ for eco-tourism. These may also include the remote cold-arid deserts of Pooh, Lahaul & Spiti with its unique culture; areas in Kullu for nature and out door activities with GHNP as the focal point, Tirthan for angling; Pong Dam for bird watching and water sports; and Shimla for trekking and nature trails etc.

The criteria for selection of project site would be its nearness to the tourist destination (which is essential for effective marketing), its viability as an economic proposition, its potential to attract discerning tourists and above all an enthusiastic local community willing to preserve its nature as well as man-made heritage.

- (a) The policy will promote Public-Private Partnership (PPP), including NGOs/CBOs and safety measures. The proposed activities include highlight trekking/nature walks through designated paths/eco-treks; over night camping in designated camps and forest rest houses, bird watching and study of flora and fauna (especially viewing of nocturnal wildlife) angling/fishing, nature camps etc.
- (b) There is a perfect setting for sustainable development of eco- tourism in the State. As some States have health tourism, some have pilgrimage based tourism, the State of Himachal Pradesh has perfect blending of natural landscapes, rich bio-diversity, medicinal plants and places of pilgrimage and therefore it encompasses the aspects of traditional healing from locally available medicinal plants, natural scenic beauty of Himalayas and its glaciers, religious belief etc. The State has already taken a number of initiatives in promoting sustainable eco-tourism in the State which has the potential of improving the livelihood of forest dependent population and overall economic growth of the State. Once the eco-tourism development in the State has become fully functional, it may generate large scale employment to rural as well as urban young and educated people and therefore this is an important sector of development. This needs to be given emphasis within the carrying capacity of the areas and overall landscape.

Leasing out guest houses, sites for tourism as per Eco-tourism policy, 2005: The Himachal Pradesh Forest Department (FD) is to lease out five sites and 10 guest houses as a first step towards promoting public-private tourism partnerships in the State.

The guest houses to be leased are situated at Ala (near Dalhousie), Kangra, Gazta (near Khara Patthar), Theog, Tatta Pani, Majhwar, Dhuna Devi, Urla (all in Mandi), and Banethi & Trilokpur (Sirmaur). The sites to be given out include Barpg, Shoghi, Sonu Banlah (near Tara Devi), McLeodganj and Dalhousie.

The lease is being given to private players on the strict condition that they will not raise any permanent structures – only camping sites can be set up there. The parties will have to appoint nature guides so as to generate awareness of the rich flora and fauna of the area. The applicants have also been asked to explain their management plans for garbage disposal and employment generation.

State Medicinal Plants Policy, 2005: The Policy visualizes Himachal Pradesh to become a major herbal State in the country by 2025 with recognition of the medicinal plant resources of the State as very important forest produce; sizeable rural and urban population deriving their livelihoods from this sector and significant contribution made by this sector to the State's economy and enabling legislation and institutional mechanisms to develop this sector firmly in place.

The policy vision and objectives are proposed to be realized through the policy principles and strategies, which include management of there source in its natural habitat; cultivation; trade and enterprise; health security; legal reforms; institutional mechanism; linkages with other policies; and linkages with neighbouring States.

Biotechnology Policy Year: The biotechnology policy is set in context to the

State being endowed with rich plant, animal and microbial biodiversity. There are many rare plants, particularly in the upper reaches of Himalayas, which have immense potential for use in the pharmaceutical industry.

The Government proposes to establish in association with private sector, two separate Bio-technology (BT) parks between Solan and Shimla & Shahpur and Jogindernagar, where land/plots would be made available to prospective entrepreneurs. The latter, however, are also free to choose their own sites or locate in the established industrial areas in the State.

For registered BT Units within declared BT Park/Industrial area, relaxation of FAR to the extent of 50% of the prevailing norms shall be given. In other areas (not including core, green, banned, restricted, heritage areas), relaxation of upto 25% could be considered in individual cases, subject to considerations of population densities, infrastructure availability, local geology etc

BT Units will be considered at par with fruit, vegetable and maize based units and shall enjoy the concessions available to the latter as contained in Annexure V of the industrial policy guidelines of the State, except the following: interest subsidy on term loans, capital subsidy on the cost of preparation of feasibility report.

The policy stresses upon the need for linkage to be established among farmers, R&D institutions and industry. This will allow continuous supply of raw material required for the industry. A buy-back facility needs to be ensured to the farmers for supplying the raw material. This is especially true for herbal and horticulture based industries.

Urbanisation Policy, 2009: Section 19 of the said policy deals with preservation of environment. sub-section 19.1 States that being located in the eco-sensitive young

folded Himalayan mountain, terrain of the State is highly eco-sensitive. The human disturbance in terms of cutting of terrain for various pursuits like construction of roads, establishment of projects, housing colonies, commercial pursuits, industrial and tourism establishments, institutional buildings etc have acquired serious proportions.

The policy proposes a balance to be struck and development pursuits are required to be carried in accordance with environmental, ecological and natural imperatives.

Sub-section 19.3 states that encroachments on forest lands, green cover, roads and public lands have to be dealt with stringently and effective measures are required to be taken to ensure optimum utilization of scarce land resources.

Sub-section 19.6 states that no damage to natural drainage shall be caused and a distance from the highest flood level shall have to be left from the drainage lines. For rivers, it is 25 meters, for khuds/streams it is 10 meters and for nallah it is 5 meters.

Sub-section 19.7 states that slopes on either side of roads shall have to be planted with trees.

Sub-section 19.11 states that each locality shall be responsible for its cleanliness, beautification, plantation and landscaping. NGOs are to be geared to involve the common man in such noble pursuits.

Sub-section 19.12 states that to restore depleting vegetal cover, each plot holder shall plant at least five trees or trees equivalent to number of inhabitants in his plot and shall be responsible for their case.

Sub-section 19.13 mentions that no construction shall be allowed within the radius of 5.00 meter from the circumference of existing tree and within a distance of 5.00

metre from the boundary of Government and forest land.

Sub-section 19.14 mentions that at high altitude places/tourist resorts like Shimla, Dalhousie, Dharamshala, Manali etc plantation of Deodar/ Coniferous/evergreen trees may be given preference, as they look more fascinating and the same are sustainable.

Other Sub-Programmes / Strategies / Projects

State Compensatory Afforestation Fund Management and Planning Authority (CAMPA): The State CAMPA guidelines approved by the Honourable Supreme Court seek to promote: (i) conservation, protection, regeneration and management of existing forests; (ii) conservation, protection and management of wildlife and its habitat within and outside protected areas including the consolidation of the protected areas; (iii) compensatory afforestation; (iv) environmental services including provision of goods such as non-timber forest products, fuel, fodder and water; and (v) research, training and capacity building. Overarching Objectives and Core Principles of State CAMPA are given below.

- a. State CAMPA is intended as an instrument to accelerate activities for preservation of natural forests, management of wildlife, infrastructure development in the sector and other allied works.
- b. The State CAMPA would presently receive monies collected from user agencies towards compensatory afforestation, additional compensatory afforestation, penal compensatory afforestation, Net Present Value (NPV) and all other amounts recovered from such agencies under the Forest (Conservation) Act, 1980 and presently lying with the Ad hoc CAMPA.

- c. The State CAMPA would administer the amount received from the Ad hoc CAMPA and utilize the monies collected for undertaking compensatory afforestation, assisted natural regeneration, conservation and protection of forests, infrastructure development, wildlife conservation and protection and other related activities and for matters connected therewith or incidental thereto.
- d. State CAMPA would serve as a common repository of funds accruing on account of compensatory afforestation and NPV. It would deploy funds as per guidelines governing the use of funds for conservation, protection and management of forests. The amounts would also be deployed for wildlife preservation and enhancement of wildlife habitats.
- e. State CAMPA would provide an integrated framework for utilizing multiple sources of funding and activities relating to protection and management of forests and wildlife. Its prime task would be regenerating natural forests and building up the institution engaged in this work in the State Forest Department including training of the forest officials of various levels with an emphasis on training of the staff including forest range level. The department would be modernized to protect and regenerate the forests and wildlife habitat.
- f. The State CAMPA may decide to utilize a minor part of its funds for contractual engagement of personnel wherever there is shortage of personnel. It may also take up State-specific activity relevant to the State, in keeping with the core objectives.
- g. The State CAMPA would also promote a voluntary movement of youth and students for supporting conservation activities initiated/ ongoing in the State Forest Department.

The Functions of State CAMPA shall include, inter alia (i) funding, overseeing and promoting compensatory afforestation done in lieu of diversion of forest land for non-forestry use under the Forest (Conservation) Act, 1980; (ii) overseeing forest and wildlife conservation and protection works within forest areas undertaken and financed under the programme; (iii) maintaining a separate account in respect of the funds received for conservation and protection of protected areas; (iv) creating transparency for the programme and mobilizing citizen support; and (v) earmarking up to two percent of the funds for monitoring and evaluation.

Guidelines for the preparation of the Catchment Area Treatment Plans (CAT Plans): In supersession of the earlier notification No. FFE- B-F-(2)-72/2004-Pt-II dated 3rd August 2009, Department of Forests, Government of HP has stipulated vide notification No. FFE-B-F-(2)-72/2004-Pt-II dated the 30.9.2009, that apart from the regular activities like afforestation, fuel-fodder plantation, pasture development, soil and moisture conservation measures including erosion control and protection against floods, forest protection including construction/repair of boundary pillars, forest infrastructure development, publicity, awareness, capacity building, training and socio-economic development, every CAT Plan being submitted by the User Agencies shall mandatorily conform to the following requirements:

a. The CAT plan size should be based on the actual extent of work to be done in the catchment, but shall not be less than 2.5% of the total project cost. The CAT Plan size would cover the outlay for all components/treatment measures, provisions for offsetting cost escalation, and other special provisions viz. Payments for Environmental Services (PES), Eco-Battalion, Monitoring & Evaluation, Eco-

tourism etc. Total project cost shall be the cost of the project proposal mentioned in the techno-economic clearance (TEC Cost).

- b. Minimum area to be treated under the CAT plan would be approximately 15% of the total effective catchment.
- c. The total cost of the CAT plan would be deposited by the user agency in equal yearly installments spread over the duration from commencement to commissioning of the project, with the last installment payable at least 6 months before the commissioning of the project.
- d. A provision with appropriate budget is to be made in the CAT plan for carrying out forestry research of relevance to the area.
- e. A provision for establishment of silt observation posts at strategic points for recording soil and silt data at regular intervals.
- f. Areas of operations may be depicted clearly on the Survey of India topo-sheet for effective monitoring and location of work sites.
- g. A detailed chapter depicting the Joint Forest Management (JFM) processes/activities including micro-planning may also be included.
- h. 1 % of the CAT plan budget should be earmarked for Eco-tourism. i.e 5 % provision for monitoring and evaluation activities.
- j. A separate chapter for improvement and development of wildlife and reduction of human-animal conflicts duly vetted by the Principle Chief Conservator of Forests (WL), GoHP will be incorporated.
- k. A provision is to be made for forest protection measures in view of the

induction of a large number of outside work force/labour in the area for project activities.

- l. A provision of 10% of total CAT plan outlay is to be ear-marked for Payment for Eco-services to the local communities.
- m. A provision of 10% per year to off set inflationary trends (Contingencies) to absorb any escalation in the cost of plan proposals on account of increase in wage-rate and material cost would be made. This provision could also be utilised to meet any unforeseen expenses, arising in future, necessary for the achievement of the objectives of the CAT plan.
- n. A provision is to be incorporated for training of the forest staff involved and sensitisation of local communities.
- o. Adequate provision for energy-saving devices to reduce the load on forests for firewood is required.
- p. Rural infrastructure component may be deleted as similar works are provided for under the Local Area Development Fund (LADF) of the Hydro Electric Projects.

Muck disposal/management plan for cases under Forest Conservation Act, 1980: While preparing a case for forest clearance, if there is any activity in the project which involves digging of land, muck disposal/management plan has to be prepared.

This should include: 1. Calculation of muck to be generated. 2. Quantity of muck to be utilized in the project activities; 3. Balance quantity of muck, which requires disposal/management plan; 4. Carriage of muck from the muck generation site to the dumping site; 5. Development of dumping site- construction of retaining walls and other structures as per requirement of the site. The objective is to completely stop rolling down

of the muck; and 6. Rehabilitation of dumping site like leveling, planting of grass, shrubs and tree species.

Cost to be incurred on the above activities has to be given component wise. Detail of dumping site including length, width and height of structure to be erected must be mentioned. Undertaking by the user agency has to be given to the effect that muck management plan will be carried out by the user agency and in case of non implementation of the plan; they will be liable to penalty/action. Dumping site should be located preferably 5 km from the river/stream/nallah.

Policy Guidelines for recommendation of FCA Cases approved by Government of H.P. on 30th September, 2009:

- a. Since out of total 37,033 sq km of forest land in H.P., only 1,896 (5.1 %) is reserve forest and these are sacrosanct by their nature and legal classification; Diversion of forest land from reserve forests should be recommended only in exceptional cases when the diversion is extremely site specific and totally unavoidable.
- b. Only Government owned/ Government approved projects should be entertained for diversion of RFs, DPFs and UPFs.
- c. For any other proposal not covered in 2 above, only those forest areas should be considered which are not RF/DPF/UPF but come under the category of forest by application of 1952 notification.
- d. Forest land should not be diverted to private individual/firm or organisation (including society), charitable trusts, etc not owned by the Government. However, it can be considered on case to case basis if it serves public interest or is for public welfare activities like hydel projects,

transmission lines, and drinking water projects etc.

- e. Forest land for mining can be diverted to individuals only if it has been approved by the Mining Department.
- f. Forest land may not be diverted for religious purposes.
- g. Forest land may not be diverted to Panchayats, Mahila Mandals, Headmasters, Principals, societies etc. directly. Rather cases should be prepared by the concerned Government department under whose control these institutions operate. On approval of the Government of India on such cases, the concerned department may arrange leasing out of the land to such user agencies. To overcome this problem, a system can be evolved for depositing such charges by the actual user agency to the concerned department (not in to treasury as revenue), who, in turn, will deposit the charges to the appropriate account/ head designated by Government of India/State Government.

Government Notification dated 19-2-11 regarding definition of forest and compact wooded block in private lands:

The Notification No. FFE-B-E (30-31/2001-I, dated 19th February, 2011 issued by Forest Department, Government of HP is in compliance of interim order dated 12.12.1996 of the Honourable Apex court in Writ Petition (C) 202 of 1995 titled – T.N. Godaverman Vs Union of India and others decided that the ‘compact wooded block’ above 5 ha in private land which are not recorded as ‘forest’ in the revenue record shall be treated as ‘forest’.

It was suggested by the Central Empowered Committee that the definition of ‘Forests’ as defined by the State of Himachal Pradesh

needs further clarification by way of certain definable parameters. The CEC vide its report dated 7th September, 2005 inter alia observed that it will be appropriate that the State of Himachal Pradesh notifies the definition of Compact Wooded Block as decided by the Himachal Pradesh Forest Department.

In compliance of the above order of the Honourable Apex Court, the definition of ‘forest’/‘compact wooded block’ is notified as 1. ‘If the private area is notified under Indian Forest Act, 1927 or other Act or is entered as Van/ban/vani/jungle in the revenue record it will be treated as forest and 2. For other type of areas not recorded as indicated in point 1. There are two components under this definition namely Compactness of the area above 5 Ha, and Woodiness in this area above 5 Ha. Compactness of an area above 5 Ha would be an area of private land with itself or in contiguity with other adjacent private khasras only and Woodiness in this area of above 5 Ha would be as defined as given below:-

Accordingly, the definition in different agro-climatic zones as indicated namely temperate areas, Sub-tropical areas, Chill forests, and Khair and other broad leaved species.

Forest Department, Government of Himachal Pradesh notification no. FFE-B-A (3) 3/2010 dated 05th May 2010 dealing with Forest offences: The said notification empowers all the Range Officer sin-charge of the ranges to compound forest offences and to accept compensation and/or release the seized property as mentioned in the aforesaid section. The notification deals with the regulation of the compounding of forest offences, disposal of the cases of illicit felling and other forest offences. The notification provides for cases not liable to be compounded, cases which may be compounded, cases to be taken to courts by the Forest Department, cases to be registered

with Police and the powers for fixing of rates of compensation value of forest produce implements and review of damage reports.

The Manual of Instructions for assessment of Tree Outside Forest (TOF)- Rural and Urban: Generally, extensive tree wealth exists outside continuous forested areas. Termed as "Trees Outside Forests" (TOF), these are in the form of small woodlots and block plantations, trees along linear features, such as roads, canals bunds, etc. and scattered trees on farmlands, homesteads, community lands and urban areas.

The manual of instructions has been prepared by Forest Survey of India and is primarily meant for the guidance of personnel concerned with field inventory like, JTAs, STAs, draftsmen, supervisory staff and data processing officers at the headquarters. The manual takes into account almost all aspects involved in the inventory right from the start of the survey to the stage of final dispatch of data to the Zonal Head Quarters for data entry.

Rescue and Release Guidelines in respect of Wild Animals, 2010: The Rescue & release Guidelines in respect to Wild Animals in the State of Himachal Pradesh were issued vide notification No. FFE-B-F (1)-3/201 dated 2nd June, 2010 by Forest Department, Government of HP.

The Rescue & Release Guidelines in respect to wild animals in the State of Himachal Pradesh are required in view of the high forest cover in the State and inter dispersal of forests and human habitations, human-wildlife interactions are inevitable. Commonly, wildlife species like black bear, Leopard, Rhesus macaque come into conflict with people requiring forest department's intervention. Every year there are numerous cases of animal and bird species that are found orphaned, sick, injured, displaced, trapped, abandoned, and/or lying in illegal possessions.

In the absence of any State level guidelines for rescues and release of such animals that are often healthy and fit, they remain in the Zoo/rescue centres for the rest of their lives. In captivity, the general well being of these animals is compromised and creates an unnecessary drain on financial resources of the Government. The objective of these guidelines is to provide a good assessment on the requirements of wild animals which are in need of medical/supportive care and those involved in conflict situations and devise appropriate strategies to deal with them.

Joint Forest Management (JFM) Order 1990: The highlights of 1990 Resolution by Ministry of Environment and Forests are summarized below:

- Developing partnership: between communities and forest departments, facilitated by non Governmental organisations;
- Access and benefits: only to organized communities undertaking regeneration, with equal opportunity based on willing participation;
- Right to usufruct: all non-wood products and percentage share of final tree harvest to communities, subject to successful protection and compliance with conditions approved by the State;
- Ten years Working Scheme: micro plans detailing forest management institutional and technical operations to be developed by community management organisations with local foresters and NGOs;
- Funding: from Forest Department programmes with encouragement to communities to seek funds from other agencies too.

The outcome of the programme, which was implemented in the State as reported in State of Environment Report (SoER) was short of expectation because as in other States of

India, it was the beginning of an experimentation for which foresters were not fully trained to cope up with the new paradigm of management. Attitude and ethos of the forest bureaucracy; lack of understanding of socio-economic and cultural value system of the locals; gender issues and women's representation; inter and intra-village conflicts; lack of statutory authority to local institutions; inadequacy in meaningful people's participation; coverage of only degraded forests under JFM; donor-driven rather than need-driven programme; Target-oriented rather than people-oriented programme and sustainability (of productivity and consumption) were some of the observations of evaluation in the State and elsewhere. Subsequently in 1995, the 1990 Resolution was slightly modified to incorporate women and landless households as well as usufruct-sharing by the committee.

Joint Forest Management Resolution (JFM), 21 February 2000: Following decade of JFM notification of Government of India, June 1990, it was again revised on 21 February 2000. This revision, inter alia, contemplates: Legal backup to JFM committees; reservation for 50% members of the general body for women and extension of JFM into good forest areas with sharper focus on activities concerning Non Timber Forest Products (NTFP) management.

JFM programme was again strengthened on 24th December 2002 by Government of India on the basis of feedback received from the States on various issues by incorporating: memorandum of undertaking (MOU); relationship with Panchayats and capacity building for the management of Non Timber Forest Products (NTFP).

Salient Features of HP Participatory Forest Management Regulation, 2001: HP Participatory Forest Management Regulations issued on 23.8.2001, is a major improvement on 1993 administrative order for JFM as these

are issued under Sections 80 and 81 of Indian Forest Act 1927. It stipulates that the 'Village Forest Development Society' or "Gram Van Vikas Samiti" will be registered under Section 3 of the Societies Registration Act, 1860 for Participatory Forest Management (JFM). The Panchayat ward will be the basic unit for setting up the VDC.

Afforestation Programme: Afforestation work in Himachal Pradesh started from the First Five Year Plan and is continuing till date. Afforestation over 2,825 sq kms area done prior to the year 1980 is presumed to have been registered in the satellite imageries being used by Forest Survey of India (FSI).

Plantations over 6807 sq kms area has been done in the post 1980 decades, the survival of which is about 60%. The afforestation programmes are being continued with enlarged emphasis on community participation in development and management of forests. Emphasis on utilizing the forest resources for promotion of eco-friendly tourism will be enlarged. During the 11th Plan (2007-12), an area of 38,700 ha is likely to be afforested under social and farm forestry including Externally Aided Projects and Soil Conservation Schemes.

With the experience gained in the past and to continue the schemes undertaken relevant to the forestry priorities, objectives for the Eleventh Five Year Plan according to the State and national forestry policies are as under:-

- i. Settlement, demarcation and consolidation of forest area to be undertaken on war-footing.
- ii. For protection of forest wealth of Himachal Pradesh of 12.68 Crores m³ standing volume, valuing about Rs. 1,00,000 Crores from where removals/services worth Rs. 1,020 Crores are being undertaken every

- year will be protected by strengthening the existing legal framework.
- iii. The degraded forest lands, the village common lands and wastelands will be rehabilitated through various State & Centrally Sponsored and Externally Aided projects/schemes so that the forest cover as per policy of the Government is achieved.
 - iv. Integrated micro watershed based approach for forestry and soil conservation will be adopted.
 - v. Need for organizing comprehensive training both in the country and abroad to be considered on high priority for capacity building and improving professional management of the cadre.
 - vi. More and more integrated externally aided projects will be prepared for conserving and ameliorating the environment of the State.
 - vii. The concept of Joint Forest Management (JFM) will be implemented in letter and spirit as per notification issued by the Government and making people partners in the management of forests.
 - viii. Forestry will be developed in such a way that it will supplement rural and tribal development.
 - ix. On account of moratorium on green felling resulting in loss of revenue, efforts will be made to get special assistance from the Central Government, in the overall national interest.

Externally Aided Projects

a. World Bank Aided Integrated Watershed Development Project (Kandi-Area): An Integrated Watershed Development Project (Hills) Kandi area was launched in the State during 1990-91 with the World Bank assistance which reached culmination on 30th September, 2005. This was an integrated project of various

disciplines such as Forestry, Agriculture, Animal Husbandry and Horticulture. Under this project, 93850 ha area was treated in five watersheds of Markanda, Ghaggar, Sirsa, Swan and Chakki in the territory of Himachal Pradesh.

IWDP (Hills II). A new project titled Mid Himalayan Watershed Development Project, funded by The World Bank has been initiated in 2005 and will be implemented till 2013. IWDP (Hills-II) Himachal Pradesh is being implemented in Shiwalik area of Himachal Pradesh since 1999. The performance of this project has been appreciated at various levels including World Bank Supervisory Missions. Encouraged by the results of the project in the field and overwhelming response of the people, a new Integrated Watershed Development Project has been formulated for the Mid-Himalayas of Himachal Pradesh with an estimated cost of Rs. 365 Crores. The Mid-Himalayas in the State include the part areas of Districts Chamba, Kangra, Hamirpur, Mandi, Bilaspur, Solan, Sirmour and Shimla ranging from 800 m to 1600 m. The project will focus primarily on the issue of poverty alleviation along with resource rehabilitation, conservation and development assimilating the lessons learnt from IWDP (Hills-II) Kandi. The total duration of the project will be of seven years. The first year will be treated as zero year and will be mainly utilized for institutional building followed by full scale implementation of various activities for another five years. Last year of the project is proposed for phasing out phase i.e. withdrawal of the project. The basic aims of the project are prevention of degradation of high potential areas while optimizing productivity of arable and non-arable lands with eco-friendly technologies, preserving and protecting the areas of high bio-diversity through better forestry process, livestock management and soil and water conservation practices, restoration of productivity of degraded lands. Improving the productivity of the livestock by increasing the proportion of

graded animals, to improve the accessibility of rural areas in order to facilitate the implementation of the project and carriage of farm produce to the nearby markets, to organize the local communities and to strengthen the local institutions in natural resource management. Its positive impact on Environment.

b. Swan River Flood Management Project (CAT-I): "Swan River Flood Management, Integrated Land Development and Watershed Management Project" is located in the Una District. Forest Department has prepared a detailed project report requiring an investment of Rs. 124.00 Crores for this project. Under this project, 85% of the total project cost will be received as external assistance and 15% will be borne by the State Government as state share. The debt sustainability clearance from the Department of Economic Affairs, Ministry of Finance, Government of India has been obtained for proposing this project for JBIC assistance. The main objective of this project is to reduce soil erosion and implement watershed catchment treatments of the 73 tributaries of the Swan River in order to reduce the water traffic to the main Swan River. The project was started in April, 2006 for 8 years and will be terminated in 2014. Its positive impact on Environment.

State Plan Schemes 2007-2012

- a) Forest Research and Training: With increasing pressure on the forests, applied research in forestry is gaining significance. Establishment of seed stand, preservation plots and biosphere reserves etc. are among the various activities taken up under this scheme.
- b) Forest Conservation and Development:
 - a) Survey and Demarcation: In order to eliminate chances of illicit felling and incidence of encroachment due to ill-defined boundaries, the forests are to be

demarcated by fixing boundary pillars. The survey operations as envisaged under this scheme are to be carried out.

- c) Forest Protection: Protection of forests under the increasing biotic pressure becomes more significant. To ensure this and protecting the forests from fires, an effective and adequate infrastructure needs to be developed.
- d) Working Plan Organisation: For scientific forestry and systematic management of the forests, revision and updating of working plans is an important pre-requisite to achieve the goal. All efforts are being made to revise the working plans under this scheme.

Social and Farm Forestry

After rationalization of schemes, the following new schemes were introduced during 2000-2001 in place of production forestry and social & farm forestry.

- a) Development of Pasture and Grazing Land Improvement: This is an ongoing scheme since the Second Five Year Plan. In this hilly State, cattle, sheep and goat mainly depend upon the pasture land in the higher reaches. Under this scheme, the high altitude pasture as well as grazing lands adjoining the village is taken care of by introducing better grasses and raising fodder trees. Besides, these steps are also taken to prevent soil erosion.
- b) Improvement of Tree Cover: The following schemes will be implemented under the scheme improvement of tree cover.
- c) Afforestation Scheme: i) Objective: This scheme envisages covering blank areas for bringing them under tree cover in order to achieve optimal land use.

Both conifer and broad leaved species of indigenous as well as tried and tested exotic origin suitable to the site are being planted. ii) Activities: Fencing of the area, soil moisture conservation measures, planting and bush cutting to a limited extent will be done to facilitate establishment and growth of plants.

- d) **Enrichment Planting:** i) Objective: Areas of poor density with inadequate stocking (with density ranging from 5% to 20%) shall be covered under this scheme to improve their stocking and productivity. ii) Activities: Fencing of the area, soil moisture conservation measures, planting wherever necessary, bush cutting and cultural operations etc. shall be done under this scheme.
- e) **Re-afforestation of Scrub Areas:** i) Objective: To convert areas under scrub including those covered by bushes and weeds like Lantana, Eupatorium and Ageratum etc. into productive forests/plantations by introducing suitable species of indigenous and exotic origin. ii) Activities: Fencing of the area, soil moisture conservation measures, weed removal bush cutting and planting etc. shall be done under this scheme.
- f) **Raising Nurseries for Departmental Planting and Public distribution:** This scheme was planned to raise genetically superior and healthy plants for planting activities and also for distribution to the public to achieve the right balance of mix of suitable species (both conifer and broad leaved) of long, medium and short gestation period in the departmental nurseries.

This scheme was introduced in the year 1998-99 to have the participation of communities in the natural resource management in general and forests in particular. It aims at empowering people and the communities in

accepting a greater role and responsibility in management of the natural resources.

The main objectives of the scheme are: i) Involvement of grass root level institutions such as Gram Panchayats, Mahila Mandals, Yuvak Mandals, Schools, Village Development Committees (VDC's), NGOs etc. in eco-restoration; ii) Regeneration of degraded forest areas through community involvement; iii) Creation of social assets for the benefit of the communities; iv) Increasing productivity of the forest areas by improvement of nursery stock through adoption of modern nursery techniques; v) Re-orientation of the forest staff for facilitating community participation; vi) Generation of employment opportunities in rural areas; and vii) To bring more areas under tree cover by encouraging rehabilitation/plantations of private wastelands on cost/benefit sharing basis.

Wildlife Conservation and Management in the State

a. **Rationalization of Protected Areas Boundaries in Himachal Pradesh:** Government of India (in third week of September, 2009) has given its approval for the proposals of the Rationalization of Boundaries of the Protected Areas in Himachal Pradesh. Many of the best forests and other wild lands of Himachal Pradesh happen to be within the Protected Area Network (PAN). So also are many areas, forested or otherwise, which are of little conservation value and are quite unnecessary (and positively inimical) had been included in the PAN. What is more important is that both the good and the not so good national parks and wildlife sanctuaries had not only several million people living within their boundaries but had tens of millions (mostly tribal and rural poor) dependent on them for their livelihood needs.

Till recently, Himachal Pradesh had a PAN comprising 32 wildlife sanctuaries and 2 national parks spread over 5 Bio-geographic zones in the State. This was about 12.8 % of the State's geographical area. Of the 32 wildlife sanctuaries there were habitations within 24. These inhabited

villages were 793 in number with a human population of 116658 (2001 Census) and a livestock of 183891. Most of the inhabitants and their livestock is forest dependent and much of the village economy is linked to access and harvest of NTFPs, grazing and so forth in forests surrounding the villages. Over the years these people have witnessed (and borne the brunt of) increasing restrictions on their livelihood related activities as also on getting development works approved and implemented.

Rationalisation of the PAN offered a way out of this impasse. It simply meant re-drawing the boundaries of wildlife sanctuaries and national parks to exclude villages/hamlets along with those forests that are heavily encumbered with people's rights. By doing this the major grieve of local people in terms of exercise of traditional rights and implementation of development schemes is sorted out. Secondly, and most importantly, a multitude of unnecessary problems around what is allowed or not allowed within PAs gets circumvented. Development departments like public works, irrigation and rural development and through them local politicians will stop looking at Forest/Wildlife Departments as their number one enemy and should over time become more amenable to the idea of conservation. The action now quickly shifts to the serious business of wildlife management that actually results in biodiversity conservation.

The State of Himachal Pradesh is the first State in the country which has undertaken exercise of Rationalization of Boundaries of

Protected Area. It took an effort of more than five years to complete this exercise.

The activities which are being carried out in the State in the wildlife wing of the Forest Department include: (i) Protect, develop and scientifically manage the wildlife in the protected areas; (ii) Bring more area under the protected area network; (3) Protect the wildlife and its habitat in areas outside the protected areas; (iv) To carry out integrated eco-development work in the vicinity of protected areas to reduce the biotic pressure in protected areas; (v) Carry out the captive breeding and rehabilitation of endangered species; (vi) Create nature awareness among local people in general and youth in particular and also to involve the Non-Governmental Organisations; (vii) Carry out field research regarding wildlife of Western Himalayas; (viii) Establish and develop zoological parks for Western Himalayas; and (ix) Propagate Eco-Tourism.

State Plan Schemes: State plan schemes include wildlife preservation, development of Himalayan Zoological Park and implementation and development of wildlife sanctuaries. Rationalisation of Protected Areas (PA) Boundary in Himachal Pradesh, the first and only State in India has been done by the Forest and Wildlife Department as a result of which total area under PA has actually increased. There is a general feeling as well as experience in other States that rationalization of PA boundaries often result in shrinking of areas of National Parks and Wild Life Sanctuaries. Himachal Forest Department has shown that if it is done on scientific lines, the area may also increase for the betterment of Wild Life Conservation and Management.

Wildlife Preservation: This scheme was introduced during the year 2001- 2002. The main objective of the scheme is payment of relief on account of loss of injury to human life and loss of cattle life by the wild life

animals in protected areas. School/college students and local youths are taken to wildlife areas for exposure and for creating affinity for wildlife and nature conservation. Equipments like projectors, films, camping equipments etc. are required for conducting such tours. Vehicles are also required for transportation and food has to be provided free of cost to the students.

Development of Himalayan Zoological Park: This is a continued scheme from the Seventh Five Year Plan. It is expected that upto the end of this plan period, 6-7 centres for collection of Western Himalayan Species are developed under this scheme in the State. The area of expenditure under this scheme includes repair of existing enclosures and feeding of zoo animals including the expenditure of treatment of the ailing wildlife animals and birds.

Improvement and Development of Wildlife Sanctuaries: This is a continued scheme from the Tenth Five Year Plan for tribal areas. The area of expenditure under this scheme is wildlife survey, habitat improvement, fodder and pasture improvement, plantation and soil conservation works, census of animals/birds, construction of infrastructure.

Assistance for Development of National Parks and Sanctuaries: The scheme envisages intensive management of 32 Wildlife Sanctuaries and two National Parks in the State. The area of expenditure under this scheme is protection works, habitat improvement, research work, fire protection measures, soil conservation works, plantation of fuel and fodder trees, improvement of existing paths and enclosure, training/awareness programme, salt licks construction of retention dams/ponds etc. in the national parks and sanctuaries. Central sector schemes include: Assistance for Development of National Park and Sanctuaries; development of Pin Valley National Park; Breeding Project for

Endangered Species; Integrated Conservation and Development Project (ICDPs); restoration of degraded habitats of animal biodiversity; forest plantation; wildlife and nature conservation; forest protection and eco-tourism.

Development of Pin Valley National Park: The Pin Valley National Park is situated in the Pin Valley of Spiti Sub-Division of Lahaul and Spiti District. The area supports unique flora of cold desert eco-system. Pin Valley National Park is one of the few areas where Snow Leopard, which is a highly endangered species in the world, is found along with its prey species.

Besides Snow Wolf, Ibex, Himalayan Brown Fox, Himalayan Blue Sheep, Snow Rabbit, Marmots, Weasels, Snow Cock, Chukor, Hill Pigeon, Yellow Billed Chough etc. are also found in the Park area. Efforts are being made to develop this park for providing proper protection to all wildlife especially to Snow Leopard etc. For this purpose necessary development work and research studies are planned in the area for better PA management.

Conservation breeding projects for endangered species: Following the success of the Western Tragopan breeding programme, Himachal Pradesh wildlife authorities are preparing to undertake similar Conservation Breeding projects for other endangered Himalayan fauna like Monal and the Chir pheasant. Manali will host the breeding programme for the Monal, found in deodar and oak forests at over 1800 m. The conservation project for the Chir Pheasant has been planned at the Chail sanctuary.

The State has also taken an initiative in regulating the menace of monkeys in tourist places by establishing 3 Monkey Sterilization Centres. Out of an estimated population of 3 lakhs monkey population in the State, about

30,000 monkeys have been sterilized and released in the wilderness.

Integrated Conservation and Development Projects (ICDPs): The wildlife Wing of H.P. Forest Department has undertaken integrated eco-development projects in Wildlife Sanctuaries and National Parks (especially the Great Himalayan National Park). They involve bio-diversity conservation linked with local socio-economic development with the active participation of local communities.

Restoration of Degraded habitats of Animal Biodiversity: The Forest Department has embarked upon an extensive programme for restoring degraded habitats of animals through large scale plantation of different species of trees under various schemes, including social and participatory forestry.

There has been a general improvement and restoration of the habitats of wild animal diversity under a World Bank funded project on the restoration of the productive potential of the highly eroded and degraded Shiwalik Hills. The H.P. Shiwalik Watershed Development Society is implementing this project.

Eco-tourism: The activities undertaken during 2009-10 include strengthening and further development of already existing eco-Tourism sites at Shimla i.e. Potter's Hill, Narkanda, Great Himalayan National Park and Dalhousie in and around forest areas and development of new sites/ circuits. Eco-tourism in circuits are being created in Kullu, Shimla Kinnaur and Bilaspur District. Under public-private partnership 10 proposals for 3 forest rest houses and 7 tenting sites belonging to 5 parties have been finally cleared by the State Government. Two of the sites, Motikuna (Sanawaar) and Chewa (Barog) have become operational and another two sites are likely to become operational shortly. Under TFC, five eco-circuits were planned to be developed during the financial year (2009-

10). Development of eco-tourism is going to generate local employment and this way the conservation measures may receive support from local communities. This strategy therefore, needs wider application for the good of local people and forests.

2.2 Wetlands

National Level Policies/Regulations

The lakes & wetlands are presently not covered by any specific legal statute but several legislations enacted till date have relevance & provisions for conservation of lakes both at national & State level. The National Environment Policy (NEP), 2006 also seeks for setting up of a legally enforceable regulatory mechanism for lakes & wetlands to prevent their degradation and enhance their conservation. Draft regulatory framework for conservation and management of wetlands is being finalized which is expected to be notified under the Environment (Protection) Act, 1986. At present conservation and usage of wetlands is being ensured through following policy and legal instruments.

The National Water Policy, 2002: National level policy addresses the water issues including prioritisation, allocation, pricing and inter-state issues related to water sharing. Policy states about the use of water, water conservation and quantification of water pollution.

Section 1.2 states that rivers and underground aquifers often cut across state boundaries. Water, as a resource is one and indivisible. Therefore, rainfall, river waters, surface ponds, lakes and ground water are all part of one system.

Section 7.3 states that integrated and co-ordinated development of surface water and ground water resources and their conjunctive use should be envisaged right from the

project planning stage and should form an integral part of the project implementation.

Section 14.5 states that necessary legislation is to be made for preservation of existing water bodies by preventing encroachment and deterioration of water quality.

Section 25 states that for effective and economical management of water resources, the frontiers of knowledge need to be pushed forward in several directions by intensifying research efforts in various areas, including hydro-meteorology; snow and lake hydrology; surface and ground water hydrology; assessment of water resources; water quality; water conservation; evaporation and seepage losses; recycling and re-use; better water management practices and improvements in operational technology; soils and material research; economical designs for water resource projects, sedimentation of reservoirs, prevention of salinity ingress; prevention of water logging and soil salinity; reclamation of water logged and saline lands; environmental impact and regional equity.

The National Environment Policy (NEP), 2006: The National Environment Policy seeks to set up a legally enforceable regulatory mechanism for identified valuable wetlands to prevent their degradation and enhance their conservation. It also undertakes to develop an inventory of such wetlands.

The policy recognizes the ecological services rendered by the water bodies like lakes & wetlands. The NEP states that wetlands including lakes are under threat from drainage and conversion for agriculture & human settlements besides pollution. The reduction in economic value of their environmental services due to pollution, as well as the health costs of the pollution itself, are not taken into account while using them as a waste dump.

The NEP recommends to develop an action plan for these water bodies, which

importantly include formulation of conservation & prudent use strategies, integration of wetland and lake conservation into sectoral development plans for poverty alleviation and livelihood improvement, formulation of eco-tourism strategies through multi stakeholders' partnership.

The NEP, 2006, contains an unambiguous assertion of the need for a holistic view of wetlands, which looks at each identified wetland in terms of its causal linkages with other natural entities, human needs and its own attributes. The NEP's six-fold 'Action Plan' in this direction comprises, among others, formulation of a regulatory framework, linkage with poverty alleviation, and programmes for employment generation.

The current initiatives on wetlands fall short of taking strong note of alien invasive species that impinge upon the structural organisation and functional integrity of these fragile ecosystems. Thus, to reduce the associated economic, social and environmental costs it is important to integrate various steps and initiatives into overall wetland resource management objectives and plans. These steps are a. Awareness-of the issues and the seriousness of wetland invasion and their consequences to wetlands, people and biodiversity; b. Information and training-specialized expertise and training for documentation of priority and potential invasive species; c. Research and Monitoring-for identifying the underlying mechanisms responsible for invasiveness and invisibility; d. Prediction and Quarantine-development of a predictive framework for potential invaders in order to prevent and limit their spread; e. Policies and Legislation- their development and implementation for management of biological invasions; f. Co-operation-among agencies and organisations involved in global, national, and regional efforts to understand and manage invasive species in wetlands, such as Global Initiative on Invasive Species, The Global Invasive Species Programme and the

Regional Invasive Species Programmes. Fortunately, the issue of invasive species is an area identified for co-operative action in the Joint Work Plan between the Convention on Biological Diversity (CBD) and the Ramsar Convention.

National Conservation Strategy and Policy Statement on Environment and Development, 1992: The National Conservation Strategy and the Policy Statement on Environment and Development are in response to the need for laying down the guidelines that will help to weave environmental considerations into the fabric of national life and of development process. It is an expression of commitment for re-orienting policies and action in unison with the environmental perspective.

Wetlands are referred to notably in section 2.7 of the statement “Our unique wetlands, rich in aquatic and bird life, providing food and shelter as also the breeding and spawning ground for the marine and fresh water fish, are facing problems of pollution and over-exploitation”

Section 3.4 on Conservation of Forests and Wildlife refers to “Management Plans for identified wetlands, mangrove areas and coral reefs”.

Section 4.0 on constraints and agenda for action states about action. The agenda for action in this regard will include the following to conserve and nurture the biological diversity, gene pool and other resources through environmentally sustainable development and management of ecosystems, with special emphasis on our mountain, marine and coastal, desert, wetlands, riverine and island ecosystems;

Section 5.2 on Conservation of Natural Resources describes conservation of wetlands for ensuring sustainable ecological and economic benefits;

Sub-section 5.2.3 mentions about conservation of biodiversity through a network of protected areas including biosphere reserves, marine reserves, national parks, sanctuaries, gene conservation centres, wetlands, coral reefs and such other natural habitats of biodiversity. This should include taxonomic and ecological studies on the flora and fauna with adequate emphasis placed on the lower vertebrate, invertebrate and micro-flora which are important in contributing to the healthy maintenance of ecosystems.

Indian Forests Act, 1927: The Indian Forest Act, 1927 is a legislation which was enacted mainly to enable the State to govern and manage the forests and their produce and to facilitate and regulate timber trade. It's an Act to consolidate the law relating to forests, the transit of forest-produce and the duty leviable on timber and other forest-produce. The Act encourages conservation of forest biodiversity only by way of controlling and restricting the uses to which the forests can be put, and by restricting access of people to certain categories of forest.

Biological Diversity Act, 2002 and Biodiversity Rules, 2004: This Act primarily aims at giving effect to the provisions of the Convention on Biological Diversity (CBD), including regulating access to biological resources and associated traditional knowledge so as to ensure equitable sharing of benefits arising out of their use, in accordance with the provisions of Article 15 of the CBD. Biological Diversity Rules were notified in 2004.

The Water (Prevention and Control of Pollution) Act 1974, (Amended -1988): The Water (Prevention and Control of Pollution) Act was enacted in 1974 to provide for the prevention and control of water pollution and for the maintaining or restoring of wholesomeness of water in the country. The Act was amended in 1988. It enables the

Government through Central & State Pollution Control Boards to prescribe standards and has provisions for monitoring & compliance and penal provisions against the violators of the Act. The Water (Prevention & Control of Pollution) Act, 1974 as amended deals comprehensively with water issues. It empowers the Government to maintain the wholesomeness of National Water Bodies. The Act also provides for prohibition on use of stream (includes inland water whether natural or artificial) or well for disposal of polluting matter etc

Chapter 5 of the Act deals with Prevention and Control of Water Pollution on Power of State Government to restrict the application of the Act to certain areas; power to obtain information; power to take sample of effluents and procedure to be followed; reports of the result of analysis on samples taken under section; power of entry and inspection; prohibition on use of stream or well for disposal of polluting matter etc; restrictions on new outlets and new discharges; provision regarding existing discharge of sewage or trade effluent; refusal or withdrawal of consent by State Board; appeals; revision; power of State Board to carry out certain works; furnishing of information to State Board and other agencies in certain cases; emergency measures in case of pollution of stream or well; power of Board to make application to courts for restraining apprehended pollution of water in streams or wells; power to give directions.

The Environment (Protection) Act, 1986: The Environment (Protection) Act, 1986, amended 1991 has been enacted to safeguard the natural environment. The Environment (Protection) Act, 1986 defines the power of the Central Government to take measures to protect and improve environment which includes water, air and land and the inter relationship which exists among and between water, air, land and human beings, other living

creatures, plants, micro organisms and property.

Environment (Protection) Rules, 1986: The Environment (Protection) Rules, 1986 were notified vide S.O.844(E), [19/11/1986]. The power conferred by the Environment Protection Act are followed under the heads of Coastal Regulation Zone; Delegation of Powers; Eco-marks Scheme; Eco-sensitive Zone; Environmental Clearance-General; Environmental Labs; Environmental Standards; Hazardous Substances Management; Loss of Ecology; Noise Pollution; Ozone Layer Depletion; Water Pollution; and 2-T Oil.

Wildlife Conservation

Wildlife protection has been included in Article 51-A, as a fundamental duty of citizens of the country. In pursuance of this constitutional directive, in 1983, the Government of India through the National Wildlife Action Plan of the Ministry of Environment laid down several sets of actions by which wildlife should be conserved. These are contained in the Prime Minister's statement to the Indian Board of Wildlife in 1982 which listed aims of wild life conservation. There should be a network of protected areas to cover representative samples of all major wild life eco-system and with adequate geographic distribution; degraded habitats in these protected areas should be restored to their natural state; rehabilitation of endangered species including restoration to former habitat and pastures; development of adequate corridors for genetic continuity in production forests and pastures; development of appropriate management system, protected areas, long term conservation of wild life based on the scientific principles of evolution of genetics.

In 1988, the Government introduced a new Forest Policy, which contains a number of statements on wildlife and on bio-diversity for

conserving the natural heritage of the country. This is to be done preserving the remaining natural forests with the vast variety of flora & fauna, which represents the remarkable biological diversity and genetic resources of the country.

The policy states that for the conservation of total biological diversity, the network of national parks, sanctuaries, biosphere reserves and other protected areas should be protected and strengthened adequately.

Wildlife Protection Act, 1972: The Government of India enacted Wildlife (Protection) Act, 1972 with the objective of effectively protecting the wild life and to control poaching, smuggling and illegal trade in wildlife and its derivatives. It extends to the whole of India, except the State of Jammu and Kashmir which has its own Wildlife Act. The Act was amended in January 2003 and punishment and penalty for offences under the Act have been made more stringent. The Ministry of Environment and Forests has proposed further amendments in the law by introducing more rigid measures to strengthen the Act. The objective is to provide protection to the listed end angered flora and fauna and ecologically important protected areas.

The Act established schedules of protected plant and animal species; hunting or harvesting these species was largely outlawed. It has six schedules which give varying degrees of protection. Schedule I and part II of Schedule II provide absolute protection and offences under these schedules are prescribed the highest penalties. Species listed in Schedule IV are also protected, but the penalties are much lower. Enforcement authorities have the power to compound offences under this Schedule (i.e. they impose fines on the offenders). Penalties are prescribed in section 51. Enforcement can be performed by agencies such as the Forest Department, the Police, the Customs and the

Central Bureau of Investigation (CBI). Charge sheets can be filed directly by the Forest Department.

Amendment in the Wildlife Protection Act was done in 1993 and 2002. Various rules under this act include (1) Recognition of Zoo Rules, 2009; (2) S.O.1092(E), [22/9/2003] - The National Board for Wild Life Rules, 2003; (3) S.O.445(E), [18/4/2003] - The Declaration of Wild Life Stock Rules, 2003; (4) G.S.R.350(E), [18/4/1995] - The Wildlife (Specified Plant Stock Declaration) Central Rules, 1995; (5) G.S.R.349(E), [18/4/1995] - The Wildlife (Specified Plants - Conditions for Possession by license) Rules, 1995; (6) G.S.R.348(E), [18/4/1995] - The Wildlife (Protection) Rules, 1995; (7) Recognition of Zoo Rules, 1992; (8) G.S.R.328(E), [13/4/1983] - The Wildlife (Protection) Licensing (Additional Matters for Consideration) Rules, 1983; (9) G.S.R.29(E), [25/1/1973] - The Wildlife (Stock Declaration) Central Rules, 1973; and (10) G.S.R.198(E), [9/4/1973] - The Wildlife (Transaction and Taxidermy) Rules, 1973.

Environment Impact Assessment (EIA) Notification, September 14, 2006: Wetlands are covered in EIA and Environment Management Plan process as part of the EIA notification. Form 1A of EIA notification, 2006 covers wetlands under section II Activity 1. Construction, operation or decommissioning of the project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.), item no 1.21 "Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers", item no 1.22 "Stream crossings, item no. 1.23 "Abstraction or transfers of water form ground or surface waters", item no 1.24 Changes in water bodies or the land surface affecting drainage or run-off ", item no.1. 29 "Introduction of alien species" and item no

1.30 “Loss of native species or genetic diversity.”

Section II Activity, point 7 “covers risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea”.

Further, wetlands are covered as “Environmental Sensitive” under Section III, FORM 1A item no.1. “Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value”, item no 2 “Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests”, item no. 3 “Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration”, item no. 4. “Inland, coastal, marine or underground waters”, item no.6 “Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas”, item no 10 “Areas containing important, high quality or scarce resources (ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)”, item no.11 “Areas already subjected to pollution or environmental damage (those where existing legal environmental standards are exceeded)”.

Significantly, wetlands are implicitly covered as General Condition (GC) of the said notification “Any project or activity specified in Category ‘B’ will be treated as Category A, if located in whole or in part within 10 km from the boundary of: (i) Protected Areas notified under the Wild Life (Protection) Act, 1972, (ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time, (iii) Notified eco-sensitive areas, (iv) inter-State boundaries and international boundaries”.

Wetlands (Conservation and Management) Rules, 2010

Ministry of Environment and Forests notified rules for conservation and management of wetlands, namely Wetlands (Conservation and Management) Rules, 2010. The rules set regulatory framework for conservation of wetlands enlist some of the activities which are prohibited and others which need to be regulated. Categorization of wetlands has also been proposed on the basis of significance of the functions performed and for determining the extent and level of regulation. The Rules have been framed for protected wetlands, set restrictions on activities within wetlands and has made provisions for setting Central Wetlands Management Authority. The Rules defined process of identification of wetlands under different categories. The rules also identified overlapping provisions and enforcement of regulated activities.

State Level Policies/ Regulations

The State level wetland policy needs to be set right. At the Center, the wetlands are under the Ministry of Environment and forest while they are a subject matter of Department of Environment, Science and Technology under the Government of HP. The wetlands thus need to come under the HP Forest Department for their biodiversity conservation.

State Water Policy Year 2002: The said policy does not explicitly and specifically covers or mentions “wetland”. However, few sections of the said policy refers to wetlands especially section 1.2 which refers to “surface ponds” and “lakes”.

Water, as a resource is one and indivisible: Rainfall, river waters, surface ponds, lakes and ground water are all part of one system. In Himachal Pradesh, availability of water is highly uneven in both space and time.

Precipitation is confined to only about three or four months in a year and varies from about 600 mm in Lahaul & Spiti District to around 3200 mm in Dharamshala District, Kangra. However, in spite of heavy rain and snow during the rainy season and winter, the summer months are periods of water scarcity in many areas as the flow in the rivers and nullahs is quite low and traditional sources also dry up. Thus, through its Water Policy, the State also has to address the issues of drought management in some areas and flood control in others.

The policy states about the requirement of clear guidelines with respect to water related projects. Planning and implementation of water related projects has many socio-economic aspects and issues such as environmental sustainability, resettlement and rehabilitation of project-affected people and livestock, public health concerns of water impoundment, dam safety etc.

It states that water resources available to the State should be brought within the category of utilisable resources to the maximum possible extent. Ground water exploitation for domestic use and irrigation will be promoted wherever feasible and improvising of surface water in pondages for usage during lean periods shall be encouraged.

The policy mentions that “Water resources development and management will have to be planned for a hydrological unit such as drainage basin as a whole or for a sub-basin, multi-sectorally, taking into account surface and groundwater for sustainable use incorporating quantity and quality aspects as well as environmental considerations. All individual developmental projects and proposals should be formulated and considered within the framework of such an overall plan keeping in view the existing agreements/ awards for a basin or a sub-basin so that the best possible

combination of options can be selected and sustained”.

The policy recommends watershed management through extensive soil conservation, catchment area treatment, preservation of forests and increasing the forest cover and the construction of check-dams and trenching. Efforts shall be made to conserve the precipitation in the catchment area itself.

It mandates that overriding ownership rights over water resources rest with the State. Water may be made available to water short areas by transfer from other areas including transfers from one river basin to another, based on a State’s perspective, after taking into account the requirement of areas/basins. Water scarce neighbourhoods will enjoy priority entitlement to avail the water available in adjoining areas for meeting their drinking water needs.

HP Forest Sector Policy, 2005: The forest sector policy introduced a “Forest Sector Concept”, where it encompasses the entire biophysical and environmental components comprising lands and biological resources (i.e. forests, watersheds, wetlands, wildlife, biodiversity and habitats) and includes the stakeholders and institutions directly or indirectly dependent on or responsible for the management of these resources for livelihood, security and sustenance. These include other sectors such as agriculture, horticulture, animal husbandry, rural development and other institutions and organisations having interests and/ or dependence on the ‘Sector’ directly or indirectly.

The policy states that the Government will further support and integrate efforts by concerned line departments, PRIs, community based in situations, NGOs with defined responsibilities in bio-diversity conservation, initiatives in protected areas, wetlands, forest land outside the protected

area network, farm forests and agricultural lands.

The policy states that an assessment of the wetlands of the State will be undertaken to establish status, threats and management strategies for sustainable use and conservation. The Himachal Pradesh Forest Department (HPFD) will be the nodal agency for management of wetlands.

State Tourism Policy, 1991: In 1991, the Government of Himachal Pradesh announced a tourism policy. Development of Lakes and wetlands for tourism has been listed as a thrust area in this policy.

Revised policy on development of eco-tourism in Himachal Pradesh, 2005: The mission of this policy is “to make Himachal Pradesh a leading Eco-tourism Destination in the Country by 2010”. One of the objectives places emphasis on actively co-ordinating with the Tourism, Fisheries, Handicrafts, Culture, YSS, HMI (Himalayan Mountaineering Institute) and other related departments to further the cause of eco-tourism.

One of the strategy of the policy reads, “It will concentrate its activities within the forest land, existing Wild Life Sanctuaries and Parks”. The policy has identified projects and sites in Himachal Pradesh that includes: “Specific areas within the State that are endowed with unique qualities will be promoted as ‘Hot Spots’ for eco-tourism. These may also include the remote cold-arid deserts of Pooh, Lahaul & Spiti with its unique culture; areas in Kullu for nature and out door activities with GHNP as the focal point; Tirthan for angling; Pong Dam for bird watching and water sports and Shimla for trekking and nature trails etc.”

Urbanisation Policy, 2009: The Urbanisation Policy section 19 outlines, “Preservation of Environment”. Its sub section 19.6 states that

“no damage to natural drainage shall be caused and a distance as under from the highest flood level shall have to be left from the drainage lines.” For Rivers it is 25 metres, for khuds/streams it is 10 metres and for nallah it is 5 metres.

Himachal Pradesh Fisheries Act, 1976: Section 3 of the Act mentions of power to make rules for prohibition and licensing of fishing in selected waters sub-section 3 states such rules may: (a). Prohibit or regulate all or any of the following matters: i. the erection and use of fixed engines; ii. the construction, temporary or permanent, of weirs, dams and bunds and killing of fish by diversion of natural waters, and iii. the dimension and kinds of fishing gears to be used and the mode of using them. (b). prohibit fishing except under licence and regulate the granting of such licences, the fees payable therefore and the conditions to be inserted therein; (c). prohibit the destruction or attempt to destroy fish by gun spear, bow and arrow or like instrument or pollution of waters by trade effluents; (d). prescribe seasons in which the killing or catching or sale of any fish of any prescribed species shall be prohibited; (e). prescribe a minimum size or weight below, which no fish or any prescribed species shall be caught, killed or sold; (f). prohibit fishing in any specified water for specified period; (g). require the owner, mortgage with possession or lease of any tank or jhil for the stocking of such tanks or jhils with any class or classes of fish; h. prescribe the formation of associations or societies and the collection of funds for the upliftment of fishermen and promotion of fishing industry; (i). regulate the marketing of fish and also purchase and use of fish for preservation or for the manufacture of any fish products; (j). regulate the possession of fishing craft and gear within such specified limits as may appear to be necessary; and (k). regulate the transport of all fish or of certain species of fish or fish products within specified limits as may appear to be necessary.

Section 6 - Punishment for Destruction of Fish by Explosives: If any person uses any dynamite or other explosive substances in any water with intent thereby to catch or destroy any fish, that may be therein, he shall be punishable with imprisonment for a term which may extend to three years or with fine which may extend to five thousand rupees or with both.

Section 7 - stipulates punishment for destruction of fish by poisoning water: If any person puts any poison, bleaching powder, lime or noxious material into any water with intent thereby to catch or destroy any fish, he shall be punishable with imprisonment for a term which may extend to five thousand rupees, or with both.

Sub Section 7-A - Stipulates punishment for the possession of dynamite and other explosive substance to be used for killing the fish. If a person is found to be in possession of a dynamite or any other explosive substance for the purpose of killing the fish near or in the vicinity or on the bank of a river, rivulet, khad, pond, lake, reservoir which are inhabited by the fish, shall, unless he explains satisfactorily that his possession or control over such a dynamite or the explosive substance was for a lawful object, he is punishable with imprisonment for a term which may extend to two years, or with fine which may extend to three thousand rupees, or with both.

Himachal Pradesh Fisheries Rules, 1979 and Himachal Pradesh Fisheries (Fourth Amendment) Rules: Section 3 (1) mention that the "General Waters, Trout Waters and Resources" are declared not being private waters to which all or any of the Rules as according to their respective provisions shall apply. These include e.i. Gobind Sagar Reservoir: impoundment formed by Bhakra Dam upto a level of 1680 R.L. in Bilaspur, Una and Mandi Districts of Himachal

Pradesh; ii. Pong Reservoir: Impoundment formed by Pong Dam upto a level of R.L. 1410 in Kangra District of Himachal Pradesh, iii. Pandoh Reservoir: Impoundment formed by Pandoh Dam on River Beas upto level of R.L. 2940 in Mandi District; iv. Chamera Reservoir: Impoundment Formed By Chamera Dam upto a Level of 763.16 Mtrs. in Chamba District of Himachal Pradesh; v. Ranjeet Sagar Reservoir:- Impoundment formed by Ranjeet Sagar Dam (Thein Dam) in the area falling in Chamba District of Himachal Pradesh.

Part V prohibits fishing by gun spear, bow arrow or similar instruments or pollution of water by trade affluent. Part VI prohibits fishing etc. in prescribed season and or specified waters.

Himachal Pradesh Non-Biodegradable Garbage (Control) Act, 1995: An Act to prevent throwing or depositing non-biodegradable garbage in public drains, roads and places open to public view and to regulate the use of non-biodegradable material in the State. The Act prohibits to throw degradable garbage in public drains and sewage and has provision for placement of receptacles and places for deposit of non-biodegradable garbage. It defines duty of owners and occupiers to collect and deposit non-biodegradable garbage etc and defines power of local authority for removal of non-biodegradable garbage. It stresses on studies, research and support programme.

The act defines non-biodegradable garbage as 1. Polyethylene, 2. Nylon, 3. Poly-vinyl Chloride C. 4. Poly-propylene and 5. Polystyrene. Section 3 mentions prohibition to throw degradable garbage in public drains and sewage. It states that 1. No person, by himself or through another, shall, knowingly or otherwise throw or cause to be thrown in any drain, ventilation shaft, pipe and fittings, connected with the private or public drainage works, any non-biodegradable garbage or any

bio-degradable garbage in a non-biodegradable bag or container likely to- i. injure the drainage and sewage system; ii. interfere with the free flow or affect the treatment and disposal of drain and sewage contents; and iii. be dangerous or cause a nuisance or be prejudicial to public health.

Subsequently, the Himachal Pradesh Non-Biodegradable Garbage (Control) Rule, 1996 was enacted. The Rules define bio-medical/clinical waste, Garbage Management Committee, Garbage Management Zones.

The rules have also set functions for Garbage Management Committee: a. selection or earmarking the places where public receptacles are to be provided for temporary deposit of garbage/waste generated from various sources in the Garbage Management Area Zone; b. for fixation of intervals within which the contents of receptacles, deposit and accumulation at all places, designated under rule 5 may be removed/cleared; c. for providing safeguard to be taken while depositing the garbage/waste in public receptacles/dustbins and its removal to dumping ground for the places fixed for bio-conversion, dumping, incineration or recycling; d. for arranging the awareness, programmes to ensure reduction, reuse and recycling of garbage/waste, especially the non biodegradable waste; e. for encouraging residents for the area to explore the social and economic/ feasibility or separation of household waste, at the source for its reuse and recycling; and f. for devising steps to be taken for the maintenance of ecology and reduction of environmental pollution in the area.

Other Sub-programmes/ Strategies/projects

National Wetlands Conservation Programme Year 2009: The Government of India has been implementing the National Wetlands Conservation Programme (NWCP) in close

collaboration with the State/ UT Governments since the year 1985-86. Under the programme, 115 wetlands have been identified by the Ministry which requires urgent conservation and management interventions. Five wetlands in Himachal Pradesh namely Renuka, PongDam, Chandratal, Rewalsar and Khajjiar have been identified under National Wetlands Conservation Programme (as on June, 2009), MoEF, Government of India for their urgent conservation and management. The limnological investigations are being carried out/ or those which are in pipeline in these five wetlands. These investigations are supposed to be incorporated in the conservation programme of these wetlands as without limnological studies it is almost impossible to go for the scientific conservation of wetland ecosystems.

The aim of the programme is conservation of wetlands in the country so as to prevent their further degradation and ensuring their wise use for the benefit of local communities and overall conservation of biodiversity.

The programme was initiated with the following objectives: To lay down policy guidelines for conservation and management of wetlands in the country; to provide financial assistance for undertaking intensive conservation measures in the identified wetlands; to monitor implementation of the programme and to prepare an inventory of Indian wetlands.

Since the land resources belong to them, the State Governments/ UT Administration is responsible for management of wetlands and implementation of the NWCP for ensuring their wise-use.

Under this scheme, wetlands, grasslands, special habitats are to be identified and declared as natural heritage sites.

Other related Schemes of the MOEF being implemented for conservation of wetlands are: Integrated Development of Wildlife Habitats; Project Tiger; Project Elephant; National Biosphere Reserves Programme and National Afforestation Programme

The Pong dam wetland is being managed by the Forest Department with a centrally assisted Intensive Management Plan for the improvement and creation of suitable habitats, nesting and roosting sites for several species of birds. The Government of Himachal Pradesh has also under taken the ecological improvement and restoration of Renuka and Riwalsar wetlands for conservation and propagation of their biotic resources.

The HP Forest Department has under taken plantation work in the peripheral area of the Pong lake. This has been done for checking the silt as well as providing nesting and roosting places for the birds. The island of Ramsar has been developed for nature conservation education. A rest house has been built on this island and boat facility is provided for the school children to go up to the island for birding.

National Lake Conservation Plan (NLCP), 2001: Recognising the importance of lakes, Ministry of Environment & Forests, Government of India, launched the National Lake Conservation Plan (NLCP), a centrally sponsored scheme exclusively aimed at restoring the water quality and ecology of the lakes in different parts of the country. The scheme was approved by the Government of India during IX Plan (June 2001) as 100% central grant. Funding pattern under NLCP has since been changed w.e.f. February 2002 from 100% central funding to 70:30 costs sharing between the Central and the concerned State Government.

In order to identify polluted and degraded lakes across the country, a study was carried

out by MOEF at the instance of the Planning Commission, Government of India vide which 62 lakes were identified across the country for conservation. This list was sent to all State Governments for amendment and finalisation keeping in view the State priority and the justification for their inclusion in the priority list. The State priority and justification for such a selection needs to be a part of the proposal for consideration under NLCP. In view of the prevailing dynamic situation, States may revise the priority list at an interval of 5 years covering different geographic regions of the State.

The objective of the scheme is to restore and conserve the urban and semi-urban lakes of the country degraded due to waste water discharge into the lake and other unique freshwater eco-systems, through an integrated eco-system approach. Unique fresh water eco-systems cover lakes that are unique entities of incomparable values and need to be preserved & conserved e.g. high altitude lakes etc.

Activities covered under NLCP: Prevention of pollution from point sources by intercepting, diverting and treating the pollution loads entering the lake. The interception and diversion works may include sewerage & sewage treatment for the entire lake catchment area.

- a. In situ measures of lake cleaning such as desilting, de-weeding, bio-remediation, aeration, bio-manipulation, nutrient reduction, with drawal of anoxi chypolimnion, constructed wetland approach or any other successfully tested eco-technologies etc depending upon the site conditions.
- b. Catchment area treatment which may include afforestation, storm water drainage, silt traps etc.
- c. Strengthening of bund, lake fencing, shoreline development etc.

- d. Lake front eco-development including public interface.
- e. Solid waste management & provision of dhobi ghats is generally not covered under NLCP.
- f. Prevention of pollution from non-point sources by providing low cost sanitation.
- g. Public awareness and public participation.
- h. Capacity building, training and research in the area of lake conservation.
- i. Any other activity depending upon location specific requirements.

* Solid waste management especially waste minimization and recycling for resource recovery (waste collection & transportation) and providing dhobi ghats (especially in semi-urban areas) generally remains to be a municipal function not covered under NLCP.

Selection criteria for the lake included hydrological, scientific and administrative criteria.

Hydrological Criteria includes: a. The lake water body is perennial i.e. it holds a certain volume of water at all times, even in the lean season of the year; b. Physical parameters of the lake are: (i) Lake size >10Ha (Exception: lakes larger than 3 Ha having socio cultural or religious importance) (ii) 4

Lake depth (maximum depth) > 3 m

Scientific Criteria includes: The lake is justifiably prioritised by the concerned State Government or if the water body is highly degraded and cannot be put to its traditional use primarily because of either (a) or (a) & (b) as indicated: a. Discharge of domestic and industrial waste water into the lake; b. i. Dumping of municipal solid waste, ii. Other non point sources of pollution and iii. Flow of heavy silt loads from the lake catchment.

The lake water body is degraded and not meeting the desired standards. In the absence of specific water quality criteria developed in respect of lakes, for the present, Designated

Best Use criteria for surface waters for bathing quality as given by Central Pollution Control Board (CPCB) shall be the target for achieving lake water quality.

Incorrect land use leading to heavy soil erosion and sediment transport into the lake resulting in nutrient enrichment of lake (Nitrate & Phosphate) signifying eutrophication.

Administrative Criteria includes: The lake if getting degraded/eutrophied, is an important source of drinking water supply, domestic use, recreational use, provide other goods & services, may be proposed under NLCP, when: there is a high degree of demand from a public forum/local stakeholders for its conservation and if the forum/stakeholders give their commitment to bear 10% out of State share in the project cost.

Subsequent to prioritisation and for consideration of a lake under NLCP, the State Governments need to get perspective plans and proposal (Detailed Project Reports) prepared through consultants or in house in case the expertise exists, based on surveys including water quality and biodiversity of the lake. The Manual on Sewerage & Sewage Treatment of Central Public Health Environmental Engineering Organisation (CPHEEO), Ministry of Urban Development, Government of India. December, 1993 be referred for sewerage, sewage treatment and storm water management whereas for water quality and sediment monitoring, Gazette Notification on Uniform Protocol Water Quality Monitoring Order (June, 2005) and American Public Health Association (Latest Edition) on Water and Waste water Analysis should be followed for preparing DPR. The DPRs need to be submitted to the Ministry along with a summary of the proposal as per the format.

National Biodiversity Action Plan, 2008: The National Biodiversity Action Plan (NBAP) is

a framework for taking action by the multitude of stakeholders in biodiversity for achieving the three objectives of the Convention on Biological Diversity (CBD), namely conservation of biodiversity, sustainable use of its components, and fair and equitable sharing of benefits arising out of their use. The NBAP draws upon the main principal in the NEP that human beings are at the centre of concerns of sustainable development and they are entitled to a healthy and productive life in harmony with nature.

Taking cognizance of the existing legislations, implementation mechanisms, strategies, plans and programmes, action points have been designed in the NBAP, so as to integrate biodiversity concerns into various other sectors. NBAP is consistent with the ecological, social, cultural and economic mosaic of the country, and provide a focus and impetus to the current efforts towards biodiversity conservation.

National Action Plan on Climate Change (NAPCC) 2008 has been prepared by the Government of India. The NAPCC has laid down the principles and has identified the approach to be adopted to meet the challenges of impact of climate change through eight National Missions namely, (a) National Solar Mission, (b) National Mission for Enhanced Energy Efficiency, (c) National Mission on Sustainable Habitat, (d) National Water Mission, (e) National Mission for Sustaining the Himalayan Eco- system, (f) National Mission for a Green India, (g) National Mission for Sustainable Agriculture, and (h) National Mission on Strategic Knowledge for Climate Change.

“National Water Mission” is part of NAPCC and identifies the strategies and methodologies in respect of (a) Assessment of Impact of Climate Change; (b) Changes in Policy, Practices and Institutional Framework; (c) Measures for Mitigation; as well as (d) Measures for Adaptations. Appropriate

monitoring and evaluation mechanism have also been proposed.

“A National Water Mission will be mounted to ensure integrated water resource management helping to conserve water, minimize wastage and ensure more equitable distribution both across and within States. The Mission will take into account the provisions of the National Water Policy and develop a framework to optimize water use by increasing water use efficiency by 20% through regulatory mechanisms with differential entitlements and pricing. It will seek to ensure that a considerable share of the water needs of urban areas are met through recycling of waste water, and ensuring that the water requirements of coastal cities with inadequate alternative sources of water are met through adoption of new and appropriate technologies such as low temperature desalination technologies that allow for the use of ocean water.

The National Water Policy would be revisited in consultation with States to ensure basin level management strategies to deal with variability in rainfall and river flows due to climate change. This will include enhanced storage both above and below ground, rainwater harvesting, coupled with equitable and efficient management structures.

The mission will seek to develop new regulatory structures, combined with appropriate entitlements and pricing. It will seek to optimize the efficiency of existing irrigation systems, including rehabilitation of systems that have been run down and also expand irrigation, where feasible, with a special effort to increase storage capacity. Incentive structures will be designed to promote water neutral or water positive technologies, recharging of underground water sources and adoption of large scale irrigation programmes which rely on sprinklers, drip irrigation and ridge and furrow irrigation.”

Wetlands and cross sector policy and regulatory framework at State level shows the intent of the State Government to address environment issues related to the sector. A mapping of the issues and policies, plans, programmes, projects framework is described in Box 1

2.3 Fisheries

The policies and laws applicable and/or related to fisheries sector of the state along with a brief description of their relevance are detailed below. These policies, laws, sub-programmes and strategies provide operating frame work for the sector to address issues, causes and impacts. Detailed explanations can be acquired from relevant departments and line ministries like Ministry of Agriculture, Ministry of Environment & Forest (MoEF) website ([www. envfor.nic.in](http://www.envfor.nic.in)), National Fisheries Development Board website (<http://nfdb. ap.nic.in>) and Department of Fisheries, Himachal Pradesh website (<http://hpfisheries.nic.in>).

National Level Policies / Regulations

The National Water Policy, 2002: National level policy addresses the water issues including prioritization, allocation, pricing and interstate issues related to water sharing. Policy states about the use of water, water conservation and quantification of water pollution.

Section 1.2 states that rivers and underground aquifers often cut across state boundaries. Water, as a resource is one and indivisible. Therefore, rainfall, river waters, surface ponds and lakes and ground water are all part of one system. Section 7.3 states that integrated and co-ordinated development of surface water and ground water resources and their conjunctive use should be envisaged right from the project planning stage and should

form an integral part of the project implementation. Section 14.5 states that necessary legislation is to be made for preservation of existing water bodies by preventing encroachment and deterioration of water quality. Section 25 states that for effective and economical management of water resources, the frontiers of knowledge need to be pushed forward in several directions by intensifying research efforts in various areas, including hydro-meteorology; snow and lake hydrology; surface and groundwater hydrology; assessment of water resources; water quality; water conservation; evaporation and seepage losses; recycling and re-use; better water management practices and improvements in operational technology; soils and material research; economical designs for water resource projects, sedimentation of reservoirs, prevention of salinity ingress; prevention of water logging and soil salinity; reclamation of water logged and saline lands; environmental impact and regional equity.

The National Environment Policy (NEP), 2006: Recognizing the value of wetlands and taking cognizance of the fact that there does not yet exist a formal system of wetland regulation, the National Environment Policy seeks to set up a legally enforceable regulatory mechanism for identified valuable wetlands to prevent their degradation and enhance their conservation. It also undertakes to develop an inventory of such wetlands.

The policy recognizes the ecological services rendered by the water bodies like lakes & wetlands. The NEP states that wetlands including lakes are under threat from drainage and conversion for agriculture & human settlements besides pollution. The reduction in economic value of their environmental services due to pollution, as well as the health costs of the pollution itself, are not taken into account while using them as a waste dump.

The NEP recommends to develop an action plan for these water bodies, which include formulation of conservation & prudent use strategies, integration of wetland and lake conservation into sectoral development plans for poverty alleviation and livelihood improvement, formulation of eco-tourism strategies through multi stakeholders partnership.

The NEP, 2006, contains an unambiguous assertion of the need for a holistic view of wetlands, which looks at each identified wetland in terms of its causal linkages with other natural entities, human needs, and its own attributes. The NEP's six-fold 'Action Plan' in this direction comprises, among others, formulation of a regulatory framework, linkage with poverty alleviation and programmes for employment generation.

The current initiatives on wetland/water body/reservoir wetlands fall short of taking strong note of alien invasive species that impinge upon the structural organisation and functional integrity of these fragile eco-systems. Thus, to reduce the associated economic, social and environmental costs it is important to integrate various steps and initiatives into overall wetland/ water body/reservoir resource management objectives and plans. These steps are (a). Awareness-of the issues and the seriousness of wetland/water body/reservoir invasion and their consequences to wetland/water body/ reservoir, people and biodiversity; (b).Information and Training-specialised expertise and training for documentation of priority and potential invasive species; (c). Research and Monitoring for identifying the under lying mechanisms responsible for invasiveness and invisibility; (d).Prediction and Quarantine development of a predictive frame work for potential invaders in order to prevent and limit their spread; (e). Policies and Legislation-their development and implementation for management of biological invasions; (f). Co-operation-among agencies

and organisations involved in global, national and regional efforts to understand and manage invasive species in wetlands, such as Global Initiative on Invasive Species, The Global Invasive Species Programme and the Regional Invasive Species Programmes.

National Forest Policy, 1988: The National Forest Policy (1988) aims 'to ensure environmental stability and ecological balance', and directs that the domestic requirements of poor and marginalized forest users should be the first charge on forest produce. The policy calls for the enhancement of incomes and employment through improved and increased production of non-wood forest products (NWFPs), and proposes that a massive people's movement with the involvement of women should be generated to achieve the objectives.

Foreign Trade Policy Fish and Fishery Products 2004-2009: In this policy, there is no quantitative restriction on export of fish. Licence is not required for import of 125 species/groups of fish, crustaceans, molluscs and other aquatic invertebrates covered under FREE policy in Chapter 3 of ITC (HS) classification of Export & Import items under the EXIM policy. Import of five groups of live fish permitted under restricted policy (EXIM Code 0301) and Import of Whale Shark (*Rhincodon typus*) and parts and products of the species is restricted.

Central Government assistance is available to states for development of critical infrastructure for export such as roads, inland container depots, container freight stations, export promotion industrial parks, setting up Export Zones and for equity participation in infrastructure projects. This includes waste disposal from fisheries related infrastructure development.

National Conservation Strategy and Policy Statement on Environment and Development, 1992: The National

Conservation Strategy and the Policy statement on environment and development are in response to the need for laying down the guidelines that will help to weave environmental considerations into the fabric of national life and of development process. It is an expression of commitment for re-orienting policies and action in unison with the environmental perspective.

Wetlands are referred to notably in section 2.7 of the statement “Our unique wetlands, rich in aquatic and bird life, providing food and shelter as also the breeding and spawning ground for the marine and freshwater fish, are facing problems of pollution and over-exploitation”. Section 3.4 on Conservation of Forests and Wildlife refers to “Management Plans for identified wetlands, mangrove areas and coral reefs”. Section 4.0 on constraints and agenda for action states about the agenda for action in this regard will include the following to conserve and nurture the biological diversity, gene pool and other resources through environmentally sustainable development and management of eco-systems, with special emphasis on our mountain, marine and coastal, desert, wetlands, riverine and island eco-systems. Section 5.2 on Conservation of Natural Resources describes conservation of wetlands for ensuring sustainable ecological and economic benefits. Sub-section 5.2.3 mentions about conservation of biodiversity through a network of protected areas including biosphere reserves, marine reserves, national parks, sanctuaries, gene conservation centres, wetlands, coral reefs and such other natural habitats of biodiversity. This should include taxonomic and ecological studies on the flora and fauna with adequate emphasis placed on the lower vertebrate, invertebrate and micro-flora which are important in contributing to the healthy maintenance of eco- systems.

National Urban Sanitation Policy: The National Urban Sanitation Policy urges states

to come up with their own detailed State-level urbansanitation strategies and city sanitation plans. It moots the idea of totally sanitised cities and the setting up of a multi-stakeholder city sanitation task force to achieve. Environmental considerations, public health implications and reaching the unserved and urban poor are given significant emphasis in the policy. As per key sanitation policy issues highlighted in the National Urban Sanitation Policy, one of the key policy issues which must be addressed include sanitation investments which are currently planned in a piece-meal manner and do not take into account the full cycle of safe confinement, treatment and safe disposal. However, Himachal Pradesh doesn't have detailed State-level urban sanitation strategies and city sanitation plans except for the City Development Plan (which inter alia covers sewage sector) for Shimla under the JNNURM initiative administered by Municipal Corporation of Shimla.

Export (Quality Control & Inspection) Act, 1963: The Export Inspection Council of India (EIC) was set up by the Government of India under Section 3 of the Export (Quality Control & Inspection) Act, 1963 as an apex body to provide for sound development of export trade through quality control and pre-shipment inspection. The main functions of EIC are to advise the Central Government regarding measures to be taken for enforcement of quality control and inspection in relation to commodities intended for export.

The main systems of export inspection and certification being followed by EIC include Consignment wise inspection (CWI), In-process quality control (IPQC), Self-certification (SC) and Food Safety Management Systems based Certification (FSMSC). Food Safety Management Systems based Certification has been aligned with international standards on Hazard Analysis Critical Control Point (HACCP)/Good

Management Practices (GMP)/General Health Practices (GHP) in the areas of fish & fishery products. Under CWI samples, based on a laid down sampling plan are drawn from the consignment, offered for inspection and tested against the specified standards. The other three schemes follow a systems approach, which involves approval of the units followed by periodic surveillance by Export Inspection Authorities (EIAs).

Final Notification on export of Bivalve Molluscs was published as also amendments to Notifications on fish and fishery products, egg products and honey to incorporate provisions for maximum residue limits.

Implementation of Certification in the Food Sector: In this area, 393 fish and fishery products processing units (145 for EU and 217 for Non-EU and 31 live fish processing units for Non EU) were on the approved list. All consignments of shrimps meant for export to EU were issued health certificates only after testing and clearance for banned antibiotics.

India Fisheries Act, 1897: The present Act extends to the whole of India, as it was before Independence and the annexing of 1956. It is divided into 7 sections: 1. Title and extent; 2. Act to be read as supplement to other Fisheries Laws; 3. Definitions; 4. Destruction of fish by explosives in inland waters and on coast; 5. Destruction of fish by poisoning of waters; 6. protection of fish in selected waters by rules of the State Government; 7. Arrest without warrant for offences under this Act. The act includes: (a) Destruction of fish by explosives in inland waters & on coasts and destruction of fish by poisoning of waters: If any person uses any dynamite or other explosive substance in any water with intent thereby to catch or destroy any of the fish that may be therein, he shall be punishable with imprisonment for a term which may extend to two months, or with fine which may extend to two hundred rupees. (b)

Protection of fish in selected waters by rules of State Government: The State Government may make rules; such rules may prohibit all fishing in any specified water for a period not exceeding two years. (c) The power to make rules under this section is subject to the condition that they shall be made after previous publication. (d) Arrest without warrant for offences under this Act; (i) Any police-officer, or other person specially empowered by the State Government in this behalf, either by name or as holding any office, for the time being, may, without an order from a Magistrate and without warrant, arrest any person committing in his view any offence punishable under section 4 or 5 or under any rule under section 6. Fishing in privately owned waters in the region is forbidden under this Act, as well as laying any net, trap, cage or other device designed to trap fish. Fish also includes turtles and molluscs. The term "Water" is used in relation with sea water within one marine league of the coast and inland waters too. Fishing shall be restricted and protected areas instituted by the State in those waters privately owned, whereas fish protection measures shall be applied regulating the fishing devices (net, mesh sizes, traps etc.) and methods and the rights of the owners of those private waters.

The Water (Preservation and Control of Pollution) Act 1974/1988: This Act provides for the prevention and control of water pollution and for maintaining or restoring of wholesomeness of water. Section 2 of the Act defines pollution as contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to create a nuisance or render such water harmful or injurious to public health or safety or to domestic, commercial, industrial, agriculture or other legitimate uses, or to the

life and health of animals, plants or of aquatic organisms.

The Environment (Protection) Act, 1986: Most significant and diversified national level Act to safe guard the natural environment. Para 2 of introduction of the Act states that it is an Act to provide for the protection and improvement of human environment and the prevention of hazards to human beings, other living creatures, plants and property. Item 2, chapter 1 of the Act states that 'environment' includes water, air, land and the inter-relationship which exists among and between water, air, land and human beings, other living creatures, plants, micro-organism and property.

"Environmental Pollution" means any solid, liquid or gaseous substance present in such concentrations as may be or tend to be injurious to the environment. It is an umbrella act, which has several rules under it, to address different problems related to environment and pollution control.

The Forest (Conservation) Act, 1980: The Forest (Conservation) Act, 1980 as amended in 1988, from time to time checks the indiscriminate diversion of forest land for non-forest purposes. Prior clearance of projects requiring diversion of forests for non-forest purpose is needed under the Forest (Conservation) Act 1980. The State Government/Union Territories are required to submit formal proposals to the Central Government (Ministry of Environment and Forests) for diversion of forest land for non-forest purposes in the prescribed proforma along with details such as flora, fauna, map of the area, compensatory afforestation proposed etc.

Under this Act, the Supreme Court passed an order on the constitution of State Compensatory Afforestation Fund Management and Planning Authority (CAMPA) in response to an affidavit filed by

the Ministry of Environment & Forests. Some of the responsibilities of State CAMPA include that it shall seek to promote: (a) conservation, protection, regeneration and management of existing natural forests; (b) conservation, protection and management of wildlife and its habitat within and outside protected areas including the consolidation of the protected areas; (c) environmental services, which include regulating services such as climate regulation, disease control, flood moderation, detoxification, carbon sequestration and health of soils, air and water regimes; supporting such other services necessary for the production of ecosystem services, biodiversity, nutrient cycling and primary production; and research, training and capacity building.

Indian Forests Act, 1927: It is an Act to consolidate the law relating to forests, the transit of forest-produce and the duty leviable on timber and other forest - produce. The Act encourages conservation of forest biodiversity only by way of controlling and restricting the uses to which the forests can be put, and by restricting access of people to certain categories of forest.

Section 35 empowers the State Government to regulate or prohibit activities in any forest or waste land for the preservation of the ridges & slopes; the prevention of land slips; the formation of ravines; the protection of land against erosion; for the maintenance of water supply in springs, rivers & tanks and for the preservation of public health.

Wildlife Protection Act, 1972: The Wildlife (Protection) Act, 1972, amended in 1983, 1986, 1991, 2003, 2006 provides for the protection of wild plants and animals and regulates hunting, trade and eco-system of forest biodiversity. The Act established schedules of protected plant and animal species; hunting or harvesting these species was largely outlawed. The Act provides for the protection of wild animals, birds and

plants; and for matters connected therewith or ancillary or incidental thereto. It extends to the whole of India, except the State of Jammu and Kashmir which has its own wildlife act. It has six schedules which give varying degrees of protection. Schedule I and part II of Schedule II provide absolute protection - offences under these are prescribed the highest penalties. Species listed in Schedule IV are also protected. Enforcement authorities have the power to compound offences under this Schedule (i.e. they impose fines on the offenders). Penalties are described in section 51 of the act.

Section 27, Chapter IV restricts entry into sanctuary while section 28 permits entry into sanctuary for photography & tourism. Section 30 prohibits fire in the sanctuary including setting fire, burning fire or leaving fire burning in the sanctuary. Section 33 on control of the sanctuaries, empowers the Chief Wildlife warden to construct roads, bridges, buildings, fences or barrier gates and carry out necessary work for the purpose of such sanctuary. sub-section 6, under section 35, prohibits destruction, exploitation or removal of any wild life from a national park or damage the habitat of any wild animal or deprive any wild animal of its habitat within a national park.

National Environmental Appellate Authority Act, 1997: National Environmental Appellate Authority Act, 1997 provides appellate forum for cases relating to site restrictions, developmental schemes and projects so as to balance development and environment.

Aquarium Fish Breeding and Marketing Rules: The Rules for the Housing and Breeding of aquarium fish apply to shop keepers and aquarium keepers as well as anyone who keeps fish for public display. They do not apply to fish caught and sold for food.

Biological Diversity Act, 2002 and Biodiversity Rules, 2004: This Act primarily aims at giving effect to the provisions of the Convention on Biological Diversity (CBD), including regulating access to biological resources and associated traditional knowledge so as to ensure equitable sharing of benefits arising out of their use, in accordance with the provisions of Article 15 of the CBD. Biological Diversity Rules were notified in 2004.

Wetlands (Conservation and Management) Rules, 2010: Ministry of Environment and Forests has prepared rules for conservation and management of wetlands, namely Wetlands (Conservation and Management) Rules, 2008. The Ministry of Environment and Forests' drafted a regulatory framework for conservation of wetlands that enlists some of the activities which are prohibited and others which need to be regulated. Categorisation of wetlands has also been proposed on the basis of significance of the functions performed and for determining the extent and level of regulation. The draft regulation also mentions of central, state, district conservation committees, their functions and powers, enforcement of regulatory activities, etc.

Under these rules, categories of wetlands for regulation have been made. Based on the relative significance of the functions performed by wetlands for overall well being of the people and for determining the extent and level of regulation, wetlands shall be identified and categorized into A, B & C.

Category 'A': Wetlands shall be categorised under this category based upon all or any one of the following criteria: (a) Wetlands listed under the Ramsar Convention; (b) Wetlands recognised as or lying within a world heritage site or a national heritage site; (c) Trans-boundary wetlands; (d) Inter-state wetlands which do not fall under category B or C; (e)

Wetlands with an area equivalent to or more than 1000 ha in arid regions, 5000 ha in semi-arid regions, 10,000 ha in sub-humid and 1,00,000 ha in humid tropic regions and (f) Wetland which is a major source of drinking water for 'Class A' cities.

Category 'B': Wetlands shall be identified & categorised under this category based upon all or any of the following criteria: (a) Wetlands recognised as, or lying within, a state heritage site; (b) Wetlands with an area of 25 ha but below 1000 ha in arid regions, 100 ha but below 5000 ha in semi- arid regions, 500 ha but below 10,000 ha in sub-humid; and 2,500 ha but below 1, 00,000 in humid tropic regions; (c) High altitude wetland at 2,500 metres or more above mean sea level and (d) Wetland which is a major source of drinking water for 'Class B' towns.

Category 'C': Wetlands shall be identified & categorised under this category based upon all or any of the following criteria: (a) Wetlands other than those covered under category A and B; (b) Wetland with an area less than 25 ha in arid regions, less than 100 ha in semi-arid region, less than 500 ha in sub-humid and less than 2,500 ha in humid tropic regions; (c) Wetland which is a major source of drinking water for local communities involving at least 100 households and (d) Wetland which is socially and/or culturally important to the local communities.

The rules also specifies the approval procedure for different categories of wetlands. Approval procedure for category 'A' wetlands: Proposal for identification of a wetland under these Rules shall be submitted at the Central Government Level to the Central Wetland Conservation Committee (CWCC) containing information on: (a). a broad geographic delineation of the wetland, and its zone of influence along with a map (not necessarily to the scale); (b). the size of the wetland; (c). threats to the wetland; d. activities needing regulation; e. account of

pre-existing rights and privileges, consistent or not consistent with the ecological health of the wetland and f. the proposed regulatory measures.

Approval procedure for category 'B' and 'C' wetlands: The process for identification of category 'B' and 'C' wetlands and approval to the MAPs shall be as indicated in Section 13 of the Rules, except that the Committee in the case of the category 'B' wetlands will be State Wetland Conservation Committee (SWCC) and in the case of category 'C' will be District Wetland Conservation Committee (DWCC). The final notification for identification of wetlands shall be issued by the State Government/UT Administration Environment Impact Assessment (EIA) Notification, September 14, 2006: This notification makes it mandatory for the eight categories of projects to prepare EIA and EMP and seek environmental clearance. EIA study mandatory for only those water sector development projects having more than 10000 ha of command area and power production more than 25 MW.

Municipal Solid Wastes (Management and Handling) Rules, 2000: Section 3, defines disposal of municipal solid wastes in terms of the specified measures to prevent contamination of ground water, surface water and ambient air quality. "Transportation" means conveyance of municipal solid wastes from place to place hygienically through specially designed transport systems so as to prevent foul odours, littering, unsightly conditions and accessibility to vectors. These rules apply to every municipal authority responsible for collection, segregation, storage, transportation, processing and disposal of municipal solid wastes.

Bio-Medical Waste (Management and Handling) Rules, 1998/2003: Rules apply to all who generate, collect, receive, store, transport, treat, dispose or handle bio-medical waste in any form. Biomedical waste means

any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining or in production or testing of biologicals. Section 4 of these rules specifies the duty of occupier to take all steps to ensure that such waste is handled without any adverse effect to human health & environment.

Guidelines on Central Waste Treatment Facilities, CPCB: CPCB Guidelines on Central Bio-Medical Waste Treatment Facilities sets out requirements for the location, land size, coverage area (maximum number of beds), treatment equipment, and infrastructure setup of the Central Waste Treatment Facilities, collection and transportation of bio-medical waste and disposal of treated bio-medical waste and other operational issues.

National Wetlands Conservation Programme Year 2009: The Government of India has been implementing the National Wetlands Conservation Programme (NWCP) in close collaboration with the State/UT Governments since the year 1985-86. Under the programme, 115 wetlands have been identified by the MoEF which require urgent conservation and management interventions. Five wetlands in Himachal Pradesh namely Renuka, Pong Dam, Chandratal, Rewalsar and Khajjiar have been identified under National Wetlands Conservation Programme (as on June, 2009), MoEF, Government of India for their urgent conservation and management.

The aim of the programme is conservation of wetlands in the country so as to prevent their further degradation and ensuring their wise use for the benefit of local communities and overall conservation of biodiversity.

The programme was initiated with the following objectives: To lay down policy guidelines for conservation and management of wetlands in the country; to provide

financial assistance for undertaking intensive conservation measures in the identified wetlands; to monitor implementation of the programme and to prepare an inventory of Indian wetlands.

Since the land resources belong to them, the State Governments/ UT Administration are responsible for management of wetlands and implementation of the NWCP for ensuring their wise use.

Under this scheme, wetlands, grasslands, special habitats are to be identified and declared nature heritage sites.

National Lake Conservation Plan (NLCP), 2001: Recognising the importance of lakes, Ministry of Environment & Forests, Government of India, launched the National Lake Conservation Plan (NLCP), a centrally sponsored scheme exclusively aimed at restoring the water quality and ecology of the lakes in different parts of the country. The scheme was approved by Government of India during IX Plan (June 2001) as 100% central grant. Funding pattern under NLCP has since been changed w.e.f. February, 2002 from 100% central funding to 70:30 costs sharing between the central and the concerned State Government.

In order to identify polluted and degraded lakes across the country, a study was carried out by MOEF at the instance of Planning Commission, Government of India vide which 62 lakes were identified across the country for conservation. This list was sent to all State Governments for amendment and finalisation, keeping in view the State priority and the justification for their inclusion in the priority list. The State priority and justification for such a selection needs to be a part of the proposal for consideration under NLCP. In view of the prevailing dynamic situation, States may revise the priority list at an interval of 5 years covering different geographic regions of the State.

The objective of the scheme is to restore and conserve the urban and semi-urban lakes of the country degraded due to waste water discharge into the lake and other unique freshwater eco-systems, through an integrated eco-system approach. Unique fresh water eco-systems cover lakes that are unique entities of incomparable values and need to be preserved & conserved e.g. high altitude lakes, Lonar lake Maharashtra, etc.

Activities covered under NLCP: Prevention of pollution from point sources by intercepting, diverting and treating the pollution loads entering the lake. The interception and diversion works may include sewerage & sewage treatment for the entire lake catchment area.

- In situ measures of lake cleaning such as desilting, de-weeding, bioremediation, aeration, bio-manipulation, nutrient reduction, with drawal of anoxichypolimnion, constructed wetland approach or any other successfully tested eco-technologies etc depending upon the site conditions.
- Catchment area treatment which may include afforestation, storm water drainage, silt traps etc.
- Strengthening of bund, lake fencing, shoreline development etc.
- Lake front eco-development including public interface.
- Solid waste management & provision of dhobi ghats is generally not covered under NLCP.
- Prevention of pollution from non-point sources by providing low cost sanitation.
- Public awareness and public participation.
- Capacity building, training and research in the area of Lake Conservation.
- Any other activity depending upon location specific requirements.

Solid waste management especially waste minimization and recycling for resource recovery (waste collection & transportation) and providing dhobi ghats (especially in semi-urban areas) generally remains to be a municipal function not covered under NLCP.

Selection criteria for the lake included hydrological, scientific and administrative criteria.

Hydrological Criteria includes: a. The lake water body is perennial i.e. it holds a certain volume of water at all times, even in the lean season of the year; b. Physical parameters of the lake are: (i) Lake size > 10 ha (Exception: lakes larger than 3 ha having socio cultural or religious importance) (ii) 4 Lake depth (maximum depth) > 3 m Scientific Criteria includes: The lake is justifiably prioritized by the concerned State Government or if the water body is highly degraded and cannot be put to its traditional use primarily because of either (a) or (a) & (b) as indicated: a. Discharge of domestic and industrial waste water into the lake; b. i. Dumping of municipal solid waste, ii. Other non point sources of pollution and iii. Flow of heavy silt loads from the lake catchment.

The lake water body is degraded and not meeting the desired standards. In the absence of specific water quality criteria developed in respect of lakes, for the present, Designated Best Use criteria for surface waters for bathing quality as given by Central Pollution Control Board (CPCB) shall be the target for achieving lake water quality.

Incorrect land use leading to heavy soil erosion and sediment transport into the lake resulting in nutrient enrichment of lake (Nitrate & Phosphate) signifying eutrophication.

Administrative Criteria includes: The lake if getting degraded/eutrophied, is an important

source of drinking water supply, domestic use, recreational use, provide other goods & services, may be proposed under NLCP, when: there is a high degree of demand from a public forum/local stakeholders for its conservation and if the forum/stakeholders give their commitment to bear 10% out of State share in the project cost. Lake categorised as a 'unique fresh water eco-system.'

Subsequent to prioritisation and for consideration of a lake under NLCP, the State Governments need to get perspective plans and proposal (Detailed Project Reports) prepared through consultants or in-house in case the expertise exists, based on surveys including water quality and biodiversity of the lake.

National Biodiversity Action Plan, 2008: The National Biodiversity Action Plan (NBAP) is a framework for taking action by the multitude of stakeholders in biodiversity for achieving the three objectives of the Convention on Biological Diversity (CBD), namely conservation of biodiversity, sustainable use of its components, and fair and equitable sharing of benefits arising out of their use. The NBAP draws upon the main principal in the NEP that human beings are at the centre of concerns of sustainable development and they are entitled to a healthy and productive life in harmony with nature.

Taking cognizance of the existing legislations, implementation mechanisms, strategies, plans and programmes, action points have been designed in the NBAP, so as to integrate biodiversity concerns into various other sectors. NBAP is consistent with the ecological, social, cultural and economic mosaic of the country, and provides a focus and impetus to the current efforts towards biodiversity conservation.

National Action Plan on Climate Change (NAPCC) 2008 has been prepared by the

Government of India. The NAPCC has laid down the principles and has identified the approach to be adopted to meet the challenges of impact of climate change through eight National Missions namely, (a) National Solar Mission, (b) National Mission for Enhanced Energy Efficiency, (c) National Mission on Sustainable Habitat, (d) National Water Mission, (e) National Mission for Sustaining the Himalayan Eco- system, (f) National Mission for a Green India, (g) National Mission for Sustainable Agriculture, and (h) National Mission on Strategic Knowledge for Climate Change.

“National Water Mission” is a part of NAPCC and identifies the strategies and methodologies in respect of (a) Assessment of Impact of Climate Change; (b) Changes in Policy, Practices and Institutional Framework; (c) Measures for Mitigation; as well as (d) Measures for Adaptations. Appropriate monitoring and evaluation mechanism has also been proposed.

“A National Water Mission” will be mounted to ensure integrated water resource management helping to conserve water, minimize wastage and ensure more equitable distribution both across and within States. The Mission will take into account the provisions of the National Water Policy and develop a framework to optimize water use by increasing water use efficiency by 20% through regulatory mechanisms with differential entitlements and pricing. It will seek to ensure that a considerable share of the water needs of urban areas are met through recycling of waste water. It states:

“The National Water Policy would be revisited in consultation with States to ensure basin level management strategies to deal with variability in rainfall and river flows due to climate change.

The mission will seek to develop new regulatory structures, combined with

appropriate entitlements and pricing. It will seek to optimize the efficiency of existing irrigation systems, including rehabilitation of systems that have been run down and also expand irrigation, where feasible, with a special effort to increase storage capacity. Incentive structures will be designed to promote water neutral or water positive technologies, recharging of underground water sources and adoption of large scale irrigation programmes which rely on sprinklers, drip irrigation and ridge and furrow irrigation.”

State Level Policies/ Regulations

The Himachal Pradesh Fisheries Act, 1976 (Act No. 16 of 1976): An Act to provide for certain matters relating to fisheries in Himachal Pradesh. Under article 3 of this Act, there are rules, which may (a) prohibit or regulate (b) the erection and use of fixed engines; (c) the construction, temporary or permanent of weirs, dams and bunds; and killing of fish by diversion of natural waters; (d) prohibit the destruction or attempt to destroy fish by gun, spear, bow and arrow or similar instruments or pollution of waters by trade effluents; (e) prescribe seasons in which the killing or catching or sale of any fish of any prescribed species shall be prohibited; (f) prohibit fishing in any specified water for specified period.

Article 7 of these rules also describe punishment for destruction of fish by poisoning water; punishment for possession of dynamite and other explosive substance to be used for killing the fish; punishment for killing or catching fish during prohibited season.

Himachal Pradesh Fisheries Rules, 1979 and Himachal Pradesh Fisheries (Fourth Amendment) Rules: Section 3 (1) mention that the “General Waters, Trout Waters and Resources” are declared not being private

waters to which all or any of the Rules as according to their respective provisions shall apply. These include: i. Gobind Sagar Reservoir: impoundment formed by Bhakra Dam upto a level of 1680 R.L. in Bilaspur, Una and Mandi Districts of Himachal Pradesh; ii. Pong Reservoir: Impoundment formed by Pong Dam upto a level of R.L. 1410 in Kangra District of Himachal Pradesh, iii. Pandoh Reservoir: Impoundment formed by Pandoh Dam on River Beas upto a level of R.L. 2940 in Mandi District; iv. Chamera Reservoir: Impoundment Formed By Chamera Dam upto a level Of 763.16 Mtrs. In Chamba District Of Himachal Pradesh; v. Ranjeet Sagar Reservoir:- Impoundment formed by Ranjeet Sagar Dam (Thein Dam) in the area falling in Chamba District of Himachal Pradesh.

Part V prohibits fishing by gun-spear, bow-arrow or similar instruments or pollution of water by trade affluent. Part VI prohibits fishing etc. in prescribed season and/or specified waters.

The Himachal Pradesh River Rafting Rules, 2005: These rules regulate river rafting in the State. Under these rules, “operation” means a river rafting trip to be undertaken or undertaken. “Season” for the purposes of these rules means whole of the year excluding the period from 15th July to 15th September during which no river rafting operation is permitted.

These rules define the procedure for application for river rafting, requirements procedures, registration and qualifications of operator for river rafting, registration requirements & procedure and qualifications of the guide, equipments required for carrying out operation and medical facilities and other facilities to be available during the operation. sub- section 3, under section 12 of chapter III of these rules prescribe that the operator shall keep the environment clean. In case, if any operator or participant or guide is found not

adhering to the environment guidelines, his licence will be suspended and a minimum fine of Rs. 5,000/- shall be charged.

River/Stream Bed Mining Policy Guidelines for the State of H.P,2004: Its basic objectives are to ensure scientific and systematic mining, conservation of minerals, proper replenishment of minerals, protection of environment and ecology, protection of river banks, protection of public and private property, checking of illegal mining etc.

No river/stream bed mining shall be allowed within 75 meters from the periphery of soil conservation works, nursery plantation, check dams, 1/5th of its span or 5 meters from the bank which ever is higher, 200 metres U/S and D/S of Water Supply Scheme, 200 meters U/S and 200 to 500 mts D/S of bridges depending upon the site-specific conditions, or within the distance as recommended by the Sub-Divisional Committee, which ever is more.

The Forest Sector Policy, 2005: The Forest Sector Policy seeks to achieve sustainable forest management in Himachal Pradesh i.e. forests, watersheds, wildlife, biodiversity and habitats, for the maintenance and rehabilitation of its environment and strive for enhanced livelihoods of the people of the State, especially women and other resource poor groups. The major objectives include conservation and improvement of status of natural resources in the State, especially forests, wildlife and biodiversity through effective watershed management practices; conservation and management of forests scientifically, contemporarily and in incorporating the best practices from within and outside the State, for the present and future generations and to increase their values historically, culturally, religiously, economically and aesthetically – for communities and the environment on a sustainable basis; strive towards an appropriate land use in the State especially in

the context of sustainable forest management, focusing on other primary land use sectors such as agriculture, horticulture, animal husbandry and those related to infrastructure development.

The Himachal Pradesh Non-Biodegradable Garbage (Control) Act, 1995: An Act to prevent throwing or depositing non-biodegradable garbage in public drains, roads and places open to public view “and to regulate the use of non-biodegradable material” in the State of Himachal Pradesh. The State Government has taken a cabinet decision to ban plastic altogether in the State with effect from 15th August 2009 under this Act.

Section 3 mentions prohibition to throw degradable garbage in public drains and sewage. It states that 1. No person, by himself or through another, shall, knowingly or otherwise throw or cause to be thrown in any drain, ventilation shaft, pipe and fittings, connected with the private or public drainage works, any non-biodegradable garbage or any bio- degradable garbage in a non-biodegradable bag or container likely to - i. injure the drainage and sewage system; ii. interfere with the free flow or affect the treatment and disposal of drain and sewage contents and iii. be dangerous or cause a nuisance or be prejudicial to public health Subsequently, the Himachal Pradesh Non-Biodegradable Garbage (Control) Rule, 1996 was enacted. The Rules define Bio-medical/clinical waste, Garbage Management Committee, Garbage Management Zones.

Drought Prone Area Programme (DPAP): This programme is basically an area development programme and aims at integrated development of natural resources like land, water, vegetation etc. by taking up watershed development projects. The programme is being implemented in 10 blocks of the State. Up to the year 1998-99, the programme was being funded by Central

and State Governments on 50:50 sharing basis but from 1st April 1999, the Government of India have changed the funding pattern from 50:50 to 75:25. Under this programme 318 micro watersheds have been taken up for development in Districts Bilaspur, Solan and Una for a period of 5 years. During the year 2005-2006, 40 new micro watersheds have been sanctioned by the Government of India under the programme.

Desert Development Programme (DDP): Under DDP, 420 Micro watersheds have been taken up for the development in Lahaul & Spiti district and Pooh Block of Kinnaur District. The Government of India has sanctioned 38 new micro watershed projects under this programme during the current financial year. (23 micro watershed for Lahaul & Spiti and 15 Micro watersheds for Kinnaur District).

Health Vision 2008: The health vision 2008 envisages the vision of the State, the targets to be attained and a guiding agenda to frame the strategy and tactical tools for attainment of targets. The primary goal of vision 2008 is to achieve the status – Health for All.

Roadmap 2008 document also mentions that as a part of good governance practices the State shall initiate and strengthen existing system to address environmental health issues in the State particularly liquid waste disposal, hospital bio-medical waste management, solid waste management and excreta disposal.

In order to implement this vision, the State will focus on the strengthening of infrastructure and service delivery to provide the basic care at village level, improve facilities and services in Community Health Centres (CHCs) and regional hospitals and providing the best available specialised care through medical colleges.

Sewerage development plan is being administered by the Urban Development Department instead of Irrigation & Public Health (I & PH) Department w.e.f. 1st April 2008. Hence the previous programme under this head and activities prepared for the annual plan 2008-09 are for 56 towns in Himachal Pradesh, out of which 49 towns are under I&PH Department. Six towns (Yol, Bakloh, Kasauli, Sabhatu, Dagshai and Dalhousie Cantonment) are under Cantonment Boards and Parwanoo is under Housing Board. Sewerage schemes for 13 towns namely, Sh. Naina Deviji, Chamba, Mandi, Bilaspur, Palampur, Rohroo, Shimla, Manali, Ghumarwin, Jawalamukhi, Arki, Jogindernagar & Palampur, two rural/tribal schemes Sarahan and Reckong Peo respectively have been completed upto 31st March, 2007. These schemes will assist in prevention of pollution of water bodies.

Desilting of water bodies is one of the schemes under rural and urban water supply plans under Five Year Plan (2007-12), Accelerated Rural Water Supply Programme (ARWSP) Rajiv Gandhi National Drinking Water Mission (RGNDWM) and Prime Minister Gramodaya Yojna.

State Five Year Plan (2007-2012)

- Plan aims at immediate arrest of the downward trend in the reservoir fish catches. For achieving this, intensive fish seed stocking would be done besides improvement in management measures.
- Fish seed is the nucleus of fisheries development hence maximum thrust is laid on strengthening of carp and trout farms. Nine seed farms (five trout and four carp) would be either upgraded or renovated. One trout farm, Nagini (Kullu) washed away due to the floods in 2005 shall be reconstructed and fish seed ranching of Tirthan river resumed.

- Intensification of aquaculture practices through Fish Farmer's Development Agencies.
- Implementation of welfare schemes such as accident insurance, risk fund and saving cum relief for fishermen.
- Revival of riverine fisheries by setting up Mahseer fish farm at an estimated cost of Rs. 505 lakhs.
- Initiation of ornamental fish farming and dissemination of technology to private sector.
- Extension of commercial trout farming technology in private sector.

Inland Fisheries Management and Development of Reservoir Fisheries

- (i) Conservation of reservoir fisheries: Reservoirs hold a prominent place in the fish production of the State besides ameliorating the economic status of dam oustees of these sprawling water bodies. Various studies conducted by the scientific institutions and past experience gained by the department during their management indicates that their fish production can be further enhanced. Instead of increasing the catches from Gobind Sagar & Pong, these had been showing downward trends for the last two years. Keeping this in view, a decision has been taken to stock these water bodies with adequate seed of commercially important fish species besides giving new orientation to the observance of fishing close season during breeding season of fish. There is a need to bring these reservoirs under one administrative control on the analogy of trout farming.
- (ii) Production of Carp Seeds: Fish seed is the nucleus of all fishery activities. In all, six carp farms have been set up in the State, which are producing 20.00 million per annum seeds of carp mainly

consisting of common carp as the major area of the State falls in cold zones unsuited for the breeding of Indian Major Carps. The State has achieved success in breeding Golden Mahseer (*Tor putitora*) at its farm which has been stocked in Chamara reservoir. All the existing carp farms in the State have been assigned clear mandate for the production of fish seed of a particular fish species instead of keeping all the different species irrespective of the fact whether they are capable of breeding at these farms or not. Besides, a fish farm is being remodeled for conversion into ornamental fish seed farm. Besides, every year angling competitions of mahseer are organized by the department with the collaboration of tourism department to promote angling competitions/angling meet in the State. Such competitions are becoming popular and giving publicity to tourists' influx in the State. Such competitions give an assessment of the establishment of the particular sport fish in the water body.

Inland Fisheries Development and Maintenance of Sports Fisheries- Trout Seed Farm: The Department has initiated a phased programme on remodelling and expansion of existing trout farms as well as construction of new ones. Under this programme, augmentation of water supply and setting up of modern hatchery has been taken up at Barot and at Dhamwari farm. The Department intends to continue trout farms' modernization programmes in view of a compelling need of large seed stocking in the rivers and streams as well as promotion of trout farming in the rural areas of the State. All the State trout farms are proposed to be upgraded to the level of Indo-Norwegian trout farming project with adequate water supply provision, filtration modern hatchery equipped with latest hatching equipments, adequate rearing space, feed mill and residential accommodation. Maximum stress

would be given on quality seed production in trout farms for stocking in river/streams as well as supplying to enterprising trout farmers. Trout is the renowned game fish of the world and every year angling competitions of trout are organised by the department with the collaboration of tourism department to promote angling tourism meet in the State.

Inland Fisheries Development & Maintenance of Carp Farms: Golden Mahseer (Tor-putitora) a prestigious game fish of the hills is quickly depleting from State waters in view of several man made and natural hazards. The present situation warrants large-scale seed transplantation of this species in the different ecologically suitable pockets of streams and rivers. The State Government has decided to set up a Mahseer farm at Machhiyal, tehsil Joginder Nagar, District Mandi. The land for the construction of the farm has been arranged and the work has been proposed to be completed within the shortest possible period.

Extension & Training Programme: Training has been identified as the weakest link of the fisheries department. A number of State & Centrally sponsored schemes initiated by the Department could not get adequate popularity in view of poor extension and training efforts. Presently, the training programme organised by the department lacks regularity and runs purely on an ad-hoc manner. Due to lack of such a mechanism, aquaculture programme is not making a good headway or impact especially in the rural pockets of the State. It is, therefore, proposed to set up an extension & training wing in the Department to promote training and extension activities.

Intensification of Aquaculture Programme Fish Farmers Development Agency (S25N) (FFDA): Development of aquaculture programme would be one of the major priority areas of the Department during the plan period. Despite having tremendous potential of raising the state's fish production,

generation of employment and strengthening of fish production, aquaculture could not make any discernible impact in the state in the earlier years in view of inadequate availabilities of quality seeds and lack of technical know how which could benefit the state's complex topography. The running water scheme initiated in the State during the 10th Plan period has provided an adequate answer to many of the problems of pond fish culturists. In view of plenty of water flowing in the form of streams, kuhls and abundance of mirror carp seeds in the state, the scheme of 'Running Water' fish culture is getting increasingly popular among the fish farmers of the state. The pond culture is also going to get a boost during the coming years in view of availability of fish seeds, initiation of several extension & training schemes and department's stress on extension programme.

Development of Inland Fisheries Aquaculture: A new dimension has been given to the FFDA schemes for cold-water areas under the title "Inland Fisheries & Cold Water Aquaculture". This shall cover cold-water fisheries & aquaculture along with reservoir fisheries development mainly from the central share for training, purchase of craft & gear and construction of landing center.

Strategy/ action plan of State Government for rehabilitation of Mahseer stock in lentic & lotic waters: The action plan of Himachal Pradesh Government for restoring of mahseer fish stock in the various rivers, streams, tributaries, lakes and reservoirs combines both passive and active measures and may be summarised as under:

- **Legislative action:** It has been observed that maximum damage to mahseer stock is done during the breeding season. The mahseer migrate in shoals upstream in shallow running streams for spawning. This gives an ample opportunity to

unscrupulous fishermen to kill the brood stock with nets, traps, sticks, sword, spears etc. as the gravid fish are heavily loaded with eggs and vulnerable to all these destructive fishing methods.

- Taking this in to consideration, a special clause has been incorporated in the Himachal Pradesh Fisheries Act under which fishing during breeding season has been made a cognizable non-bailable offence inviting imprisonment upto three years.
- Further, based on scientific studies, a clause has been incorporated in the H.P. Fishing Rules under which minimum catchable size for mahseer has been increased from 300 to 500 mm or approximately 1.2 kg. giving opportunity to each female mahseer to breed at least once before being caught. Since incorporation of this clause in the Fisheries Act during 1998, the average size of mahseer has increased from 0.12 to 1.7 kg in Pong dam and 0.6 to 0.9 kg in Gobind Sagar reservoir.
- Research efforts: An I.C.A.R. sponsored collaborative research project between State Government & Punjab University on "Breeding and seed production of golden mahseer" has been initiated. Under this project, besides building up a Mahseer broodstock, a modern mahseer hatchery has been set up at Deoli (Bilaspur) fish farm. Few breeding trials of mahseer have been undertaken with limited success.
- Setting up National Mahseer Fish Farm: Taking the importance of mahseer and the efforts made by Himachal Pradesh Government, the Government of India has approved a State Government's proposal of setting up a 'National Mahseer Fish Farm' in the State involving financial assistance of Rs. 2.00 Crores. The farm would be able to meet the long standing demand of mahseer seed transplantation in open waters.

Reservoirs Fishermen Accident Insurance Scheme: Fishing in the big reservoirs is a hazardous job. There is every risk of life during heavy rains and storms. Keeping this in view all active fishermen working in the reservoirs have been insured for Rs. 50,000/- in case of permanent disability and Rs. 1,00,000/- in case of death of the fishermen. The insurance premium of Rs. 30/- is being shared by the Government of India and Government of Himachal Pradesh in 50:50 ratio.

Saving-cum-Relief Scheme (Close Season Assistance): In order to ensure sustained yield of fish from the reservoirs apart from the other management measure, a fishing 'closed-season' of two months from 1st June to 31st July every year has been enforced. This measure has helped in building up fisheries of considerable magnitude by facilitating free run to the mother fish spawner during breeding season and the auto stocking of the fish seed. Every year fish over 4 Crores value is being harvested accounting an income of Rs. 60 lakhs to the State exchequer. This measure has also generated considerable resentment in the fishermen community and they were insisting on the provision of some financial assistance during this period. Himachal Pradesh is perhaps the first State in the country which has acceded to the demand of fishermen by introducing a 'Contributory Saving-cum-Relief Scheme' to its reservoir fishermen. Under this scheme, each fisherman who is a member of the co-operative society deposits Rs. 40/- for ten consecutive fishing months from August to May and an equal amount to this is added by Government of HP and Government of India. Thus Rs. 1200/- that is raised is distributed to him in two equal installments of Rs. 600/-. **Fishermen Risk Fund Scheme:** Fishing in the reservoir is nocturnal in nature and hence involves a considerable element of risk to the life of the fishermen as well as his fishing equipments. Due to changes in

atmospheric pressure, followed by cyclonic storms the reservoirs become quite rough and such situations create a lot of hardships to the poor fishermen. To mitigate to a certain extent the losses to the fishermen a 'Fishermen Relief Fund Scheme' has been formulated in the State. Under this scheme, each reservoir fisherman contributes Rs. 20/- annually, to be collected from him at the beginning of the year while issuing the licences. The State Government contributes an amount equal to the total contribution of the fishermen. The assistance from the fund to the fishermen is given only on loss of gill nets, wooden boats and tents. Based on the present value of the equipments, the compensation is given up to 33% of the loss of each item. Maximum assistance is given in case of total loss/destruction of the equipment.

Grant-in-Aid/Subsidy for the Construction of Fish Ponds: In order to assist the people to take the fish culture, the State Government has formulated a scheme to provide subsidy up to maximum of Rs 5,000 for the construction/renovation of ponds. The subsidy is available @ 50% of the total project cost to Scheduled Castes/Tribes, while others living below poverty line @ 20%. The State Government is also providing training and technical guidance to the entrepreneurs.

Renovation/Reclamation of ponds and Tanks: The scheme envisages renovation/reclamation of old ponds and tanks which are owned or taken on lease by the farmers. The estimated per ha renovation cost of the pond is Rs. 75,000/- and subsidy @ 20% with a maximum of Rs. 15,000 /- for Non Scheduled Castes/other fish farmers and for S.C/S.T it is Rs. 18,750/- per ha. (25%) is provided.

Construction of New Ponds: This scheme has been introduced during 1991-92 with an aim to create more ponds for increased fish

production. The unit cost of the scheme is Rs 4.00 lakhs per ha in the plain areas including arrangement for water supply either in the form of tube-well or gravity flow. The subsidy component is available @ 20% with a maximum of Rs. 80,000/- per ha for Non Scheduled Castes/other farmers and for S.C/S.T farmers it is 1,00,000/- per ha (25%).

Integrated Fish Farming: The scheme envisages assistance for setting up integrated units including hatcheries for ornamental fish e.g. Unit cost Rs. 15 lakhs which includes hatchery of 5-10 million capacity.

Construction of Fresh Water Prawn & other Fish Hatchery: Fish seed is the nucleus of aquaculture. The State Department of Fisheries at its seed farms is producing 20.0 million fish seed annually which is not even sufficient to meet the fish seed stocking requirements of its reservoirs and open waters. Hence there is a need to involve private entrepreneurs in fish seed production. The scheme envisages Rs. 12.00 lakhs for a fish seed hatchery with 10 million (fry) capacity for the plain areas and Rs. 16.00 lakhs with same capacity for the hill States/districts. Subsidy @ 10% with a maximum ceiling of Rs.1.20 lakhs in the plain and Rs. 1.60 lakhs in the hilly areas is available for entrepreneurs only.

Establishment of Fish Feed Unit: For setting up of a fish feed unit, the Government of India has sanctioned the cost @ Rs. 7.5 lakhs for building, machinery and equipment of the unit which will be set up in the private sector. Subsidy @ 20% with a maximum ceiling of Rs. 1.50 lakhs is admissible for each entrepreneur.

Subsidy on 1st Year Inputs: The fish farmers who avail the benefits of Grant-in-Aid subsidy for the renovation and construction of ponds are also provided subsidy on the purchase of 1st year inputs such as fish seed, feed, manure etc. @ 20% with a maximum

ceiling of Rs 10,000/- per ha for all farmers except SC's/ST's for whom it is Rs. 12,500/- per ha (25%). The total cost per ha has been allowed at Rs.30,000/-

Schemes for Youth: The various schemes applicable are given below.

- Construction of New Ponds: Assistance for construction of a pond (size 1 ha) Rs. 1,00,000/- for SC/ST and Rs. 80,000/- for General Category farmers.
- Reclamation/ Renovation of Ponds: Assistance for a pond (size 1 ha) Rs. 18,750/- for SC/ST and Rs. 15,000/- for General category farmers.
- First Year Inputs: Assistance for a pond of one ha Rs. 12,500/- for SC/ ST's and Rs. 10,000/- for general category farmers.
- Integrated Fish Farming: Additional Assistance for integrated fish farming pond (size 1 ha.) Rs. 20,000/- for S.C./S.T. & Rs. 16,000/- for general category.
- Freshwater Fish Seed Hatchery: Assistance for setting up hatchery with 10 million seed (fry) capacity Rs. 1.6 lakhs for each unit only.
- Fish Feed Unit: Assistance for setting up fish feed unit for Rs. 1.50 lakhs on a unit cost of Rs. 7.50 lakhs.

2.4 Horticulture

The policies and laws applicable and/or related to environmental issues to horticulture sector of the State along with a brief description of their relevance are listed below. These policies, laws, sub-programmes & strategies provide operating framework for the sector to address issues, causes and impacts. Detailed information can be taken from relevant ministries and departments like Ministry of Environment & Forest (MoEF), Ministry of Agriculture, State Department of Horticulture website (www.hphorticulture.nic.in) and Department of Floriculture,

Himachal Pradesh website ([http:// hp.floriculture.nic.in](http://hp.floriculture.nic.in)).

National Level Policies/ Regulations

Technology Mission for Integrated Development of Horticulture in the North-eastern and Himalayan States (TMNE): This is Centrally Sponsored Scheme which was launched during the Ninth Five Year Plan period. The implementation of the scheme was later extended to the States of Jammu and Kashmir, Himachal Pradesh and Uttarakhand during 2003- 04 in the Tenth Plan as a major initiative to bring about diversification in agriculture and augment the income of farmers through cultivation of high value horticultural crops. The specific objectives of horticulture development were to improve productivity and quality of horticulture crops through upgradation of production/farming technologies; to reduce post- harvest losses and improve marketability of the produce and its availability to consumers; to promote better utilisation and increased consumption of the produce to ensure higher returns to farmers/producers and better nutritional health to the people; to promote export; to develop a strong base for supply of inputs, transfer of technology and human resource development to support the development activities.

National Policy for Farmers 2007: There is a need to focus more on the economic well-being of the farmers, rather than just on production. Socio- economic well-being must be a prime consideration of agricultural policy, besides production and growth. The aim of the Policy is, therefore, to stimulate attitude and actions which should result in assessing agricultural progress in terms of improvement in the income of farm families, not only to meet their consumption requirements but also to enhance their capacity to invest in farm related activities.

The major goals of the “National Policy for Farmers” are:

- i) To improve economic viability of farming by substantially increasing the net income of farmers and to ensure that agricultural progress is measured by advances made in this income.
- ii) To protect and improve land, water, bio-diversity and genetic resources essential for sustained increase in the productivity, profitability and stability of major farming systems by creating an economic stake in conservation.
- iii) To develop support services including provision for seeds, irrigation, power, machinery and implements, fertilizers and credit at affordable prices in adequate quantity for farmers.
- iv) To strengthen the bio-security of crops, farm animals, fish and forest trees for safeguarding the livelihood and income security of farmer families and the health and trade security of the nation.
- v) To provide appropriate price and trade policy mechanisms to enhance farmers’ income.
- vi) To provide for suitable risk management measures for adequate and timely compensation to farmers.
- vii) To complete the unfinished agenda in land reforms and to initiate comprehensive asset and aquarian reforms.
- viii) To mainstream the human and gender dimension in all farm policies and programmes.
- ix) To pay explicit attention to sustainable rural livelihoods.
- x) To foster community-centred food, water and energy security systems in rural India and to ensure nutrition security at the level of every child, woman and man.
- xi) To introduce measures which can help attract and retain youths in farming and processing of farm products for higher value addition by making it intellectually stimulating and economically rewarding.
- xii) To make India a global outsourcing hub in the production and supply of the inputs needed for sustainable agriculture, products and processes developed through biotechnology and Information and Communication Technology (ICT).
- xiii) To restructure the agricultural curriculum and pedagogic methodologies for enabling every farm and home science graduate to become an entrepreneur and to make agricultural education gender sensitive.
- xiv) To develop and introduce a social security system for farmers.
- xv) To provide appropriate opportunities in adequate measure for non- farm employment for the farm households.

National Seed Policy, 2002: It has become evident that in order to achieve the food production targets of the future, a major effort will be required to enhance the seed replacement rates of various crops. A major increase in the production of quality seeds is required in which the private sector is expected to play a significant role. At the same time, private and public sector seed organisations at both central and State levels are expected to adopt economic pricing policies that would seek to realize the true cost of production. The creation of a facilitative climate for growth of a competitive and localised seed industry, encouragement of import of useful germ plasm and boosting of exports are the core elements of the agricultural strategy of the new millennium.

National Agriculture Policy, 2000: The first National Policy on Agriculture was brought out in 2000 which seeks to actualise the vast untapped growth potential of Indian agriculture, strengthen rural infrastructure to support faster agricultural development, promote value addition, accelerate the growth of agro business, create employment in rural areas, secure a fair standard of living

for the farmers and agricultural workers and their families, discourage migration to urban areas and face the challenges arising out of economic liberalization and globalisation. Over the next two decades, it aims to attain a growth rate in excess of 4% per annum in the agriculture sector; growth that is based on efficient use of resources and conserves soil, water and bio-diversity; growth with equity, i.e., growth which is widespread across regions and farmers; growth that is demand driven and caters to domestic markets and maximises benefits from exports of agricultural products in the face of the challenges arising from economic liberalisation and globalisation, and growth that is sustainable technologically, environmentally and economically.

National Water Policy 2002: As per the latest assessment (1993), out of the total precipitation, including snowfall, of around 4000 billion cubic metres in the country, the availability from surface water and replenishable ground water is put at 1869 billion cubic metres. Because of topographical and other constraints, about 60% of this i.e. 690 billion cubic metres from surface water and 432 billion cubic metres from ground water can be put to beneficial use. Availability of water is highly uneven in both space and time.

National level policy addresses the water issues including prioritisation, allocation, pricing and inter-state issues related to water sharing. Policy states about the use of water, water conservation and quantification of water pollution.

Irrigation planning either in an individual project or in a basin as a whole should take into account the irrigability of land, cost-effective irrigation options possible from all available sources of water and appropriate irrigation techniques for optimising water use efficiency. Irrigation intensity should be such so as to extend the benefits of irrigation to as

large a number of farm families as possible, keeping in view the need to maximise production.

Section 7.3 states that integrated and coordinated development of surface water and ground water resources and their conjunctive use should be envisaged right from the project planning stage and should form an integral part of the project implementation.

Section 25 states that for effective and economical management of water resources, the frontiers of knowledge need to be pushed forward in several directions by intensifying research efforts in various areas, including hydro-meteorology; snow and lake hydrology; surface and ground water hydrology; assessment of water resources; water quality; water conservation; evaporation and seepage losses; recycling and re-use; better water management practices and improvements in operational technology; soils and material research; canonical designs for water resource projects, sedimentation of reservoirs, prevention of salinity ingress; prevention of water logging and soil salinity; reclamation of water logged and saline lands; environmental impact and regional equity.

The National Environment Policy, 2006: The National Environment Policy, 2006 states that the degradation of land in India through soil erosion, alkali-salinization, water logging, pollution and reduction in organic matter content has several proximate and underlying causes. The proximate causes include loss of forest and tree cover (leading to erosion by surface water run-off and winds), unsustainable grazing, excessive use of irrigation (in many cases without proper drainage, leading to leaching of sodium and potassium salts), improper use of agricultural chemicals (leading to accumulation of toxic chemicals in the soil), diversion of animal wastes for domestic fuel (leading to reduction in soil nitrogen and organic matter), and

disposal of industrial and domestic wastes on productive land. These proximate causes of land degradation in turn, are driven by implicit and explicit subsidies for water, power, fertiliser and pesticides.

The policy prescribes that it is essential that the relevant fiscal, tariffs and sectoral policies take explicit account of their unintentional impacts on land degradation, if the fundamental basis of livelihood for the vast majority of our people is not to be irreparably damaged.

In addition, to such policy review, the following specific initiatives would be taken: a) Encourage adoption of science-based and traditional sustainable and use practices, through research and development, extension of knowledge, pilot scale demonstrations and large scale dissemination, including farmer's training and where necessary, access to institutional finance; b) promote reclamation of wasteland and degraded forestland, through formulation and adoption of multi stakeholder partnerships, involving the land owning agency, local communities, and investors; c) prepare and implement thematic action plans incorporating watershed management strategies, for arresting and reversing desertification and expanding green cover; d) promote sustainable alternatives to shifting cultivation where it is no longer ecologically viable, ensuring that the culture and social organisation of the local people are not disrupted and encourage agro-forestry, organic farming, environmentally sustainable cropping patterns and adoption of efficient irrigation techniques.

The Agricultural and Processed Food products export Development authority act, 1985 no. 2 of 1986: An Act to provide for the establishment of an Authority for the development and promotion of exports of certain agricultural and processed food products and for matters connected therewith. The Gazette of India extraordinary

(part ii-sec-1) include schedule for Fruits, vegetables and their products and floriculture and floriculture products.

Fruit Protection Act 137 of 1935: It's an Act to provide for the protection of public health; to promote the fruit growing industry; to assist in the marketing of fresh fruit; to provide for establishing of temporary chemical laboratories in the fruit growing sections during the harvesting and shipping season, in order to control excess poisonous spray residue on fruit; to provide for the payment of inspection fees for chemical analyses; to issue clearance certificates on lots of apples and other fruits prepared for shipment; to make an appropriation there for and to prescribe the duties and powers of the Commissioner of Agriculture.

Prevention of Food Adulteration Act, 1954: An Act to make provision for the prevention of adulteration of food, this Act aims to assure a high level of protection of human health and consumers' interests in relation to food. Primary food means any article of food, being a produce of agriculture or horticulture in its natural form.

Integrated Pest Management Act and Regulations, 2004: Integrated Pest Management is the use of pest control methods which minimize harm to beneficial organisms and the environment and a process for managing pest populations. The Ministry of Environment & Forest administers the Integrated Pest Management Act and Regulations. Environmental Protection Division, IPM Unit which: Applies to pesticide use on public land; on private land used for forestry, transportation, public utilities and pipelines and for pest control service companies; regulates the sale, use and handling of pesticides in the province and promotes an Integrated Pest Management approach to managing pests.

The Seeds Act, 1966: It's an Act to provide for regulating the quality of certain seeds for sale and for matters connected therewith. Subsequently, the Seeds (Amendment) Act, 1972 (no. 55 of 1972) was made. It has specified power to notify kinds or varieties of seeds, power to specify minimum limits of germination and purity, etc., regulation of sale of seeds of notified kinds or varieties, restriction on export and import of seeds of notified kinds or varieties, recognition of seed certification agencies of foreign countries.

National Oilseeds and Vegetable Oils Development Board Act, 1983 (29 of 1983): It's an Act to provide for development under the control of the Union of the oilseeds industry and the vegetable oils industry and the matter connected therewith. Subsequently, the National Oilseeds and Vegetable Oils Development Board Rules, 1984 was framed under National Oilseeds and Vegetable Oils Development Board Act, 1983 (29 of 1983).

Essential Commodities Act, 1955: It gives powers to control production, supply, distribution etc. of essential commodities for maintaining or increasing supplies and for securing their equitable distribution and availability at fair prices. Using the powers under the Act, various ministries/departments of the Central Government have issued, "Control Orders" for regulating production/distribution/quality/aspects/movement etc. pertaining to the commodities which are essential and administered by them.

Himachal Pradesh is also encouraging the use of Corrugated Fibre Board (CFB) carton for the packing of apple and other fruits, so that not only forest wealth of the state could be protected but also packing cases may be made available at reasonable prices to the growers. The Department of Horticulture has mooted an "Order" to put CFB cartons under this Act for maintaining quality parameters, equitable distribution and availability at fair

price for consideration of the Government of Himachal Pradesh.

The Insecticides Act, 1968 G.S.R. 576 (E), dated 26th August. 1993: It's an Act to regulate the import, manufacture, sale, transportation, distribution and use of insecticides with a view to prevent risk to human beings or animals, environment and for matters connected therewith. Subsequently, Insecticides Rules was framed in 1971.

Notification dated 25th October, 2005 under the Act mandates withdrawal of the use of Dichloro-Diphenyl-Trichloroethane (DDT) and restricts the use of 10000 metric tonnes per annum for public health programme.

Under Subsection (2) of Section 27 read with Section 28 of the Insecticides Act, 1968, an order dated May 06, 2005 was issued banning the use of Monocrotophos on vegetables. Similarly, use of Linuron and Iprodione has been banned vide notification dated 31st December 2008.

In respect to those registrants who do not return the registration certificate, as per this order within a period of six months with effect from the date of publication of this order, their license granted under section 13 of the said Act shall not be renewed or action under Section 14 of the Act should be taken. The State Governments shall have power to take such steps under the relevant provisions of the said Act and the rules made there under as they may deem fit for the execution of these "Orders" in the state concerned. Under the Insecticide Act, 1968, cancellation of Certificate of Registration Order 2010 has been issued for cancellation of registration to manufacturers of insecticides.

The Water (Preservation and Control of Pollution) Act 1974/1988: This Act provides for the prevention and control of water pollution and for maintaining or restoring of

wholesomeness of water. Section 2 of the act defines pollution as contamination of water or such alteration of the physicals, chemical or biological properties of water or such discharge of any sewage or any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to create a nuisance or render such water harmful or injurious to public health or safety or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals, plants or of aquatic organisms.

The Air (Preservation and Control of Pollution) Act, 1981/1987: This Act provides for the prevention, control and abatement of air pollution. Chapter 1 defines “Air Pollution” as any solid, liquid or gaseous substance present in the atmosphere in such concentration as may be or tend to be injurious to human beings on living creatures or plants or property or environment.

The Patent Second Amendment Act, 2002: The Plant Variety Protection Act is supportive of research on transgenics because of the strong rights it grants to plant breeders. However, it is the Patent Second Amendment Act that makes distinct concessions to the biotechnology sector and the breeding of transgenic crops. According to this Act, process patents will be allowed on microbiological, biochemical and biotechnological processes. In this way, methods of genetic engineering, processes in the pharmaceutical industry using micro-organisms and related processes will be patentable.

Processes and methods for making plants resistant to disease and for increasing their value or the value of their products will be patentable. Discoveries, however, will not be patentable under the Indian law. To qualify for a patent, invention will have to be demonstrated. Plants and animals and species of plants and animals have been kept out of

the purview of patents, so have plant varieties and seeds. New varieties of crops and their seeds are thus outside the patent system. Though the Indian law permits process patents, this will not apply to the crucial sector of food. Methods and processes of agriculture and horticulture cannot be patented nor can any other biological processes. The Patent Amendment Act also does not allow the patenting of cells, cell lines, cell organelles like mitochondria and genes.

Destructive Insects and Pests Act, 1914 (2 of 1914): It's an Act to prevent the introduction into India and the transport from one province to another of any insect, fungus or other pest, which is or may be destructive to crops. In this Act, crops include all agricultural or horticultural crops and all trees, bushes or plants and “import” means the bringing or taking by sea, land or air across any customs frontier as defined by the Central Government.

It empowers the Central Government to prohibit or regulate, subject to such restrictions and conditions as it may impose, the import into India or any part thereof, or any specified place therein, of any article or class of articles likely to cause infection to any crop or of insects generally or any class of insects. A notification under this section may specify any article or class of articles or any insect or class of insects either generally or in any particular manner, whether with reference to the country of origin or the route by which imported or otherwise. The Central Government may, by notification under this section, also levy and collect such fees at such rates and in such manner as may be specified therein for making an application for a permit to import, or for making inspection, fumigation, disinfection or supervision of, any article or class of articles or any insect or class of insects under this section.

The Seeds Rules, 1968: The Seeds Rules framed in 1968, made provisions for Central Seed Committee, Central Seed Laboratory, Seed Certification Agency, marking or labeling, certification of seeds, seed analysts and seed inspectors. It also contains a form for seed production under the Seed Certification Programme. Part IV, item k of the rules specifies that Seed Certification Agency will ensure that seed borne diseases are not present in the field to a great extent than those provided in the standards of certification. Further, Part V, item 8c specifies that marking and labeling should ensure that seeds treated with chemicals should not be used for food, seed or oil purpose. Subsequently the Seeds (Amendment) Rules has been amended in 1973, 1974, Corrigendum Seeds (Amendment) Rules, 1974 and The Seeds (Amendment) Rules, 1981.

The Seeds (Control) Order, 1983: Under Section 3 of the Essential Commodities Act, 1955 (10 of 1955), the said order deals with; dealer in seeds to be licensed and enforcement authority. It also contains form of application to obtain dealer's license, license to carry on the business of a dealer in seeds, application for renewal of license and a schedule for sealing, fastening, dispatch and analysis of samples.

Fertiliser Control Order, 1985: The said order was notified vide No.11- 3/83-STU, Government Of India, Ministry of Agriculture and Rural Development (Department of Agriculture and Cooperation) New Delhi, dated 25th September 1985. It covers, Price control; control on distribution of fertilisers by manufacturer/importer; authorisation or registration of dealers; manufacture of mixtures of fertilisers; organic fertiliser and bio- fertiliser; restrictions on manufacture/import, sale etc. of fertiliser; defines bio-fertiliser as a product containing carrier based (solid or liquid) living micro-organisms which are agriculturally useful in

terms of nitrogen fixation; phosphorus solubilisation or nutrient mobilization to increase the productivity of the soil and/or crop.

Insecticides Rules, 1971: In exercise of the powers conferred by section 36 of the Insecticides Act, 1968 (46 of 1968), the Central Government, after consultation with the Central Insecticides Board, have promulgated these rules. According to these rules, the board has some functions: The Board shall, in addition to the functions assigned to it by the Act, carry out the following functions: advise the Central Government on the manufacture of insecticides under the Industries (Development and Regulation) Act, 1951 (65 of 1951); specify the uses of the classification of insecticides on the basis of their toxicity as well as their being suitable for aerial application; advise tolerance limits for insecticides, residues and an establishment of minimum intervals between the application of insecticides and harvest in respect to various commodities; specify the shelf-life of insecticides; suggest colourisation, including colouring matter which may be mixed with concentrates of insecticides, particularly those of highly toxic nature and carry out such other functions as are supplemental, incidental or consequential to any of the functions conferred by the Act or these rules.

Ozone Depleting Substances (Regulation and Control) Rules, 2000: MoEF vide its notification dated 17th July, 2000 under the section of 6, 8 and 25 of the Environment (Protection) Act, 1986 has notified rules for regulation/ control of Ozone Depleting Substances (ODS) under Montreal Protocol. As per the notification, certain control and regulation has been imposed on manufacturing, import, export and use of these compounds. Organisations as per provisions of notification shall phase out all equipment, which uses these substances and

is aiming at CFC free organisation in the near future.

Notification Floriculture and Seed, 2004-09: S.O (E) – In exercise of powers conferred by Section 5 of the Foreign Trade (Development and Regulation) Act, 1992 (No. 22 of 1992) read with Para 1.3 of the Foreign Trade Policy, 2004-2009 (as amended from time to time), the Central Government hereby makes the following amendment in Foreign Trade Policy (RE2008): In third sub para of Para 3.8.2 of FTP RE2008, the words ‘Flowers, Fruits and Vegetables’ are replaced by ‘Flowers, Fruits, Vegetables and Other Products’.

Farmers Rights, 2001: The Act recognizes the farmer not just as a cultivator but also as a conserver of the agricultural gene pool and a breeder who has bred several successful varieties. The Act makes provisions for such farmer’s varieties to be registered, with the help of NGOs so that they are protected against being scavenged by formal sector breeders. The rights of rural communities are acknowledged as well. Farmer’s rights are defined in the following way:

The farmer shall be deemed to be entitled to save, use, sow, resow, exchange, share or sell his farm produce including seed of a variety protected under this Act in the same manner as he was entitled before the coming into force of this Act; provided that the farmer shall not be entitled to sell branded seed of a variety protected under this Act.

Importance of farmers’ right to sell seed: The pivotal importance of the farmer having the right to sell (not save nor exchange, but sell) seed has to be seen in the context of seed production in India. In India, the farming community is the largest seed producer, providing about 87% of the country’s annual requirement of over 60 lakhs tonnes. If the farmer were to be denied the right to sell, it would not only result in a substantial loss of

income for him but far more importantly, such a step would displace the farming community as the country’s major seed provider.

Breeders’ rights: Breeders’ rights over the varieties they have developed are more than adequately protected by the draft legislation. On registration, the breeder has rights of commercialisation for the registered variety either in his/her own person or through anyone he designates. These rights include the right to produce, sell, market, distribute, import or export a variety, in short, full control over formal marketing. The strong protection granted to a plant breeder over his/her variety is seen in the section dealing with infringement of breeders’ rights where punishment in the form of substantial fines and jail terms has been prescribed for those who infringe the rights of the registered breeder.

State Level Policies/ Regulations

Fruit Nurseries Registration Act 1973: The propagation of fruit plant material in HP is regulated under the Himachal Pradesh Fruit Nurseries Registration Act 1973 but new draft “The Himachal Pradesh Horticulture Crops Nurseries Registration and Plant Certification Act 2007” has been proposed to the Government of HP for approval. At present, 553 nos. (456 pvt. & 67 under public sector) of fruit nurseries are registered with the Department of Horticulture under the present Act. The Himachal Pradesh Agricultural & Horticultural Produce Marketing (Development & Regulation) Act, 2005: The State has introduced reform in the agriculture marketing sector by replacing the old Act “The Himachal Pradesh Agriculture Marketing Act, 1969” and enacted “The Himachal Pradesh Agricultural and Horticultural Produce Marketing

(Development & Regulation) Act, 2005” which provides for:

Setting up of private markets/ consumer/ farmer market/contract farming/direct marketing.

At present, the State has been divided into 10 Agricultural Produce Market Committees (APMCs), it has setup 48 principal market yards/sub-market yards, 5 market yards are under construction and 5 market yards have been proposed for construction in which proposal to establish modern fruit and vegetable market at Parala in District Shimla is also included. Most of the market yards are provided with AGMARKNET connectivity for display of daily arrivals and rates.

Any farmer for his bonafide use may create Post Harvest Management Infrastructure facilities at the farm level such as grading standardization pack house, cold storage, primary processing and other post harvest management facilities under Technology Mission for Integrated Development of Horticulture in the North-eastern States (TMNE) being executed by the Department of Horticulture through NHB/DMI/MFPI/APEDA Government of India.

The Himachal Pradesh Agricultural Pests, Diseases & Noxious Weeds Act, 1969: The Act was provided for prevention of the introduction, spread or reappearance of pests, plant diseases & noxious weeds injurious to crops, plants or trees in State. State Government may by notification in the official gazette: Declare that any insect, vertebrate or invertebrate animal, disease or weed is injurious to plant in any local area as noxious weed; specify the local area within which and the period during which such declaration shall remain in force; prohibit/restrict movement or removal of any plant, earth, soil and manure from one place to another and prescribe the period within which it shall not be lawful to plant with a

specified crop the whole or any portion of notified area.

- If any pest, plant diseases or noxious weeds appear in any village adjoining a notified area Patwari of such villages shall report the fact to such Officer as State Government may appoint in this behalf.
- Whoever removes any plant, earth, soil, manure or other thing may be fined.

If, on the inspection of any land or premises under section 5, the Inspector finds that there is any pest, plant disease or noxious weed on such land or premises and that the preventive or remedial measures mentioned in the notification issued under section 3 have not been carried out the Inspector may, subject to any general or special orders of the State Government, call upon the occupier of such land or premises, by notice in writing, to carry out such preventive or remedial measures within the time specified in such notice.

If any pest, plant disease or noxious weed appears in any village adjoining a notified area, the Patwari or Lambardar of such village shall forthwith report the fact to such Officer as the State Government may appoint in this behalf.

Whoever removes any plant, earth, soil, manure or other thing in contravention of the directions contained in a notification issued under section 3 shall, on conviction by a Magistrate, be punishable with fine which may extend to rupees fifty or in default to simple imprisonment for a period not exceeding ten days; any occupier who fails to comply with a notice given under subsection (1) of Section 6 or with any order passed on appeal under subsection (3) of Section 6 shall, on conviction by a Magistrate, be punishable with fine which may extend to rupees fifty or in default to simple imprisonment for a period not exceeding ten days and whoever having once been convicted of an offence

under sub section (1) or (2) of this section is again convicted of an offence under either of these subsections shall be punishable with fine which may extend to rupees two hundred and fifty or in default to simple imprisonment not exceeding one month.

The Himachal Pradesh Holdings (Consolidation & Prevention of Fragmentation) Act, 1971: This Act was to provide consolidation of agricultural holdings and for preventing the fragmentation of agricultural holdings in the State and for assignment or reservation of land for common purposes of the village. State Government may specify any estate or its subdivision as notified area. State Government may provisionally settle for any class of land in any notified area. No person shall transfer or lease any fragment of the land. No land in any notified area shall be transferred or partitioned to create a fragment. The transfer or partition of any land contrary to provision of this act shall be void. If the owner of the fragment wants to sell it he should make an application to the Collector for determination of market price.

The Himachal Pradesh Warehouses Act, 1976: An Act to provide for the regulation and licensing of warehouses in the State of Himachal Pradesh. “Depositor” means a person who has deposited goods with a warehouseman for storing and includes any person who lawfully holds the receipt issued by the warehouseman in respect of such goods and derives, title thereto by a proper endorsement or transfer thereof to him by the depositor or the depositor’s lawful transferee; (vegetables, herbal produce and others) “Goods” means any of the articles specified in the Schedule to this Act. “Warehouseman” means a person, who has obtained licence under this Act, in respect of his warehouse; “Warehousing” means the business carried on by a warehouseman under licence granted under this Act and in accordance with such

terms and conditions thereof as may, from time to time, be prescribed.

Every warehouseman shall take such care of the goods deposited with him as a man of ordinary prudence would take of his own goods under similar circumstances and conditions. Every warehouseman shall keep his warehouse clean and free from damp, take all necessary precautions against rats and other pests and fulfill such other conditions as may be prescribed. No warehouseman shall accept such goods for deposit as are likely to cause damage to other goods which are or may be deposited in the warehouse. Whenever goods deposited in a warehouse begin to deteriorate, he shall forthwith give notice of such fact to the depositor requiring him to take delivery of the goods immediately, after surrendering the receipt duly discharged and paying all charges due to the warehouseman. If the depositor does not, within a reasonable time as prescribed, comply with a notice given to him under subsection (1), the warehouseman may cause the goods to be removed from the warehouse and sold by public auction on such conditions as may be prescribed at the cost and risk of the depositor.

The prescribed authority may, at any time, during business hours, inspect or examine or cause to be inspected or examined any licensed warehouse, its machinery and equipment goods deposited therein, and the account books and records relating thereto, for the purpose of satisfying itself that the requirements of this Act and the rules.

This Act is to be applied for the following horticultural goods: Vegetables (potatoes, tomatoes, onions, chillies); herbal produce (dhoop, karu and violet-flowers) and others (gur, shakkar, apples, plums, peach, ginger (including dry ginger) lemon, kuth, chilgoza, dioscorea, etc.)

The Himachal Pradesh Warehouses Rules, 1987: Every warehouseman shall maintain his warehouse in accordance with the directions issued by the Registrar from time to time, in this behalf and in particular shall keep the warehouse in the following manner: the warehouse shall be damp- proof and rat-proof; the warehouse shall be repaired whenever necessary and shall be kept disinfected; the goods stored in the warehouse shall be arranged and stored in such a manner so as to render stock-taking and verification facile and effective; stocks shall not be stacked touching the walls and a space of about 60 cm. shall be left except in the case of a warehouse run by the Central Warehousing Corporation established under the Warehousing Corporation Act, 1962 (Act No. 58 of 1962) and in which the stocks are deposited by the Government, the Food Corporation of India and the Co-operative Societies, the stocks shall not ordinarily exceed 15' x 15' in dimensions and shall not be more than a pile of 15 bags in height; goods of different classes or grades or qualities shall be stored separately; all leakages in the roof, dampness in walls and floors during the monsoons shall be carefully watched and repaired in good time and all appliances in the warehouse, such as scales, weights, measures, packers and ladders shall be maintained in proper form and in good condition.

Every warehouseman shall keep his warehouse clean, free from straw, rubbish or accumulation of materials which may increase the risk of fire or may interfere with handling of goods. All goods for storage shall be delivered at the warehouse properly marked and packed for handling. The depositor shall furnish at or prior to such delivery a manifestation action showing marks, brands or sizes to be kept and accounted for separately and the class of storage desired, otherwise the goods may be stored in bulk or assorted lots at the discretion of the warehouseman and will be charged for

accordingly. In the case of deterioration of goods, the warehouseman shall serve the depositor with a notice to remove the goods within a period of one week from the date of receipt of the said notice. On failure of the depositor to remove the goods within the period fixed under rule 30/32, the warehouseman shall proceed to sell the goods by public auction.

The Himachal Pradesh Universities of Agriculture, Horticulture and Forestry Act, 1986: An Act to make suitable provisions for enforcing uniform standards of teaching, research and extension education in the fields of agriculture, horticulture and forestry in the two Universities of Himachal Pradesh namely the Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishwavidyalaya at Palampur and Dr. Yashwant Singh Parmar University of Horticulture and Forestry at Solan, as also, for having uniformity in financial arrangements and in service conditions of the employees in the said Universities.

“Agriculture” means the basic and applied sciences of soil and water management, crop production, home science, food science, agricultural engineering and technology, animal husbandry including veterinary and dairy science, fisheries, mushroom growing, bee-keeping, tea cultivation, sericulture, vegetables, social sciences and agricultural marketing, processing, co-operation, land use and management and economic and social uplift of the rural people;

“Extension” means educational activities concerned with the training of orchardists, farmers and other groups serving agriculture, horticulture and forestry, in improved practices related thereto and the various phases of scientific technology related to agriculture, horticulture and forestry, including post harvest technology and marketing;

“Forestry” means and includes basic and applied sciences concerning silviculture, plant breeding, farm forestry, conservation of ecology of the biosphere, wildlife, sericulture, medicinal and aromatic plants and their products;

“Horticulture” means the basic and applied sciences of fruits, vegetables, floriculture plantation crops, spices, hops and shall include mushroom growing, landscaping, bee-keeping, marketing and processing of horticultural produce;

The Himachal Pradesh Panchayati Raj Act, 1994: An Act to consolidate, amend and replace the law relating to Panchayats with a view to ensure effective involvement of the Panchayati Raj Institutions in the local administration and developmental activities. The Gram Sabha shall perform the following function, namely: mobilize voluntary labour and contribution in kind and cash for the Community Welfare Programmes; identification of beneficiaries for the implementation of developmental schemes pertaining the village; rendering assistance in the implementation of developmental schemes pertaining to the village; approve plans, programmes and budget, prepared by the Gram Panchayat, for economic development and social justice and authorise, after being satisfied, issuance of utilisation certificate of funds spent on the implementation of the plans, projects and programmes of the Gram Panchayat.

The Agriculture and Industry Committee shall perform functions relating to: agriculture production, animal husbandry, co-operation, contour bunding and reclamation; village and cottage industries and promotion of industrial development of the district.

Functions of Gram Panchayats: Plantation and preservation of Panchayat Forests; agriculture, including agricultural extension

and small scale industries, including food processing industries.

The following area related plans and major programme of horticultural development being implemented in the State are as under:

Area Expansion Programme: Under the area expansion programme, it is proposed to bring 20,000 ha area under fruit plantation additionally in the State during the 11th Five Year Plan by distribution of 20.00 lakhs fruit plants annually. Besides this, 10000 ha area of old and uneconomic orchard is also proposed to be planted during the 11th Five Year Plan. An area of 2000 ha is proposed to be replanted during the year 2007-08.

Improved Package of Practices: The programme is of great importance in the transfer of technology to the fruit growers in increasing the productivity and quality of fruit crops. The programme of work under this programme would be demonstration of the new technology or improved package of practices developed by the State Horticulture University or any other research institutions and industries on the field of farmers. The incentives to the fruit growers for implementing this scheme shall be given as per the approved procedure of the State Government. The objectives of the programme are given below:-

1. To effect improvement in the level of management in the existing plantations through the demonstration of new technologies, primarily with a view to maximize production per unit area.
2. To provide opportunities to the fruit growers specially small and marginal farmers and other weaker sections of farming community to acquire skills to augment their knowledge and understanding by learning through doing.
3. To provide forum for the farmers to exchange ideas and experience operating under various agro-climatic conditions.

4. To collect data on the impact of the package of practices and the new technologies demonstrated on the yield and quality of fruit crops.

Special Subsidy Scheme: The horticulture production units require huge investment for the installation at initial stages and further maintenance. It is therefore, proposed to provide assistance in the form of subsidy to the fruit growers to encourage them to take to horticulture and its ancillary activities for their self employment and to generate income.

Subsidy for the Development of Individual Orchards: Under this scheme, subsidy on various inputs for the establishment and maintenance of orchards like fruit plants, fencing, irrigation material, horticultural tools and implements, micro-nutrients etc. are available to an individual fruit grower belonging to small and marginal and other weaker section of farmers community at the following rates subject to the maximum of Rs. 3000 per farmer.

Subsidy for the Development of Garden Colonies: The garden colony is the concept of developing fruit plantation by more than six farmers in a compact area under a common fencing and common infrastructural facilities like farm machinery and irrigation facilities. Such a programme will help in the reduction of cost on the management of orchards. The total area of the garden colony should not be less than 5 acres. The following incentives are available to the small and marginal and weaker section of farmers' community for the establishment of garden colony.

Transportation Subsidy on Various Horticultural Inputs upto Village Extension: Under this scheme, it is proposed to provide 100% subsidy on transportation of horticultural inputs up to village extension circle level so as to ensure timely supply of horticulture inputs to the fruit growers on

reasonable rates for the scientific management of their orchards.

Development of Walnut/Hazelnut/Pecan/Pistachio Nut: Although, agro climatic conditions in mid and higher hill regions of the State are quite suitable for the cultivation of walnut (*Juglans regia*) yet its cultivation has not been commercially exploited yet. According to the horticultural census conducted by the State in 1989, there were about 1, 63,750 walnut trees (about 935 ha area) in the State. According to the latest estimates, an area of 4785 ha is existing under walnut plantations, which are generally in scattered form planted at higher lands.

Promotion programme for Integrated Pest Management: For the promotion of integrated pest management, units for disease and pest forecast are being established to forewarn about the outbreak of diseases and pests. The assistance being provided under this programme is: -

@ Rs.1,000 per ha per farmer for adoption of Bio-pesticides.

@ Rs. 80 lakhs (Public Sector) and @ 50% of the cost with a maximum limit of Rs. 40 lakhs (Private Sector) for setting up of Bio Control Laboratories.

@ Rs. 4 lakhs for establishing Disease Forecast Centre (Public Sector).

Programme for the Establishment of Plant Health Clinic: Plant health clinics are being established in private sector by encouraging Agriculture/ Horticulture Graduates to provide this service at the farmers' doorstep. Assistance with a maximum limit per unit @ Rs. 20 lakhs (Public Sector) and Rs. 5 lakhs (Private Sector) for setting up these clinics is available.

Programme for the Establishment of Tissue/Leaf Analysis Laboratory: For the determination of essential nutrients

availability to the plants and enabling recommendation of different fertilisers and trace elements for supplementing the deficiency of these nutrients, setting up of Tissue Analysis Laboratories is being encouraged. Assistance @ 100% with a ceiling of Rs. 20 lakhs (Public Sector) and @ 50% with a ceiling of Rs. 5 lakhs (Private Sector) is being made available under this Programme.

Development Programme of Beekeeping: Beekeeping has a predominant role to play in pollination, honey production and wax production. Pollination benefits can be evaluated at higher level as compared to the byproduct produced by the bees. To take honey production the bee colonies have to be migrated depending upon the availability of the flora. Bee breeding aspect has to be also taken care of for providing quality bees to the novice beekeepers. Assistance @ 50% of the cost or Rs. 250/- per colony and @ 50% of the cost of bee hives/equipment or Rs. 350/- per set, whichever is less is being made available under this Programme.

Entrepreneurial Development Programme of Women farmers: Women are inextricably involved in horticulture activities in Himachal Pradesh. There is a need that these women be organised by making self-help groups and providing them training in different horticultural activities. They should be empowered and be involved in decision making at the household level. The assistance being provided under this programme is as follows:

@ Rs. 10,000 per district for conducting base line survey.

@ Rs. 20,000 per district for the development of curriculum.

@ Rs. 10,000 per district for conducting refresher training of facilitators.

@ Rs. 1,000/- per woman farmer for training of 5-day duration.

@ Rs. 5,000/- for the formation of self help group.

Development Programme of Floriculture: The main object of this programme in the district is to earn more income in lesser time span by harnessing diverse agroclimatic potentials for the year round production of flower bulbs, seeds, live plants, dry flower etc. The department is providing a subsidy at 50% on the cost of planting material and other inputs subject to the maximum of Rs.20,000 bulbs crops, Rs.50,000 grafted/cutting crops, Rs.4,000 seeds crops of 0.2 ha respectively. Two flower nurseries are located at Bhatoon and Dharamshala which provide input to the growers.

Development Programme of Mushroom: The main objective under this programme is to enhance the production of Mushroom by exploitation of agro climatic potential for providing self employment. The Mushroom Development Programme is mainly directed towards improving economic conditions of the farmers. Project Co-ordinator Mushroom and two Horticulture Development Officers along with the technical staff are posted to popularise the cultivation of mushroom in the district.

Horticulture Programme: Back-ended capital investment subsidy @ not exceeding 20% of the total project cost with a maximum limit of Rs.25 lakhs per project shall be provided under the scheme to these projects, which are found technically and financially viable. However, for the North-Eastern/Tribal/Hilly areas, maximum limit of subsidy would be Rs.30.00 lakhs per project.

Cold Storage Programme: Under the revised cost norms, the assistance for construction/expansion/modernization of cold storages in Mini Mission III of Horticulture Technology Mission through NHB are as under:

Mini Mission-III

1.	Post Harvest Management	
i)	On farm collection and sorting unit) pack house)	Rs. 3 lakhs/unit with size of 9m x 6m
ii)	Pre-cooling unit	Rs. 15 lakhs for 6MT capacity
iii)	Mobile pre-cooling unit	Rs. 24 lakhs for 5MT capacity
iv)	Cold storage units (construction/ expansion. Modernization) with insulation, humidity control, fin foil cooling system with multi chamber	Rs. 6000/MT for 500 MT capacity
v)	Integrated CA chamber with facilities like pre cooling, cleaning, sorting & grading etc.	Rs. 70,000/MT for maximum upto 5000 MT capacity
vi)	C.A. storage units	Rs. 32,000/MT for 5000 MT capacity

Initially, the amount of subsidy would also be sanctioned as loan to the State Government for which a separate account would be maintained by the State Government. No interest on such loan would be charged by NCDC till the completion of the unit in the stipulated period of 18 months. On completion, this loan will be converted into subsidy.

Farmers Trainings and Education: The Department runs two training centres one at, Mashobra, District Shimla and other at Sundernagar, District Mandi. Besides this, farmers' training camps are organised at village, block and district level.

Horticulture Development Schemes under 11th Five Year Plan:

Development of Olive: The activities of the project are being carried out under the State plan funds. The olive development work in the State will be undertaken under this scheme during the 11th Five year Plan with the following objectives:

- Introduction of improved live varieties from abroad and multiplication of planting material of outstanding olive varieties in glass houses set up at Bajaura and Chamba for supply to the fruit growers.
- Planting of demonstration plots in the field of the farmers in various districts/locations to evaluate the performance of different olive varieties at different locations.
- To provide extensionservices too live growers so as toacquaintthem with the improved techniques of olive cultivation.
- To organize training to olive growers in various operations in olive production.
- Training of field staff in the propagation of olive planting material.
- To intensify the drive to popularise the olive cultivation in mid hill areas of the State.

Development of Mango/Litchi in Lower Hill Areas: Increase the mango and litchi production by bringing more and more area under these crops, in lower hill areas for economic upliftment of rural population; increasing the production of planting material of mango and litchi in departmental and private orchards and fruit nurseries; to demonstrate the technology in plantation and maintenance of litchi orchards; to demonstrate the technology "In Situ" plantation of mango and to create employment generation through large-scale plantation of these fruit crops in rural areas. Generally fruit plantations are raised by planting seedlings or grafted plants in the properly spaced pits. Under normal plantation programme, planting material is first pits.

Development of Strawberry and Other Small Fruits: So far not much attention has been paid towards the promotion of cultivation of small fruits like strawberry, raspberry, blueberry, currants etc. The small fruit has utilization in processing industries for the

manufacture of high quality fruit products as well as demand in fresh market. But these fruits are highly perishable, so the cultivation of these fruits will preferably been encouraged in the areas surrounding the processing industries in the State. The cultivation of these fruits should also be encouraged in the orchards as inter crops to supplement the income of fruit growers in case of failure of the main crops. It is proposed to establish 1-2 demonstration orchards-cum nurseries for the collection of improved germplasm of strawberry and other small fruits and propagation of planting material of these fruit crops for supply to the fruit growers.

Horticulture Information Services: Himachal Pradesh, where the farming population is inhabited in far flung and difficult areas and the marketing centres for the State horticultural products are also located all over the country. Taking these factors into consideration, the horticultural information and publicity services need to be properly strengthened, to be able to serve the ever increasing needs of the orchardists of the State through:

1. Publication of farm bulletins, pamphlets, posters, handouts, newsletters monthly magazines, farming guide and horticultural calendars.
2. Issue of press notes, farm features and special supplements on various aspects of horticultural development for publication in the newspapers and periodicals.
3. Publicity thorough radio and television by supplying scripts and recorded tapes of features, talks and timely limits to the orchardists.
4. Setting up of State and Regional Horticultural Museum.

5. Organisation of farmers fairs, horticultural shows, exhibition and horticultural production competitions.
6. Preparation of films and videotapes on horticultural subjects.
7. Publishing the horticultural products of the State through advertisements, hoardings, radio, television, slides and publicity brochures etc.
8. Establishment and maintenance of departmental libraries at directorate and district level.
9. Provision of modern equipments required for preparing publicity materials and other teaching aids etc.

This scheme has four Mini Missions:

Mini Mission I: Mini Mission-I aims to provide technological support by way of providing information on practices, nucleus planting material and skill upgradation for adoption of technology. This mini mission is the major link for inflow of improved technologies. Support under this mission is limited to identified gaps in technologies, which may hamper the progress of the mission. The DAC will allocate and release funds directly to the ICAR/MM I Nodal Officer.

Nodal Officer of the Mini Mission-I for Himachal Pradesh is the Director, Central Potato Research Institute, Shimla, who prepares an action plan for the year and submits to TM Cell for allocation of funds.

Mini Mission II: Assistance Provided Under Various Components of HMNEH, MM II

Sr. No.	Item	Maximum permissible cost	Pattern of Assistance
A. MINI MISSION- I			
1.	Seed and planting material/production and supply of parental lines, quality seeds, rootstock, mother stocks (scion blocks)	Rs.15 Lakhs/project	

Sr. No.	Item	Maximum permissible cost	Pattern of Assistance
2.	Technology standardization/refinement and dissemination	Rs. 20 Lakhs/project	Project based-100% for public sector
3.	Acquisition of technologies including import of planting material from other countries	Rs. 10 Lakhs/project	
4.	Imparting training through on farm trails/frontline demonstrations	Rs. 5 lakhs/project	
B. MINI MISSION- II			
1. Production of planting material			
i)	Model Nursery/Big Nursery (2-4 ha)	Rs. 6.25 lakhs/ha	100% of the cost for public sector and 50% for private sector having production capacity of 50,000 plants/ha/year. Assistance could be availed upto Rs. 25 Lakhs by public sector and Rs. 12.50 lakhs by private sector for an area of 4 ha.
ii)	Small nursery (1 ha)	Rs. 6.25 lakhs/ha	100% of the cost for public sector and 50% for private sector having production capacity of 50,000 plants/ha/year for 1 ha.
iii)	Setting up of TC units	Rs. 100 lakhs/unit	100% of the cost for public sector and 50% for private sector having production capacity of 15 lakhs plants of mandated crops for which protocols are available for commercial use.
iv)	Rehabilitation of existing Tissue Culture Units	Rs. 15 lakhs/unit as project based activity	100% of the cost for public sector and in case of private sector 50% of the cost.
v)	True Potato Seeds Centres	Rs. 25 lakhs/Centre	100% of the cost for public sector and 50% for private sector.
vi)	Progeny and herbal gardens	Rs. 5 Lakhs/unit	100% of the cost for public sector and in case of private sector @ 50% of the cost
vii) Seed production for vegetables and rhizomatic spices			
a.	Open pollinated crops	Rs. 30,000/ha	For public sector 100% for private sector, 75% of the cost, limited to 5 ha. Output target of seed for each crop will be fixed by the individual State for each beneficiary, before releasing funds.
b.	Hybrid seeds	Rs. 1,33,000/ha	For public sector 100% for private sector, 75% of the cost, limited to 5 ha. Output target of seed for each crop will be fixed by the individual State for each beneficiary, before releasing funds.
viii)	Import of planting material for trial and demonstration purpose by State Government, growers associations recognized by NHB/ MOA, PSU	Rs. 10 lakhs	100% of the cost for state Government/PSUs and 75% of the cost to recognized Growers Association.
ix)	Seed Infrastructure for handling, processing, packing, storage etc. of seeds of horticulture crops.	Rs. 200 lakhs	100% of the cost for public sector and 75% of the cost to private sector.
2. Area expansion under Horticulture Crops			
I Fruits (for a maximum area of 4 ha/beneficiary)			
i) Cost intensive Crops			
a)	Fruit crops like grapes, Strawberry, kiwi, Passion fruit etc.	Rs. 1,00,000/ha	75% of the cost i.e. Rs. 75,000/ha in 3 installments of 60:20:20 subject to

Sr. No.	Item	Maximum permissible cost	Pattern of Assistance
			survival rate of 75% in 2nd year and 90% in 3rd year.
b)	Fruit crops like TC banana & pine apple.	Rs. 1,00,000/ha	75% of the cost i.e. Rs. 75,000/ha in 2 installments of 75:25.
c)	Fruits crops like banana sucker & papaya	Rs. 70,000/ha	75% of the cost i.e. Rs. 52500/ha in 2 installments of 75:25.
ii)	High density planting (apple, pear, peach, mango, guava, litchi, ber etc.)	Rs. 80,000/ha	75% of the cost i.e. Rs.60000/ha in 3 installments of 60:20:20 subject to survival rate of 75% in 2nd year and 90% in 3rd year.
iii)	Fruit crops other than cost intensive crops using normal spacing	Rs. 40,000/ha	75% of the cost i.e. Rs.30000/ha in 3 installments of 60:20:20 subject to survival rate of 75% in 2nd year and 90% in 3rd year.
II Vegetable (for maximum area of 2 ha/ beneficiary)			
i)	Open pollinated	Rs. 30,000/ha	75% of the cost i.e. Rs. 32500/ha.
ii)	Hybrid	Rs. 45,000/ha	75% of the cost i.e. Rs. 33750/ha.
III Mushroom			
i)	Integrated mushroom unit consisting of composting, spawn production unit and training	Rs. 50 lakhs/unit	100% of the project cost for public sector 50% for private sector.
ii)	Spawn making unit	Rs. 15 lakhs/unit	100% of the cost to public sector 50% for private sector.
iii)	Compost making unit	Rs. 20 lakhs/unit	100% of the cost to public sector 50% for private sector.
IV Flowers (for a maximum area of 2 ha/beneficiary)			
i)	Cut flowers	Rs. 70,000/ha	75% of the cost i.e. Rs. 52500/ha. Provision of protected cultivation can also be availed in addition to the above.
ii)	Bulbous flowers	Rs. 90,000/ha	75% of the cost i.e. Rs. 67500/ha. Provision of protected cultivation can also be availed in addition to the above.
iii)	Loose flowers	Rs. 24,000/ha	75% of the cost i.e. Rs. 18000/ha.
iv)	Model Floriculture Centre	Rs. 100 lakhs/centre	100% of the cost i.e. Rs. 18000/ha.
V Spices (for a maximum area of 4 ha/ beneficiary)			
i)	Seed spices and Rhizomatic spices	Rs. 25,000/ha	75% of the cost i.e. Rs. 18750/ha.
ii)	Perennial spices (black pepper, cinnamon, clove and nutmeg)	Rs. 40,000/ha	75% of the cost i.e. Rs. 30000/ha.
iii)	Cost intensive spices viz. Saffron	Rs. 80,000/ha	75% of the cost i.e. Rs. 60000/ha.
VI Aromatic Plants (for a maximum area of 4 ha/ beneficiary)			
i)	Cost intensive aromatic plants (patchouli, geranium rosemary etc)	Rs. 75,000/ha	75% of the cost i.e. Rs. 56250/ha.
ii)	Other aromatic plants	Rs. 25,000/ha	75% of the cost i.e. Rs. 18750/ha.
3.	Rejuvenation/Replacement of senile plantations	Rs. 30000/ha	50% of the cost subject to a maximum of Rs. 15000/ha limited to 2 ha/ beneficiary.
4 Creation of water sources			
i)	Community tank/on farm pond/on farm water reservoirs with use of plastic /RCC lining	Rs. 17.25 lakhs/unit	100%of the cost for 10 ha of command area, with size of 100m x 100m x 3m or any other size depending upon pro rata basis, owned & managed by a community/farmer group. Cost for non-lined ponds/tanks only in black cotton soils will be 33% less. Assistance under the mission will be restricted to the cost of plastic/RCC lining. However, for non

Sr. No.	Item	Maximum permissible cost	Pattern of Assistance
			NREGA beneficiaries, assistance on entire cost including construction of pond as well as lining can be availed.
ii)	Water harvesting system for individuals – for storage of water in 20m x 20m x 3m pond/tube wells/dug wells	Rs. 1.38 lakhs/unit	75% of the cost i.e. Rs. 1.03 lakhs/beneficiary.
5	Protected Cultivation		
I	Green House Structure		
a)	Fan and pad system	Rs. 1465/sqm	50% of the cost limited to 1000 sqm/beneficiary
b)	Naturally ventilated system		
i)	Tubular Structure	Rs. 935/sqm	
ii)	Wooden Structure	Rs.515/sqm	
iii)	Bamboo Structure	Rs. 375/sqm	50% of the cost limited to 1000sqm/beneficiary.
II	Plastic Mulching	Rs. 20,000/ha	50% of the cost limited to 2 ha/beneficiary.
III	Shade Net House		
i)	Tubular Structure	Rs. 600/sqm	
ii)	Wooden Structure	Rs. 410/sqm	
iii)	Bamboo Structure	Rs. 300/sqm	50% of the cost limited to 1000sqm/beneficiary.
IV	Plastic Tunnels	Rs. 30/sqm	50% of the cost limited to 5000sqm/beneficiary.
V	Anti Bird/Anti Hail Nets	Rs. 20/sqm	50% of the cost limited to 5000sqm/beneficiary.
VI	Cost of planting material of high value vegetables grown in poly house	Rs. 105/sqm	50% of the cost limited to 500sqm/beneficiary.
VII	Cost of planting material of high value flowers for poly house	Rs. 500/sqm	50% of the cost limited to 500sqm/beneficiary.
6	Precision Farming Development and extension through precision farming development centres (PFDCs)	Project based	100% of the cost to PFDCs
7	Promotion of INM/IPM		
i)	Sanitary and phytosanitary infrastructure (public sector)	Rs. 500 lakhs/unit	100% of the cost
ii)	Promotion of INM/IPM	Rs. 2000/ha	50% of cost subject to a maximum of Rs. 1000/ha limited to 4 ha/beneficiary.
iii)	Disease forecasting unit (public sector)	Rs. 4 lakhs/unit	100% of the cost
iv)	Bio-control lab	Rs. 80 lakhs/ unit	100% of the cost to public sector and
v)	Plant health clinics	Rs. 20 lakhs/unit	50% of the cost to private sector.
vi)	Leaf/Tissue analysis labs	Rs. 20 lakhs/unit	
8	Organic Farming		
i)	Adoption of organic farming	Rs. 20,000/ha	50% of cost limited to Rs. 10000/ha for a maximum area of 4 ha/beneficiary, spread over a period of 3 years involving assistance of Rs. 4000/- in first year and Rs. 3000/- each in second & third year. The programme to be linked with certification.
ii)	Organic Certification	Project based	Rs. 5 lakhs for a cluster of 50 ha which will include Rs. 1.50 lakhs in first year, Rs. 1.50 lakhs in second and Rs. 2.00 lakhs in third year.

Sr. No.	Item	Maximum permissible cost	Pattern of Assistance
iii)	Vermi-Compost Unit	Rs. 60,000/unit for permanent structure and Rs. 10,000/unit for HDPE vermibed	50% of cost confirming to the size of the unit of 30' x 2.5' x 2.5' dimension of permanent structure to be administrated on pro-rata basis. For HDPE vermibed, 50% of cost confirming to the size of 96 cft (12' x 4'2") to be administrated on pro-rata basis.
9	Certification for GAP, including infrastructure	Rs. 10,000/ha	50% of the cost
10	Center of excellence for horticulture	Rs. 500 lakhs/center	100% of the cost
11	Pollination Support through Bee Keeping		
i)	Production of nucleus stock(public sector)	Rs. 10 lakhs	100% of the cost
ii)	Production of bee cobnies by bee breeder	Rs. 6 lakhs	50% of cost for producing minimum of 2000 colonies/year.
iii)	Honey bee colony	Rs. 1400/colony of 4 frame	50% of cost limited to 50 colonies/beneficiary.
iv)	Hives	Rs. 1600/hive	
v)	Equipment including honey extractor (4 frame), food grade container (30 kg), net etc.	Rs. 14,000/set	50% of the cost limited to one set/beneficiary.
12	Horticulture Mechanization		
i)	Power operated machines/tools including power Saw and plant protection equipments etc	Rs. 35,000/set	50% of cost limited to one set/beneficiary
ii)	Power machines (upto 20 BHP) with rotavator/equipment	Rs. 1.20 lakhs/set	
iii)	Power machines (20 HP& above) including accessories/ equipments	Rs. 3 lakhs/set	
iv)	Impart of new machines & tools for horticulture for demonstration purpose (public sector)	Rs. 50 lakhs/machine	100% of the total cost
13	Human Resource Development (HRD)		
i)	Training of Farmers including women		
a)	Within the district	Rs. 400/day/farmer excluding transport	
b)	Within the State	Rs. 750/day/farmer excluding transport	100% of the cost
c)	Outside the State	Rs. 1000/day/farmer excluding transport	
ii)	Exposure visit of farmers including women		
iii)	Training/Study tour of technical officers/field functionaries involved in implementation of the scheme at central/ State level including women		
a)	Within the State	Rs.200/day/participant plus TA/DA, as admissible	
b)	Study tour/training in progressive States/units (group of minimum 5 participants) including women	Rs.650/day/participant plus TA/DA, as admissible	100% of the cost
c)	Outside India	Rs. 5 lakhs/participant	100% of the cost on actual basis
iv)	Information dissemination through publicity, printed literature etc and local advertisements	Rs. 0.40 lakhs/block	100% of the total cost
v)	Development of technology packages in electronic form to be shared through IT network	Rs. 1.00 lakhs/district	
vi)	Technical collaboration with international agencies like FAO, World bank etc	Project based, on actual cost	100% assistance
14	Special Interventions		
I	Special in terventions: such as land development, transportation on case to case basis (from farm-gate to processing units/ market places and	Rs. 200 lakhs	Project based and restricted to 10% of quality fir the State proposal under the scheme

Sr. No.	Item	Maximum permissible cost	Pattern of Assistance
	transportation centres) projects of need based		
II	Tackling of emergent/unforeseen requirements of State Government/ implementing agencies	Rs. 10 lakhs	100% of the total cost
15	Mission Management		
i)	Project management including additional manpower & project preparation cost, institutional strengthening, hire/purchase of vehicle, hardware/software etc.	Project base	100% assistance
ii)	Technical support group (TSG) at head quarter at TM Cell and at SHM		100% of the total cost
iii)	Seminars, Conferences, exhibitions, kisan mela, horti-expo, honey festivals etc		
a)	State level Event	Maximum of Rs. 3 lakhs/event	100% of cost limited to Rs. 3.00 lakhs/event to public sector/State Governments/SAUs/ Research institutions/Recognized Growers Associations by MOA
b)	District Level Event	Maximum of Rs. 2 lakhs/event	100% of cost limited to Rs. 2.00 lakhs/event to public sector/State Governments/SAUs/Research institutions/Recognized Growers Associations by MOA
16	Support to Technology Mission Cell at DAC HQ		
i)	Technical Support Group i.e. Project based evaluation/monitoring/printing campaign/ data base generation/ services/infrastructure to TM cells/Other misc. activities etc.		100% of the cost, maximum limit of Rs. 500.00 lakhs
C.	Mini Mission-III		
1.	Post Harvest Management		
i)	On farm collection and sorting unit) pack house)	Rs. 3 lakhs/unit with size of 9m x 6m	50% of the capital cost
ii)	Pre-cooling unit		Rs. 15 lakhs for 6 MT capacity
iii)	Mobile pre-cooling unit		Rs. 24 lakhs for 5MT capacity
iv)	Cold storage units (construction/expansion. Modernization) with insulation, humidity control, fin foil cooling system with multi chamber	Rs. 6000/MT for 500 MT capacity	Credit linked back-ended subsidy @50% of the cost of projects
v)	Integrated CA chamber with facilities like pre cooling, cleaning, sorting & grading etc.	Rs. 70,000/MT for maximum upto 5000 MT capacity	
vi)	C.A. storage units	Rs. 32,000/MT for 5000 MT capacity	Credit linked back-ended subsidy @50% of the capital cost of projects
vii)	Reefer vans/containers	Rs. 24 lakhs for 6 MT capacity	
viii)	Primary /mobile/minimal processing unit	Rs. 24	Credit linked back-ended subsidy @50% of the cost

Sr. No.	Item	Maximum permissible cost	Pattern of Assistance
ix)	Ripening chamber	lakhs/unit Rs. 6000/MT for 5000 MT capacity	of projects
x)	Evaporative/low energy cool chamber (8 MT)	Rs. 4.00 lakhs/unit	
xi)	Preservation unit (low cost)	Rs. 2.00 lakhs/unit for new unit and Rs. 1.00 lakhs/unit for up gradation	50% of the cost of project
xii)	Low cost onion storage structure (25MT)	Rs. 1.00 lakhs/unit	
xiii)	Pusa Zero energy cool chamber (100 kg)	Rs. 4000/unit	
xiv)	Integrated project on production and post harvest management of horticultural crops	Rs. 50.00 lakhs	
2. Establishment of Marketing Infrastructure for Horticultural Produce in Government/Private/Co-operative sector			
i)	Terminal Markets	Rs. 150 Crores/project	25% to 40% (limited to Rs. 50.00 Crores) as Public Private Participation mode through competitive bidding, in accordance with operational guidelines issued separately
ii)	Wholesale Markets	Rs. 100 Crores	Credit linked back-ended subsidy @ 33.00% of the capital cost of the project
iii)	Rural Markets/Apni mandies/District market	Rs. 20.00 lakhs/unit	
iv)	Retail Markets/outlets (environmentally controlled)	Rs. 10.00 lakhs/unit	50% of the capital cost
v)	Static/mobile vending cart/platform with cool chamber	Rs. 30,000/Unit	50% of total cost
vi)	Functional Infrastructure		
a)	For collection, grading etc	Rs. 15 lakhs	50% of the total cost
b)	Quality control/analysis lab	Rs. 200 lakhs	100% of the total cost to public sector and 50% of the cost to private sector
vii)	Market extension, quality awareness & market led extension activities for fresh products	Rs. 3 lakhs/event	100% assistance to State Government/SHM/Public Sector Agencies

Mini Mission III: This mini mission aims to create infrastructural facilities for post harvest management, marketing and export. For this purpose, existing schemes of the NHB, DMI, NCDC, APEDA, NAFED etc., either with the existing outlays or with enhanced outlays are implemented. The existing approved

schemes of National Horticulture Board (NHB) with additional outlays as required will be implemented to give focus.

Source: <http://bpagrisnet.gov.in/> ; Department of Horticulture, Himachal Pradesh

Schemes of National Horticulture Board (NHB): Scheme-I Development of

Commercial Horticulture through Production and Post Harvest Management. Scheme-II Capital Investment Subsidy for Construction/ Expansion/ Modernization of Cold storages/ Storages of Horticulture Produce (1999-2002). Scheme-III Technology Development and Transfer. Scheme-IV Establishment of Nutritional Gardens in Rural Areas. Scheme-V Market Information Service for Horticulture Crops. Scheme-VI Horticulture Promotion Service. These are proposal based schemes the details of which must be obtained from National Horticulture Board and the proposals must be submitted on the prescribed format of the Board.

Mode of Release of funds: State Government to submit proposals relating to post harvest management and commercial horticulture as per the schemes of NHB to MD, NHB. Proposals will be approved by the Project Approval Committee Funds will be released by NHB directly.

DAC will release funds to NHB: Similarly proposals relating to NCDC, NAFED and APEDA shall be submitted directly to respective organisations who in turn will release the funds.

Source: <http://bpagrisnet.gov.in/> ; Department of Horticulture; Himachal Pradesh

Considering the gap, new components have been proposed in marketing.

A. POST HARVEST MANAGEMENT

1. Controlled Credit linked back ended

Name of Component	% of cost	Rate of assistance	Eligible agencies
1. Promotion of new units	50%	Rs. 4 Crores and promoter's share should not be less than 20%	PSUs, joint/assisted sector/NGOs/Co-operatives
2. Upgradation expansion of existing units	50%	50% of capital cost- Max. Rs. 1 Crore	-do-
3. Promotional activities for conducting studies, surveys and entrepreneurship development etc.		As per the need Project based to be approved by Committee	Government academic bodies, NGOs and associations.

subsidy @
33.33% of the project cost of
Atmospheric (CA) Storage Rs. 16.00 Crores/ unit.

2. Cold Storage Credit linked back-ended subsidy @
33.33% of the project cost of
Rs. 2.00 Crores /unit.

B. MARKETING*

Establishment of Marketing Infrastructure Credit linked back ended subsidy @
33.33% of the project cost of
Rs. 100.00 Crores.

* The proposals relating to development of Wholesale Markets, Rural Primary Markets, Apni Mandis and State Grading Laboratories are required to be submitted in prescribed Proforma to Directorate of Marketing intelligence, Department of Agriculture & Cooperation, GoI, New Delhi.

NCDC has got its own budget to assist co-operative societies for marketing of horticulture products. However, if additional funds are required, NCDC will submit a proposal to DAC.

Assistance under all schemes of APEDA particularly for freight subsidy and for packaging development can be availed as per the existing guidelines of APEDA schemes.

Mini Mission-IV: This Mini Mission will be implemented by Ministry of Food Processing Industries.

These programmes should be credit-linked through Banks/NABARD/IDBI/ State Financial Corporations/NERAMAC. In case of additional requirements by MFPI, funds will be provided by the Horticulture Technology Mission. The schemes of MFPI would be implemented as credit linked back ended subsidy through financial institutions/scheduled banks.

Mode of release of funds and submission of proposals: State Governments to submit proposals as per their needs on the above components to MFPI.

The proposal should have the approval of the State Level Steering Committee. The Horticulture/Nodal Officer should be in the know of the things.

After approval of the project by State level committee the Project Approval Committee of MFPI will further approve the projects and recommend release of funds to SFAC.

Organisation Structure and Implementation:- The scheme will be implemented through Small Farmer's Agri-business Consortium (SFAC) except programmes of ICAR, NHB, APEDA and NCDC.

Horticulture Development Scheme

Services: (a) Supply of Fruit Plants and elite plant material from registered Government and Private nurseries; (b) Supply of horticulture inputs; (c) Establishment of new orchard (Individually or as Garden colony).

Incentives and Subsidy: (a) Establishment of individual orchard: 50% to SC/ ST/IRDP, 25% to small farmers, 33.33% to & marginal farmers' maximum limit-Rs. 3000; (b) Establishment of garden colony: Combined Fencing, plant protection equipments, irrigation facility-75% to S/C, 50% to Small/ marginal and backward area farmer Land development, Plantation, other orchard

management operations: 50% to S/C and backward area farmer, 25% to small farmer, 33.3% to marginal farmer and nil to other farmers. Maximum limit- Rs.18000 (for 2 ha.), Rs. 36000 (for 4 ha.).

Plant Protection Services: (a) Supply of pesticides and plant protection equipments; (b) Release of bio agents in farmers.

Horticulture Farms & Nurseries Services: (a) Serve as Model demonstration centres for modern horticulture technology; (b) Production of elite plant material at Government registered nurseries.

Horticulture Training & Extension Service Services: (a) Training of Farmers through short term training camps and training courses; (b) Exposure visits of farmers within and outside the State and (c) Organisation of seminars and workshops.

Incentives and Subsidy: (a) 1 day village level trainings - Rs.45.75+5.00 per day per farmer; (b) 2 day block/dist. Level trainings- Rs.45.75+5.00 per day per farmer; (c) 10 day study tour within State - Rs.45.75+5.00 per day per farmer+Free travel and lodging; (d) 15 day study tour outside the State - Rs.45.75+5.00 per day per farmer + Free travel + lodging restricted to Rs. 50 per day.

Fruit Processing Programme Services: (a) Community Canning Service; (b) Processing of fruits and vegetables.

Incentives and Subsidy: (a) 2 days training in home scale preservation of fruits and vegetables; (b) Processing of fruit products under community canning service on nominal rates; (c) 2 day practical training in home scale preservation of fruits and vegetables - Rs.45.75+5.00 per day per farmer.

Marketing & Quality Programme Services: (a) Survey of markets under market intelligence scheme; (b) 2 days training in post harvest

management/ picking, grading and packing of fruits; (c) Procurement of fair average quality fruit (Apple, Citrus and Mango) under market intervention scheme.

Incentives and Subsidy: (a) Procurement of fair average quality fruit (apple, citrus and mango) under Market intervention scheme at minimum support price fixed by the Government from year to year; (b) 2 days training in post harvest management/picking, grading and packing of fruits-Rs.45.75+5.00 per day per farmer.

Source: <http://hpagrisnet.gov.in/> ; Department of Horticulture; Himachal Pradesh

A Note on the Scheme “Advisory Service on Fruit Plant Nutrition to Fruit Growers of Himachal Pradesh”: Department of Horticulture, Himachal Pradesh is implementing a scheme “Advisory Service on Fruit Plant Nutrition to Fruit Growers of Himachal Pradesh”, since 1974. The scheme is based on Tissue/Leaf Analysis Technique under which leaf/plant tissues samples from the orchards of the farmers are collected at specific time adopting set methodology. The samples are then processed and chemically analyzed to ascertain the status of various macro and micro nutrients in the orchard. The results are then compared with established standard values or sufficiency norms and thereafter balanced and judicious doses of various nutrients/ chemical fertilisers are worked out and recommended to the concerned farmer. The farmers are advised to adopt the fertiliser recommendations made on the basis of leaf/tissue analysis technique. Thus the farmers obtain higher yields of good quality fruits for longer period from their orchards at low cost of production.

The main thrust areas of this scheme are: (1) To assess the nutritional status of commercially important fruit crops through leaf analysis technique; (2) To formulate and stabilize fertilisers schedules of fruit crops; (3) To provide advisory services on fruit plant

nutrition to fruit growers of the State and (4) To establish new fruit plant nutrition laboratories equipped with latest and advanced equipments for leaf analysis, in different areas of the State.

At present three fruit plant nutrition laboratories are working in the State. These laboratories have been established in Shimla at Naubahar; Kangra at Dharamshala and Kullu at Bajaura.

In order to provide leaf analysis service to the farmers of tribal areas of the State the Department of Horticulture has established two leaf sample drying cum grinding units. These units are located at Reckong Peo in District Kinnaur and Bharmour in District Chamba. A fruit plant nutrition laboratory is well equipped to analyze leaf samples for nitrogen, phosphorus, potassium, calcium, magnesium, iron, manganese, copper and zinc. Drying cum Grinding Units have the facilities for receiving and processing of leaf samples for analysis. Analysis of the processed samples is carried out in the Fruit Plant Nutrition Laboratories.

Source: <http://hpagrisnet.gov.in/> ; Department of Horticulture; Himachal Pradesh

2.5 Agriculture

National Level Policies/ Regulations

National Agriculture Policy 2000: The first National Policy on Agriculture was brought out in 2000 which seeks to actualise the vast untapped growth potential of Indian agriculture, strengthen rural infrastructure to support faster agricultural development, promote value addition, accelerate the growth of agro business, create employment in rural areas secure a fair standard of living for the farmers and agricultural workers and their families, discourage migration to urban areas and face the challenges arising out of economic liberalisation and globalisation. Over the next

two decades, it aims to attain a growth rate in excess of 4% per annum in the agricultural sector; growth that is based on efficient use of resources and conserves soil, water and bio-diversity; growth with equity, i.e., growth which is widespread across regions and farmers; growth that is demand driven and caters to domestic markets and maximises benefits from exports of agricultural products in the face of the challenges arising from economic liberalisation and globalisation, and growth that is sustainable technologically, environmentally and economically.

National Policy for Farmers, 2007: There is a need to focus more on the economic well-being of the farmers, rather than just on production. Socio- economic well-being must be a prime consideration of agricultural policy, besides production and growth. The aim of the Policy is, therefore, to stimulate attitudes and actions which should result in assessing agricultural progress in terms of improvement in the income of farm families, not only to meet their consumption requirements but also to enhance their capacity to invest in farm related activities.

The major goals of the National Policy for Farmers are:

- (i) To improve economic viability of farming by substantially increasing the net income of farmers and to ensure that agricultural progress is measured by advances made in this income.
- (ii) To protect and improve land, water, bio-diversity and genetic resources essential for sustained increase in the productivity, profitability and stability of major farming systems by creating an economic stake in conservation.
- (iii) To develop support services including provision for seeds, irrigation, power, machinery and implements, fertilisers and credit at affordable prices in adequate quantity for farmers.
- (iv) To strengthen the bio-security of crops, farm animals, fish and forest trees for safeguarding the livelihood and income security of farmer families and the health and trade security of the nation.
- (v) To provide appropriate price and trade policy mechanisms to enhance farmers' income.
- (vi) To provide for suitable risk management measures for adequate and timely compensation to farmers
- (vii) To complete the unfinished agenda in land reforms and to initiate comprehensive asset and agrarian reforms.
- (viii) To mainstream the human and gender dimension in all farm policies and programmes.
- (ix) To pay explicit attention to sustainable rural livelihoods.
- (x) To foster community-centered food, water and energy security systems in rural India and to ensure nutrition security at the level of every child, woman and man.
- (xi) To introduce measures which can help attract and retain youths in farming and processing of farm products for higher value addition by making it intellectually stimulating and economically rewarding.
- (xii) To make India a global outsourcing hub in the production and supply of the inputs needed for sustainable agriculture, products and processes developed through biotechnology and Information and Communication Technology (ICT).
- (xiii) To restructure the agricultural curriculum and pedagogic methodologies for enabling every farm and home science graduate to become an entrepreneur and to make agricultural education gender sensitive.
- (xiv) To develop and introduce a social security system for farmers.
- (xv) To provide appropriate opportunities in adequate measure for non- farm employment for the farm households.

Agriculture Produce Marketing Committee (APMC) Act: The APMC Act in each State of India requires all agricultural products to be sold only in agricultural markets. Agriculture markets in most parts of the country are established and regulated under the State APMC Acts. The APMC have been made specifically responsible for ensuring complete transparency in pricing system and transactions taking place in market area; providing market-led extension services to farmers; ensuring payment for agricultural produce sold by farmers on the same day; promoting agricultural processing including activities for value addition in agricultural produce and publicizing data on arrivals and rates of agricultural produce brought into the market area for sale. Setup and promote public-private partnership in the management of agricultural markets. Besides, a new Chapter on 'Contract Farming' is added to provide for compulsory registration of all contract farming sponsors, recording of contract farming agreements, resolution of disputes, if any, arising out of such agreement, exemption from levy of market fee on produce covered by contract farming agreements and to provide for indemnity to producers' title/possession over his land from any claim arising out of the agreement.

The State Agricultural Produce Marketing (Development & Regulation) Act, 2003: It's an Act to provide for improved regulation in marketing of agricultural produce, development of efficient marketing system, promotion of agri-processing and agricultural export and the establishment and proper administration of markets for agricultural produce in the State and where it is expedient to put in place an effective infrastructure for marketing of agricultural produce and lay down procedures and systems.

The Act defines "Agricultural Produce" as all produce and commodities, whether processed or unprocessed, of agriculture, horticulture, apiculture, sericulture, livestock and products

of livestock, fleeces (raw wool) and skins of animals, forest produce etc. as are specified in the schedule or declared by the Government by notification from time to time and also includes a mixture of two or more than two such products. Subsequently, a draft model Rules namely the State Agricultural Produce Marketing (Development and Regulation) Rules, 2007 has been framed which States can adopt.

The Agricultural and Processed Food Products Export Development Authority Act, 1985: It's an Act to provide for the establishment of an Authority for the development and promotion of exports of certain agriculture and processed food products and for matters connected therewith.

Essential Commodities Act, 1955: The Act provides for regulation and control of production, distribution and pricing of commodities, which are declared as essential for maintaining or increasing supplies or for securing their equitable distribution and availability at fair prices. Using the powers under the Act, various Ministries/Departments of the Central Government have issued Control Orders for regulating production/distribution/quality aspects/movement etc. pertaining to the commodities which are essential and administered by them. Most of the powers under the Act have been delegated to the State Governments. Orders under this act provide: (a) for bringing under cultivation any waste or arable land, whether appurtenant to a building or not, for the growing thereon of food-crops generally or of specified food-crops, and for otherwise maintaining or increasing the cultivation of food-crops generally, or of specified food-crops; (b) for regulating by licences, permits or otherwise the storage, transport, distribution, disposal, acquisition use or consumption of any essential commodity.

The items declared as essential commodities under the Essential Commodities Act, 1955 are reviewed from time to time in the light of liberalised economic policies in consultation with the Ministries/ Departments administering the essential commodities and particularly with regard to their production, demand and supply. From 15th February 2002, the Government removed 11 classes of commodities in full and one in part from the list of essential commodities declared earlier. In order to accelerate economic growth and to benefit consumers, two more commodities have been deleted from the list from 31st March 2004. At present the list of essential commodities contains 15 items.

List of commodities declared essential under the Essential Commodities Act, 1955: Declared under Clause (a) of Section 2 of the Act: 1. Cattle fodder, including oil cakes and other concentrates; 2. Coal, including coke and other derivatives; 3. Component parts and accessories of automobiles; 4. Cotton and woolen textiles; 5. Drugs; 6. Foodstuff, including edible oilseeds and oils; 7. Iron and Steel, including manufactured products of Iron & Steel; 8. Paper, including newsprint, paperboard and strawboard; 9 Petroleum and Petroleum products; 10 Raw Cotton either ginned or unginned and cotton seed; 11. Raw Jute.; 12. Jute textiles; 13. Fertiliser, whether inorganic, organic or mixed; 14. Yarn made wholly from cotton; and 15. (i) seeds of food crops and seeds of fruits and vegetables, (ii) seeds of cattle fodder and (iii) jute seeds. Meat Food Products Order, 1973 under Essential Commodities Act, 1955 (10 of 1955): This Act regulates meat production. Item 2 of the Act defines animal “an animal belonging to any of the species specified Ovine’s (ii)Caprines; (iii)Suillines; (iv)Bovines; and includes poultry; “Carcass” means the dead body or any part thereof including the viscera of any animal which has been slaughtered; “Factory” means any premises including the precincts thereof, wherein meat food products are manufactured or packed

for sale; “Local authority” means a municipal council, committee, corporation, Panchayat, notified area committee or other authority entrusted with the regulation and licensing of slaughter houses in any local area; “Slaughter house” means the building, premises or place which is licenced as a slaughter house by the local authority for the slaughter of animals intended for human consumption. This act enables licensing of meat/meat item manufacturers into three categories A, B & C; Category ‘A’ manufacturer who makes meat food products exclusively from meat of animal(s) slaughtered and dressed in his factory; Category ‘B’ manufacturer who makes meat food products exclusively from meat of animal(s) slaughtered and dressed in a recognised slaughter house and whose factory is situated in close proximity to such slaughter houses; Category ‘C’ manufacturer who makes meat food products exclusively from poultry and/or pig meat at places where authorised slaughter houses do not exist and the total quantity manufactured is less than 30 tonnes per annum.

All the three categories are given licences based on certain criteria. Every licensee shall manufacture meat food products in conformity with the sanitary and other requirements specified in the second Schedule. Every licensee who slaughters animals for the purpose of manufacturing meat food products shall conform to the hygienic and other requirements specified in the third schedule. Every licensee shall, in regard to packing, marking and labeling containers of food products comply with the requirements specified in the fourth Schedule.

Agricultural Produce (Grading and Marking) Act, 1937 as amended up to 1986: It’s an Act to regulate grading and marking of agriculture and other produce. This Act came into force since 1975. Item 2 defines “agricultural produce” as all produce of agriculture or horticulture and all articles of food or drink wholly or partly manufactured from any such

produce, and fleeces and the skins of animals. This act provides guidance in grading and marking in the interest of public health & safety.

Its schedule lists 80 products namely 1. Fruit, 2. Vegetables, 3. Egg, 4. Dairy product, 5. Tobacco, 6. Coffee, 7. Hides and Skins, 8. Fruit products, 9. Atta, 10. Oilseeds, 11. Vegetable oils (including hydrogenated oils and vegetable fats), 12. Cotton, 13. Rice, 14. Lac, 15. Wheat, 16. Sunn Hemp, 17. Sugarcane, gur (Jaggery), 18. Myrobalans, 19. Bura, 20. Wool and Goat Hair, 21. Bristles, 22. Rosin and Turpentine, 23. Areca nuts, 24. Essential Oil, 25. Cashew nut, 26. Cardamom, 27. Pepper, 28. Ginger, 29. Honey, 30. Curry Powder, 31. Kapok, 32. Raw Jute, 33. Paddy, 34. Millet, 35. Mesta, 36. Chillies, 37. Turmeric, 38. Tapioca Chips and Tapioca Flour, 39. Sisal and Aloe Fibres, 40. Oil cakes, 41. Condiments and Spices (Other than pepper, ginger, cashew nut, cardamom, chillies and turmeric, to which the provisions of the Act have already been applied.), 42. Pulses, 43. Walnut, 44. Animal casings (cattle, buffaloes, sheep, goats and pigs), 45. Guar Gum, 46. Karaya Gum, 47. Senna Leaves and Pods, 48. Palmyra fibre, 49. Catechu, 50. Tendu Leaves, 51. Water Chestnut, 52. Mushrooms, 53. Poppy seed, 54. Cashew-Shell Oil (Liquid.), 55. Beeswax, 56. Gram (Cicer arietinum), 57. Jowar (Sorghum vulgare), 58. Maize (Zea mays), 59. Barley (Hordeum vulgare), 60. Ragi (Eleusine coracana), 61. Bajra (Pennisetum typhoides), 62. Sheekakai Powder, 63. Meat chicken and dressed chicken meat, 64. Saffron, 65. Soy bean, 66. Hay, 67. Buffalo hair, 68. Tamarind and tamarind products, 69. Compounded asafetida, 70. Besan (flour obtained from dehusked gram), 71. Papain, 72. Coconut (including copra), 73. Cattle Feeds, 74. Poultry Feeds, 75. Suji and Maida, 76. Agar Agar, 77. Tea, 78. Isubgol husk, 79. Carcass meat and products there of, and 80. Tapioca Sago. Subsequently, General Grading and Marking Rules, 1988 were framed. The Act

provides powers to inspect & seize agriculture produce and penalize under sections 93 and 102 of Criminal Penal Code.

Dangerous Machine Regulation Act, 2007: Under this Act, Central Government has specified that Power operated chaff cutter and power operated sugarcane crusher of Power operated chaff cutter used in agricultural and rural as dangerous machine as it may cause to its operator death, dismemberment of any limb or other bodily injury. This Act provides detailed specifications of the two machines to minimize operational hazards from them.

Destructive Insects and Pests Act, 1914 (2 of 1914): It's an Act to prevent the introduction into India and the transport from one province to another of any insect, fungus or other pest, which is or may be destructive to crops. In this Act, crops include all agricultural or horticultural crops and all trees, bushes or plants and "import" means the bringing or taking by sea, land or air across any customs frontier as defined by the Central Government. It empowers the Central Government to prohibit or regulate, subject to such restrictions and conditions as it may impose, the import into India or any part thereof, or any specified place therein, of any article or class of articles likely to cause infection to any crop or of insects generally or any class of insects. A notification under this section may specify any article or class of articles or any insect or class of insects either generally or in any particular manner, whether with reference to the country of origin or the route by which imported or otherwise. The Central Government may, by notification under this section, also levy and collect such fees at such rates and in such manner as may be specified therein for making an application for a permit to import, or for making inspection, fumigation, disinfection, disinfection or supervision of, any article or class of articles or any insect or class of insects under this section.

Dangerous Machines (Regulation) Rules, 2007; Plant Quarantine (Regulation of Import into India) Order, 2003: The order set regulations for prohibiting and regulating imports into India of agriculture articles. It has been amended two times in 2004, and subsequently amended in 2005, 2006 and 2007. Besides, a corrigendum namely Plant Quarantine (Regulation of Import into India) Order (Corrigendum), was issued in 2006.

Chapter II & II cover general & specific conditions for import & issuance of Phytosanitary Certificate. Chapter IV describes post entry quarantine conditions & measures, schedule IV describes list of 14 plant species and countries from where import is prohibited along with justifications. Schedule V describes list of 17 plant species/plant material restricted for imports and permissible only by authorized institutions. Schedule VI describes 525 plant species and category species of plant material allowed to be imported. Schedule VII describes list of 81 plants and plant materials, where import is permissible on the basis of phytosanitary certificate issued by exporting country, the inspection conducted by inspection authority and fumigation, 'if required'. Schedule VIII describes list of 61 quarantine weed species. This order also covers germplasm, transgenic or genetically modified organism. Further this covers noxious weeds, pests, plant product, timber & tissue culture plants.

Insecticide Act, 1968 (46 of 1968): It's an Act to regulate the import, manufacture, sale, transport, distribution and use of insecticides with a view to prevent risk to human beings or animals, environment and for matters connected therewith. Subsequently, Insecticides Rules were framed in 1971.

Notification dated 25th October, 2005 under the act mandates withdrawal of the use of Dichloro-Diphenyl-Trichloroethane (DDT)

and restricts the use of 10000 metric tonnes per annum for public health programme.

Under sub-section(2) of section 27 read with section 28 of the Insecticides Act, 1968, an order dated May 06th, 2005 was issued banning the use of Monocrotophos on vegetables. Similarly use of Linuron and Iprodione has been banned vide notification dated 31st December 2008.

In respect of those registrants who do not return the registration certificate, as per this Order within a period of six months with effect from the date of publication of this Order, their licence granted under section 13 of the said Act shall not be renewed or action under Section 14 of the Act should be taken. The State Governments shall have the power to take such steps under the relevant provisions of the said Act and the rules made there under as they may deem fit for the execution of these Orders in the State concerned. Under the Insecticide Act, 1968, cancellation of Certificate of registration Order 2010 has been issued for cancellation of registration to manufacturers of insecticides.

Cancellation of Certificate of Registration Order, 2010 issues under the Insecticides Act, 1968. Destructive Insects and Pests Act, 1914 (2 of 1914)

- Plant Quarantine (Regulation of Import into India) Order, 2003
- Plant Quarantine (Regulation of Import into India) (Amendment) Order, 2004
- Plant Quarantine (Regulation of Import into India) (second
- Amendment) Order, 2004
- Plant Quarantine (Regulation of Import into India) (third Amendment) Order, 2004

- Plant Quarantine (Regulation of Import into India)(first Amendment) Order, 2005
- Plant Quarantine (Regulation of Import into India) (second Amendment) Order, 2005
- Plant Quarantine (Regulation of Import into India)(Amendment) Order, 2006
- Plant Quarantine (Regulation of Import into India) Order (Corrigendum), 2006
- Plant Quarantine (Regulation of Import into India) (Amendment) Order, 2006
- Plant Quarantine (Regulation of Import into India) (First Amendment) Order , 2006
- Plant Quarantine (Regulation of Import into India) (First Amendment) Order , 2007
- Insecticides Act,1968
- Insecticides Rules
- Notification for Banning the Use of Monocrotophons on Vegetable (06.06.2005)
- Notification for Banning the Use of Monocrotophons on Vegetable (06.06.2005)

Fertiliser Control Order, 1985: This order vide No.11-3/83-STU, Government Of India, Ministry of Agriculture and Rural Development (Department of Agriculture and Cooperation) New Delhi, dated 25th September 1985 has been made under section 3 of the Essential Commodities Act. This order covers, price control, control on distribution of fertilisers by manufacturer/importer, authorisation or registration of dealers”, manufacture of mixtures of fertilisers, organic fertiliser and bio- fertiliser, restrictions on manufacture/import, sale, etc. of fertiliser. Schedule 1 of this order covers the quality of different type of fertilisers.

This order mandates registration of Industrial dealers and authorization of other dealers. It states that no person shall sell, offer for sale or carry on the business of selling of fertiliser

at any place as wholesale dealer or retail dealer except under and in accordance with clause 8:“Provided that a State Government may, if it considers it necessary or expedient, by notification in the Official Gazette, exempt from the provisions of this clause any person selling fertiliser to farmers in such areas and subject to such conditions as may be specified in that notification.” This order also puts restriction on preparation of mixtures of fertiliser and defines conditions for disposal of non-standard fertilisers. The order prescribes procedure for disposal of non- standard fertilisers. This order is enforced through inspectors appointed by State Governments who have power to enter, inspect and seize under the provisions of the code of criminal procedure, 1973 (2 of 1974),

- CDB Rules of 1981,
- DCB Regulation of 1982,
- National Cooperative Development Corporation (NCDC) Act, 1962 (26 of 1962), NCDC Rules, 1975,
- NCDC General Regulations, 1975
- NCDC Services Regulations,
- Multi State Cooperative Societies Act,
- Multi-State Cooperative Societies Act, 2002,
- Multi-State Cooperative Societies Rules 2002 and
- Model Bye-laws for Registration of Societies under MSCS Act, 2002

The Seeds Act, 1966: It's an Act to provide for regulating the quality of certain seeds for sale, and for matters connected therewith. Subsequently, the Seeds (Amendment) Act, 1972 (no. 55 OF1972) was made. It has specified power to notify kinds or varieties of seeds, power to specify minimum limits of germination and purity, etc., regulation of sale of seeds of notified kinds or varieties, restriction on export and import of seeds of notified kinds or varieties, recognition of seed certification agencies of foreign countries.

The Seeds Rules, 1968: The Seeds Rules framed in 1968, made provisions for Central Seed Committee, Central Seed Laboratory, Seed Certification Agency, marking or labeling, certification of seeds, seed analysts and seed inspectors. It also contains a form for seed production under the seed certification programme. Part IV, item k of the rules species that Seed Certification Agency will ensure that seed borne diseases are not present in the field to a great extent than those provided in the standards of certification. Further, Part V, item 8c specifies that marking and labeling should ensure that seed treated with chemical should not be used for food, seed or oil purpose. Subsequently the Seeds (Amendment) Rules have been amended in 1973, 1974, Corrigendum Seeds (Amendment) Rules, 1974 and The Seeds (Amendment) Rules, 1981.

The Seeds (Control) Order, 1983: Under Section 3 of the Essential, Commodities Act, 1955 (10 of 1955), the said order deals with; dealer in seeds to be licenced and enforcement authority. It also contains form of application to obtain dealer's licence, licence to carry on the business of a dealer in seeds, application for renewal of licence and a schedule for sealing, fastening, dispatch and analysis of samples.

National Oilseeds and Vegetable Oils Development Board Act, 1983 (29 of 1983): It is an act to provide for development under the control of the Union of the oilseeds industry and the vegetable oils industry and the matter connected therewith. Subsequently, the National Oilseeds and Vegetable Oils Development Board Rules, 1984 were framed under National Oilseeds and Vegetable Oils Development Board Act, 1983 (29 of 1983).

National Cooperative Development Corporation Act, 1962 (no. 26 of 1962): Its an Act to provide for the incorporation and regulation of a Corporation for the purpose

of planning and promoting programmes for the production, processing, marketing, storage, export and import of agricultural produce, foodstuff, industrial goods, livestock, certain other commodities and services on co-operative principles and for matters connected therewith or incidental thereto. In order to implement this Act, National Cooperative Development Corporation Rules, 1975 were formulated. Under National Cooperative Development Corporation (NCDC) Act, 1962 no. 26 of 1962 NCDC Rules, 1975 were framed.

The Multi-State Cooperative Societies Act MSCS, 2002: Its an Act to consolidate and amend the law relating to co-operative societies, with objects not confined to one State and serving the interests of members in more than one State, to facilitate the voluntary formation and democratic functioning of co-operatives as people's institutions based on self-help and mutual aid and to enable them to promote their economic and social betterment and to provide functional autonomy and for matters connected there with or incidental there to. In order to implement this Act, The Multi- State Co-operative Societies Rules, 2002 were formulated. The rules were released under section 124 of the Multi-State Cooperative Societies Act, 2002 (39 of 2002), the Central Government.

The Environment (Protection) Act, 1986: Most significant and diversified national level act to safeguard the natural environment. Para 2 of introduction of the Act states that it is an Act to provide for the protection and improvement of human environment and the prevention of hazards to human beings, other living creatures, plants and property. Item 2, chapter 1 of the Act states that 'environment' includes water, air, land and the inter-relationship which exists among and between water, air, land and human beings, other living creatures, plants, micro-organism and property. "Environmental Pollution" means

any solid, liquid or gaseous substance present in such concentrations as may be or tend to be injurious to environment. It is an umbrella act, which has several rules under it, to address different problems related to environment and pollution control.

Municipal Solid Wastes (Management and Handling) Rules, 2000: Section 3, defines disposal of municipal solid wastes in terms of the specified measures to prevent contamination of ground water, surface water and ambient air quality. "Transportation" means conveyance of municipal solid wastes from place to place hygienically through specially designed transport systems so as to prevent foul odour, littering, unsightly conditions and accessibility to vectors. These rules apply to every municipal authority responsible for collection, segregation, storage, transportation, processing and disposal of municipal solid wastes.

The Air (Preservation and Control of Pollution) Act 1981/1987: This Act provides for the prevention, control and abatement of air pollution. Chapter 1 defines "Air Pollution" as any solid, liquid or gaseous substance present in the atmosphere in such concentration as may be or tend to be injurious to human beings on living creatures or plants or property or environment.

The Water (Preservation and Control of Pollution) Act 1974/1988: This Act provides for the prevention and control of water pollution and for maintaining or restoring of wholesomeness of water. Section 2 of the Act defines pollution as contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to create a nuisance or render such water harmful or injurious to public health or safety or to domestic, commercial, industrial, agriculture or other legitimate uses, or to the

life and health of animals, plants or of aquatic organisms.

The National Water Policy, 2002: National level policy addresses the water issues including prioritisation, allocation, pricing and inter-state issues related to water sharing. Policy states about the use of water, water conservation and quantification of water pollution.

Section 1.2 states that rivers and under ground aquifers often cut across state boundaries. Water, as a resource is one and indivisible. Therefore, rainfall, river waters, surface ponds and lakes and ground water are all part of one system.

Section 7.3 states that integrated and co-ordinated development of surface water and ground water resources and their conjunctive use should be envisaged right from the project planning stage and should form an integral part of the project implementation.

Section 14.5 states that necessary legislation is to be made for preservation of existing water bodies by preventing encroachment and deterioration of water quality.

Section 25 states that for effective and economical management of water resources, the frontiers of knowledge need to be pushed forward in several directions by intensifying research efforts in various areas, including hydro-meteorology; snow and lake hydrology; surface and ground water hydrology; assessment of water resources; water quality; water conservation; evaporation and seepage losses; recycling and re-use; better water management practices and improvements in operational technology; soils and material research; economical designs for water resource projects, sedimentation of reservoirs, prevention of salinity ingress; prevention of water logging and soil salinity; reclamation of water logged

and saline lands; environmental impact and regional equity.

The National Environment Policy, 2006: The National Environment Policy, 2006 states that the degradation of land in India through soil erosion, alkali-salinization, water logging, pollution and reduction in organic matter content has several proximate and underlying causes. The proximate causes include loss of forest and tree cover (leading to erosion by surface water run-off and winds), unsustainable grazing, excessive use of irrigation (in many cases without proper drainage, leading to leaching of sodium and potassium salts), improper use of agricultural chemicals (leading to accumulation of toxic chemicals in the soil), diversion of animal wastes for domestic fuel (leading to reduction in soil nitrogen and organic matter), and disposal of industrial and domestic wastes on productive land. These proximate causes of land degradation in turn, are driven by implicit and explicit subsidies for water, power, fertiliser and pesticides.

The policy prescribes that it is essential that the relevant fiscal, tariffs and sectoral policies take explicit account of their unintentional impacts on land degradation, if the fundamental basis of livelihoods for the vast majority of our people is not to be irreparably damaged.

In addition, to such policy review, the following specific initiatives would be taken: a) Encourage adoption of science-based, and traditional sustainable land use practices, through research and development, extension of knowledge, pilot scale demonstrations, and large scale dissemination, including farmer's training, and where necessary, access to institutional finance; b) Promote reclamation of wasteland and degraded forestland, through formulation and adoption of multi stakeholder partnerships, involving the land owning agency, local communities, and investors; c) Prepare and implement thematic

action plans incorporating watershed management strategies, for arresting and reversing desertification, and expanding green cover; d) Promote sustainable alternatives to shifting cultivation where it is no longer ecologically viable, ensuring that the culture and social organisation of the local people are not disrupted and encourage agro-forestry, organic farming, environmentally sustainable cropping patterns and adoption of efficient irrigation techniques.

State Level Policies/Regulations

The Himachal Pradesh Agricultural & Horticultural Produce Marketing Development & Regulation Act, 2005: This Act provides regulation in marketing of agricultural produce, development of efficient marketing system, promotion of agro-processing & agricultural exports, establishment & proper administration of markets for agricultural produce in the State. The Act regulates trading & contract farming as under:

- The State Government on its own or on representation made by growers or on recommendation by board may by notification declare its intension of exercising control over purchase, storage, processing & sale of agricultural produce.
- The State Government may alter the limits of market area, a malgamate two or more market areas and constitute one committee, split market area and constitute 2 or more committee, de-establish a market.
- In every market area there may be market yard, sub market yard & a private yard managed by the committee.
- If any person wants to establish private yard and wants to purchase agricultural produce directly from agriculturalist, he shall make an application for obtaining the licence.

- Consumers or farmers market may be established by developing infrastructure by any person in any market area & producer may himself sell his agricultural produce directly to consumer.
- No person shall undertake contract farming unless registered under
- Section 40 of this act.
- No person may use any place in market area for marketing of notified agricultural produce.
- All notified agricultural produce shall be sold in market yards, sub market yards & private yards.

The Himachal Pradesh Agricultural Pests, Diseases & Noxious Weeds Act, 1969: The Act is for prevention of the introduction, spread or reappearance of pests, plant diseases & noxious weeds injurious to crops, plants or trees in the State. State Government may by notification (a) declare that any insect, vertebrate or invertebrate animal, disease or weed is injurious to plant in any local area as noxious weed, (b) specify the local area within which and the period during which such declaration shall remain in force, (c) prohibit/restrict movement or removal of any plant, earth, soil and manure from one place to another, (d) prescribe the period within which it shall not be lawful to plant with a specified crop the whole or any portion of notified area, (e) if any pest, plant diseases or noxious weeds appear in any village adjoining a notified area Patwari of such villages shall report the fact to such Officer as the State Government may appoint in this behalf and (f) whoever removes any plant, earth, soil, manure or other thing may be fined.

The Himachal Pradesh Agricultural Credit Operations & Miscellaneous Provisions (Banks) Act, 1972: This act makes provisions to facilitate adequate flow of credits for agricultural production & development through banks and other institutional credit

agencies and for matters connected with. State Government may vest agriculturalist not having alienable rights. It shall be lawful for an agriculturalist to create a charge on movable property owned by him. When an agriculturalist creates a charge on land or any other immovable property which he owns or in which he has interest in respect to any financial assistance he may make a declaration on lines of form set out in the schedule. Removal of disability in creation of charges & mortgages. No charge or mortgages created on any land shall have priority over a charge on such land created by an agriculturalist in favour of a bank as security. Whenever a charge or mortgage on land or interest therein is created in favour of bank by an agriculturalist, bank may give intimation to Tehsildar. An agriculturalist that has availed him of financial assistance by bank by creating charge or mortgage on land or interest shall not lease or create any tenancy right. Nothing can prevent the bank from causing any land to secure under financial assistance. State Government official may recover dues of bank through prescribed authority. Bank shall have power to acquire agricultural land or any other immovable property which had been charged or mortgaged.

The Himachal Pradesh Holdings (Consolidation & Prevention of Fragmentation) Act, 1971: This act provides consolidation of agricultural holdings and for preventing the fragmentation of agricultural holdings in the State and for assignment or reservation of land for common purposes of the village. State Government may specify any estate or its subdivision as notified area. State Government may provisionally settle for any class of land in any notified area. No person shall transfer or lease any fragment of the land. No land in any notified area shall be transferred or partitioned to create a fragment. The transfer or partition of any land contrary to provision of this act shall be void. If the owner of the fragment wants to

sell it, he should make an application to the Collector for determination of market price.

Other Sub-programmes/Strategies/ Projects

Quality Seed Multiplication and Distribution: Agriculture Department owns 25 Seed Multiplication Farms where Foundation Seeds of Kharif and Rabi crops are produced. Annually about 3500 to 4000 quintals seed of cereals, pulses and vegetables are produced. Further about 1,00,000 quintals of Certified Seeds of various crops are distributed to the farmers in the State.

Soil Testing: Department has 11 Soil Testing Labs besides 2 Mobile Soil Testing Labs to provide free soil testing facilities to the farmers. About 1,00,000 number of samples are analysed annually.

Crop Protection: The Department exercises vigil on pest situation. To overcome this, about 60 M.T of pesticides through 991 Sale Centres are being supplied to the farmers. For quality control, pesticide testing laboratory has been set up with an analysing capacity of 500 samples per year. One Bio Control Laboratory has been set up at Palampur where conservation pest situation augmentation, rearing and multiplication of bio-agents and training to extension staff and farmers is being done. The plant protection material including equipments are supplied to the SCs/ STs/IRDP families and farmers of the backward areas at 50% cost.

Seed Potato Development: The Department owns 14 Potato Development Stations where Foundation Seed Potato is produced. More area is being diversified towards cash crops and marketing of potato produce is being preferred. **Vegetables Development Project:** Annually more than 11.00 lakhs tonnes of fresh vegetables are produced. The Department owns three Vegetable Seed Farms where Quality Seed is produced.

Ginger Development: For production of disease free Ginger, the Department is providing Training, Demonstrations and Quality Seed. Annually about 35,000 tonnes of Green Ginger is produced which is marketed to the neighbouring States. The Department owns two Ginger Farms where quality seed is produced.

Agricultural Marketing: This is regulated in the State through new APMC Act, The H.P. Agricultural and Horticultural Produce Marketing (Development and Regulation) Act, 2005. At present, 10 Market Committees are functioning and 45 markets have been made functional. Market fee @ 1% is levied on buyers. Information on daily market rates is also disseminated through All India Radio/ Doordarshan/ Agrimarknet.

Farmers Trainings and Education: The Department runs two Training Centres, one at Mashobra, District Shimla and the other at Sundernagar, District Mandi. Besides this, farmers training camps are organized at village, block and district level.

Agricultural Economics and Statistics: Under this programme, three Centrally Sponsored Schemes viz. (i) Timely Reporting Schemes (TRS) for estimation of area and production of crops (ii) Improvement of Crop Statistics (ICS) for bringing quality in the land record data at grass root level and (iii) Estimation of Production of Commercial crops like Potato and Ginger. The estimation is done accordingly to statistical techniques. Production estimates on principal crops like wheat, barley of Rabi season and maize, paddy, potato and ginger crops of Kharif are released on the basis of results of crop cutting experiments conducted by the Random Sampling Method. The Director of Land Records is the agency in the State responsible for collection and release of area estimates, forecast report etc.

Tea Development: Total area under Tea is 2,312 ha. The Department is disseminating the latest production technology of tea cultivation to the tea growers.

Rashtriya Krishi Bima Yojna (RKBY): The State Government has adopted this Scheme from Rabi 1999-2000 season. Crops covered are wheat, barley, maize, paddy and potato. 50% subsidy in premium was allowed to small and marginal farmers on sunset basis. The scheme is compulsory for loanee farmers and optional for non-loanee farmers. The scheme provides comprehensive risk insurance against yield losses viz. drought, hailstorm, floods and pests disease etc. The Agriculture Insurance Company of India (AICI) is implementing the scheme. The farmers of the State can get benefit out of this programme. The State and Government of India share the losses equally. The subsidy on premium has been raised from 10% to 50% to small and marginal farmers. From Kharif, 2008 season, ginger crop of District Sirmour has also been taken up on pilot basis for coverage under the Crop Insurance Scheme. Besides this, tomato and potato in Solan and Kangra/ Una respectively have been covered under Weather Based Crop Insurance Scheme (WBCIS).

Rural Infrastructure Development Fund (RIDF): The Department of Agriculture is participating in RIDF for creation of irrigation potential through minor irrigation/WHS. The Department got funds under RIDF-V during 1999-2000 where NABARD sanctioned 157 FIS amounting to Rs.14.85 Crores which has created irrigation potential of 3,560 ha. These schemes are being executed through Water Users Associations who will also maintain them after their completion. Under RIDF-VI, 140 flow irrigation schemes were posed to NABARD which have been sanctioned for Rs.11.37 Crores covering an area of 3,031 ha. Under RIDF-VII, 126 schemes worth Rs.7.84 Crores have been sanctioned, which will

create CCA of 2,395 ha. Besides, 90 water harvesting projects have been sanctioned for Hamirpur, under RIDF-VII with cost of Rs.6.78 Crores. Under RIDF-IX, 200 minor irrigation schemes amounting to Rs.8.32 Crores have been executed creating CCA 7,161 ha. Under RIDF-XII, 150 minor irrigation schemes amounting to Rs.9.01 Crores have been executed creating CCA 1333.62 ha during 2006-2007. During the year 2007-2008, an amount of Rs.9.58 Crores has been incurred creating CCA 1821.71 ha. During 2008-2009, an amount of Rs.12.00 Crores has been incurred by creating CCA 1104.22 ha. During 2009-2010 an amount of Rs.7.50 Crores has been proposed for minor irrigation/ water harvesting projects.

Pandit Deen Dayal Kisan Bagwan Samridhi Yojna: The Department of Agriculture has launched Pt. Deen Dayal Kisan Bagwan Samiridhi Yojna with the assistance of NABARD under RIDF-XIV tranche. The project is being implemented in all districts of the State with an outlay of Rs.353.01 Crores. This project comprises two parts i.e. Production of cash crops through adoption of precision farming practices through poly house cultivation for Rs.154.92 Crores and Project on Diversification of Agriculture through micro-irrigation and other related infrastructure for Rs.198.08 Crores. The detailed guidelines are available in the web site. For poly house and micro- irrigation 80% subsidy is available, whereas, for creation of water source 50% subsidy is available. This project has been launched in January, 2009 and the project period is 4 years.

Scheme on Diversification of crops

Government of Himachal Pradesh has prepared a Rs. 372 Crores Scheme to promote diversification of crops, with special focus on organic farming and water harvesting so as to increase farm incomes. This has been taken up with the Government of India for funding this Scheme through

Japan International Cooperation Agency (JICA). This Scheme has been included by the Government of India in the Rolling Plan and the implementation is likely to begin in 2010-11.

2.6 Animal Husbandry & Livestock

The policies and laws applicable and/or related to animal husbandry and livestock sector of the State along with a brief description of their relevance are listed below. These policies, laws, sub-programmes & strategies provide operating framework for the sector to address issues, causes and impacts. Detailed explanations can be acquired from relevant departments and ministries like Ministry of Agriculture, Government of India; website (www.dahd.nic.in) including Department of Animal Husbandry; Dairying & Fisheries, Government of India; Ministry of Environment and Forest (MoEF) website (www.envfor.nic.in) and Department of Animal Husbandry, Himachal Pradesh website (<http://ahdhp.nic.in>).

National Level Policies/ Regulations

Grassland Eco-system and Grazing Policy Year: According to this policy with the evolution of biodiversity conservation theory, grazing and browsing of herbivores has been generally treated as an unsustainable practice for long-term conservation of wild flora. As a result, livestock grazing has been stopped in the protected areas, especially in the National Parks. However, after the ban on livestock grazing, there seems to be chaos on the continuation of this policy mainly due to (i) violation of rights of local pastoral communities and (ii) diverse sets of opinion on its impact on natural vegetation.

Feed, Fodder, Animal Nutrition and Grazing Policy Year: According to this policy, some of the measures which are

necessary and will be introduced are: cattle & poultry feed manufacturing should be freed from reservation for small-scale sector; the farmers to put at least 10% of the total cultivable land for fodder crop production while making their crop-plan; for this, area specific fodder varieties will be identified and developed as is being done by Uttaranchal Livestock Development Board.

Other measures: Development of waste lands/gairn land in to community pasture lands through systematic efforts of green cover augmentation under soil & water conservation schemes with involvement of village panchayats and NGOs; democratization of management of grazing areas on forest land through effective implementation of joint-forest management and giving priority to plant and grass species, which provide good quantity and quality of green fodder; in order to protect the fodder cover on grass-land on CPRs, stall-feeding shall be promoted by suitable extension tools, programme-based tools and regulatory interventions.

Promotion of fodder enrichment techniques (nutritive value addition with use of urea & molasses) shall be researched and introduced, which is suitable to address problem of fodder shortage in hilly, tribal and drought prone areas. Mineral deficiency pattern and its geo-climatic distribution be determined and updated from time to time so that suitable mineral supplementation (in feed) can be prescribed.

Establishment of fodder banks in the drought prone areas to tackle with fodder scarcity. Quality parameters for cattle & poultry feed, minerals & trace minerals (for supplementation in feed) should be upgraded. Stipulated quality parameters will be made mandatory for the manufacturers through enactment and enforcement of suitable legislation.

Grazing Policy Year: According to this policy, animals should not be allowed to graze in the heavy rainy season as during this time, the soil strata is very loose and thus heavy erosion will occur.

National Health Policy 2002: The main objective of this policy is to achieve an acceptable standard of good health amongst the general population of the country. It proposes an approach to increase access to decentralized public health system by establishing new infrastructure in deficient areas and by upgrading the infrastructure in the existing institutions. The policy states that over riding importance would be given to ensure a more equitable access to health services across the social and geographical expanse of the country. It is expected that this initiative will strengthen the capacity of the public health administration at the State level to render effective service delivery.

Policy highlights the need for developing the capacity within the State public health administration for scientific designing of public health projects, suited to the local situation. This policy recognizes the need for more frequent service training of public health medical personnel, at the level of medical officers as well as paramedics. Such training would help to update the personnel on recent advancements in science, and would also equip them for their new assignments, when they are moved from one discipline of public health administration to another.

This policy welcomes the participation of the private sector in all areas of health activities – primary, secondary or tertiary. The policy recognizes the significant contribution made by NGOs and other institutions of the civil society in making available health services to the community. It also emphasises the need to simplify procedures for government – civil society interfacing in order to enhance the involvement of civil society in public health programmes.

Prevention and Control of Infectious and Contagious Diseases In Animals Act, 2009, No. 27 of 2009: An Act to provide for the prevention, control and eradication of infectious and contagious diseases affecting animals, for prevention of outbreak or spreading of such diseases from one State to another and to meet the international obligations of India for facilitating import and export of animals and animal products and for associated matters connected with it. The schedule of this Act describes different types of disease under this head e.g. disease cattle, disease sheep & goat, equine diseases, swine diseases, avian diseases, lungworm diseases, bee diseases, fish diseases, mollusc diseases, crustacean diseases and other diseases.

The State Government may, with the object of preventing, controlling or eradicating any scheduled disease, by notification, declare an area to be a controlled area in respect of any scheduled disease affecting any species of animal and any other species that may be susceptible to the disease specified in the said notification.

Every owner or person or NGO, public bodies in charge of an animal, which he has reason to believe it infective of a scheduled disease, shall segregate such animal and have it kept in a place away from all other animals which are healthy and take all possible steps to prevent the infected animal from coming in contact with any other animal. Further, the owner shall report the fact in writing to village officer or village Panchayats in-charge, who may report in writing to nearest veterinarian.

Where in any State, there is any occurrence of scheduled disease in relation to any animal, the Director shall send intimation to the Directors of the States which are in the immediate neighbourhood of the place where there is such occurrence, for taking appropriate preventive measures against the spread of the disease.

Every Veterinarian shall, on receipt of a report under sub-section (I), or otherwise, if he has reason to believe that any animal is infected with a scheduled disease, report the matter to the Veterinary Officer.

Every owner, or any other person, non-governmental organisation, public bodies or the village Panchayat, in charge of any animal which he or it has reason to believe to be infective of a scheduled disease shall report the fact to the Village Officer Panchayat in-charge, who may report the same in writing to the nearest available Veterinarian.

Where any animal has been vaccinated for any scheduled disease in compliance with the provisions of sub-section (I), the person vaccinating the animal shall cause to put a mark by branding, tattooing or ear tagging, or in such other manner as the Director may, by general or special order, direct and the same shall, unless otherwise specified by the Director, shall not be removed.

Department of Animal Husbandry and Dairying Notification: (Published In Part II, Section 3, Sub Section (II) Of The Gazette Of India Extraordinary Dated 9.7.2001), Government of India, Ministry of Agriculture New Delhi, the 7th July, 2001 S.O. 655 (E) - In exercise of the powers conferred by Section 3A of the Livestock Importation Act, 1898 (9 of 1898), the Central Government hereby restricts, with effect from the date of publication of this notification in the Official Gazette, the import into India of all livestock products, including meat and meat products of all kinds including fresh, chilled and frozen meat, tissue or organs of poultry, pig, sheep, goat, egg and egg powder, milk and milk products, bovine, bovine and caprine embryos, ova or semen and pet food products of animal origin.

The import of these products shall be allowed only against a sanitary import permit to be

issued by this Department as per the procedure laid down in the Schedule annexed to this notification.

The Prevention of Cruelty to Animals Act, 1960: To prevent the infliction of unnecessary pain or suffering on animals and for that purpose to amend the law relating to the prevention of cruelty to animals. According to this Act, it shall be the duty of every person having the care or charge of any animal to take all reasonable measures to ensure the well-being of such animal and to prevent the infliction upon such animal of unnecessary pain or suffering. For the promotion of animal welfare, generally and for the purpose of protecting animals from being subjected to unnecessary pain or suffering, in particular, there shall be established by the Central Government, as soon as may be after the commencement of this Act, a Board to be called the Animal Board of India. The functions of the Board are: (a) to keep the law in force in India for the prevention of cruelty to animals under constant study and advise the Government on the amendments to be undertaken in any such law from time to time; (b) to advise the Central Government on the making of rules under this Act with a view to preventing unnecessary pain or suffering to animals generally, and more particularly when they are being transported from one place to another or when they are used as performing animals or when they are kept in captivity or confinement; (c) to advise the Government or any local authority or other person on improvements in the design of vehicles so as to lessen the burden on draught animals; (d) to take all such steps as the Board may think fit for amelioration of animals by encouraging or providing for, the construction of sheds, water-troughs and the like and by providing for veterinary assistance to animals; (e) to advise the Government or any local authority or other person in the design of slaughter-houses or the maintenance of slaughter-houses or in connection with slaughter of animals so that unnecessary pain or suffering,

whether physical or mental, is eliminated in the pre-slaughter stages as far as possible, and animals are killed, wherever necessary, in as humane a manner as possible; (f) to take all such steps as the Board may think fit to ensure that unwanted animals are destroyed by local authorities, whenever it is necessary to do so, either instantaneously or after being rendered insensible to pain or suffering; (g) to encourage by the grant of financial assistance or otherwise, 12 (the formation or establishment of pinjrapoles, rescue homes, animal shelters, sanctuaries and the like) where animals and birds may find a shelter when they have become old and useless or when they need protection; (h) to co-operate with, and co-ordinate the work of, associations or bodies established for the purpose of preventing unnecessary pain or suffering to animals or for the protection of animals and birds; (i) to give financial and other assistance to animal welfare organisations functioning in any local area or to encourage the formation of animal welfare organisations in any local area which shall work under the general supervision and guidance of the Board; (j) to advise the Government on matters relating to the medical care and attention, which may be provided in animal hospital, and to give financial and other assistance to animal hospitals whenever the Board thinks it necessary to do so; (k) to impart education in relation to the humane treatment of animals and to encourage the formation of public opinion against the infliction of unnecessary pain or suffering to animals and for the promotion of animal welfare by means of lectures, books, posters, cinematographic exhibitions and the like; (l) to advise the Government on any matter connected with animal welfare or the prevention of infliction of unnecessary pain or suffering on animals.

Livestock Importation Act, 1898: An Act to make better provision for the regulation of the importation of livestock. The Central Government regulates, prohibits or restricts

in such a manner and to such extent as it may fit into any specified place of any livestock which may be liable to be affected by infectious or contagious disorders and of any fodder, dung, stable-litter, clothing harness or fittings appertaining to livestock or that may be in contact therewith.

The State Government may make rules for detention, inspection, disinfection and destruction of imported livestock and of fodder, dung, stable litter, clothing, harness or fittings appertaining to imported livestock or that may have in contact therewith and for regulating the powers and duties of the officers whom it may appoint in this behalf.

Livestock Importation Act 2001: An Act further to amend the Livestock Importation Act 1898. Livestock products include meat and meat products of all kinds including fresh, chilled and frozen meat, tissue organs of poultry, pig, sheep, goat, egg, egg powder, milk and milk products, bovine, ovine and caprine, embryos, ova semen, pet food products of animal origin and other animal product which may be specified by the Central Government.

The Central Government may restrict or prohibit in such a manner and to such extent that it may think fit, the import into territories to which this Act extends of any livestock product, which may be liable to effect human and animal health.

Animal Birth Control (Dogs) Rules, 2001: According to this Rule, all dogs shall be classified in one of the following two categories (i) pet dogs, (ii) street dogs. The owner of pet dogs shall be responsible for the controlled breeding, immunisation, sterilisation and licensing in accordance with these rules and the law for the time being in force within a specified local area. The committee constituted shall be responsible for planning and management of dog control programme in accordance with these rules.

The committee may: (a) issue instructions for catching, transportation, sheltering, sterilisation, vaccination, treatment and release of sterilised, vaccinated or treated dogs; (b) authorize a veterinary doctor to decide on a case to case basis the need to put to sleep critically ill or fatally injured or rabid dogs in a painless method by using sodium pentathol. Any other method is strictly prohibited; (c) create public awareness, solicit co-operation and funding; (d) provide guidelines to pet dog owners and commercial breeders from time to time; (e) get a survey done of the number of street dogs by an independent agency; (f) take such steps for monitoring the dog bite cases to ascertain the reasons of dog bite, the area where it took place and whether it was from a stray or a pet dog; (g) keep a watch on the national and international development in the field of research pertaining to street dogs' control and management; development of vaccines and cost effective methods of sterilisation, vaccination, etc.

Animals (Registration) Rules, 2000: According to this Rule, the Animal Welfare Board is set up and reconstituted from time to time. A fitness certificate is granted by a veterinary doctor nominated by the prescribed authority certifying the health and fitness of the animal.

Form of certificate of registration

- (i) The certificate of registration shall be issued by the prescribed authority in the form set out in the Second Schedule.
- (ii) Every registration shall be given a serial number in an order in which it is made and it shall be indicated in the certificate of registration

Transport of Animals Rules, 1978: According to this Rule, the transport by rail of cows, bulls, bullocks, buffaloes, yaks and calves, (here in after these rules referred to as cattle), there must be: A valid certificate by a qualified veterinary surgeon to the effect that the cattle are in a fit condition to travel by rail

or road and are not suffering from any infectious or contagious or parasitic disease and that they have been vaccinated against strindrpestand any other infectious or contagious or parasitic disease, shall accompany each consignment.

In the absence of such certificate, the carrier shall refuse to accept the consignment for transport. The certificate shall be in the form specified in Schedule - E. Veterinary first-aid equipment shall accompany all batches of cattle. Suitable rope and platforms should be used for loading cattle from vehicles. In case of railway wagon, the dropped door of the wagon may be used as a ramp when loading or unloading is done to the platform. Cattle shall be loaded after they are properly fed and given water. Cattle in advanced stage of pregnancy shall not be mixed with young cattle in order to avoid stampede during transportation.

Watering arrangements enroute shall be made and sufficient quantities of water shall be carried for emergency. Sufficient feed and fodder with adequate reserve shall be carried to last during the journey. Adequate ventilation shall be ensured.

Performing Animals Rules, 1973: According to this Rule "performing animal" means any animal which is used at, or for the purpose of any entertainment to which the public are admitted through sale of tickets. The prescribed authority means the State Government or such other authority as the State Government may, by general or special order, specify in this behalf. Every application for registration shall be accompanied by a fee of rupees twenty five which may be paid either in cash or in such other manner as may be specified by the prescribed authority.

The Wildlife (Protection) Act, 1972: An Act to provide for the protection of wild animals, birds and plants and for matters connected therewith or ancillary or incidental thereto

with a view to ensuring the ecological and environmental security of the country. According to this Act, it shall be the duty of the State Board for Wildlife to advise the State Government in the selection and management of areas to be declared as protected areas; in formulation of the policy for protection and conservation of the wildlife and specified plants; in relation to the measures to be taken for harmonising the needs of the tribals and other dwellers of the forest with the protection and conservation of wild life and in any other matter connected with the protection of wildlife which may be referred to it by the State Government.

The Environment (Protection) Act, 1986: Most significant and diversified national level act to safeguard the natural environment. Para 2 of introduction of the act states that it is an act to provide for the protection and improvement of human environment and the prevention of hazards to human beings, other living creatures, plants and property. Item 2, chapter 1 of the Act states that 'environment' includes water, air, land and the inter-relationship which exists among them and between water, air, land and human beings, other living creatures, plants, micro-organism and property. "Environmental Pollution" means any solid, liquid or gaseous substance present in such concentrations as may be or tend to be injurious to environment. It is an umbrella act, which has several rules under it, to address different problems related to environment and pollution control.

The Air (Prevention and Control of Pollution) Act 1981/1987: This act provides for the prevention, control and abatement of air pollution. Chapter 1 defines "Air Pollution" as any solid, liquid or gaseous substance present in the atmosphere in such concentration as may be or tend to be injurious to human beings or living creatures or plants or property or environment.

The Water (Prevention and Control of Pollution) Act 1974/1988: This act provides for the prevention and control of water pollution and for maintaining or restoring of wholesomeness of water. Section 2 of the Act defines pollution as contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to create a nuisance or render such water harmful or injurious to public health or safety or to domestic, commercial, industrial, agriculture or other legitimate uses, or to the life and health of animals, plants or of aquatic organisms.

Forest (Conservation) Act, 1980: An Act to provide for the conservation of forests and for matters connected therewith or ancillary or incidental thereto. Restriction on the de-reservation of forests or use of forest land for non-forest purpose. The Central Government may constitute a Committee consisting of such number of persons as it may deem fit to advise the Government with regard to the grant of approval and any other matter connected with the conservation of forests which may be referred to by the Central Government. Whoever contravenes or abets the contravention of any of the provisions, shall be punishable with simple imprisonment for a period which may extend to fifteen days.

Pet Food Order, 2008: Any pet food product of animal origin shall be permitted by the Central Government to be imported into India subject to the following conditions:

The sanitary import permit shall be issued for import of pet food product of animal origin, if after a detailed import risk analysis, the concerned authorities are satisfied that the import of consignment shall not adversely effect the health of animal or human being or both in India. The import of products shall be allowed against a sanitary import permit to be

issued by Department of Animal Husbandry, Dairying and Fisheries subject to the animal health condition.

The issue of permit may be refused or withheld by the issuing authority after giving a reasonable notice to the applicant. The import of pet food products of animal origin shall be prohibited from the country.

Milk and Milk Product Order, 1992: The Central Government is of the opinion that for maintaining and increasing the supply of liquid milk of the desired quality in interest of the general public, it is necessary to provide for regulating the production, supply and distribution of milk and milk product by: a) facilitation of the supply of availability of liquid milk by balancing uneven supplies in different regions and seasons; (b) maintenance or increase in the supply of milk and equitable distribution and availability thereof; c) establishment of proper standards and norms for control and handling of milk and milk products; d) maintenance of high standards of sanitary and hygienic conditions in the manufacture of milk and milk product; e) establishment, promotion or registration of any industry, which is relatable to milk product and f) such other purposes as are necessary or incidental to the effective implementation of the Order.

Veterinary Council of India (Minimum Standards of Veterinary Education)- Degree Course (B.V.Sc. & A.H.) Regulations, 1993: This has been published in Extraordinary Gazette of India Part II –Section 3–Sub-section (i), Veterinary Council of India Notification New Delhi, the 7th February, 1993 GSR 69 (E) –In exercise of the powers conferred by sub- section (I) of section 22 read with clause (b) of sub-section (i) of Section 21 of the Indian Veterinary Council Act, 1984, (52 of 1984) the Veterinary Council of India, with the previous approval of the Central Government hereby makes the following regulations.

These courses shall come into force on the date of their publication in the Official Gazette. A degree course of B.V.Sc. & A.H. shall comprise of a course of study consisting of curriculum and syllabus provided in these regulations spread over five complete academic years including a compulsory internship of six months duration undertaken after successful completion of all credit hours provided in the syllabus. During the course of study, there shall be training in a teaching Veterinary hospital, livestock (including avian) farms and field training in Veterinary Institution as part of the course.

Procedure to be adopted for imparting training in the veterinary hospital/ institutions and internship with suitable adjustment/requirements are:

- a. No veterinary teaching hospital shall be recognised unless they have an average minimum of 35 outdoor cases daily and 10 indoor cases (for a college having upto 60 annual admission).
- b. All the concerned staff of the clinical department shall be responsible for the treatments and allied public services and would invariably attend the clinics every forenoon.
 - (i) Admission to the veterinary course: No candidate shall be admitted to the veterinary course unless.
 - a. He/She has completed the age of 17 years on or before 31st December of the year of his/her admission to the 1st B.V.Sc. & A.H. course.
 - b. He/She has passed the higher secondary examination or the Indian School Certificate Examination equivalent to 10 + 2.

The subjects for study and examination for B.V.Sc. & A.H. shall be as under:

- Veterinary Anatomy and Histology.
- Veterinary Physiology.
- Veterinary Biochemistry.
- Veterinary Pharmacology and Toxicology.
- Veterinary Parasitology.
- Veterinary Microbiology.
- Veterinary Pathology.
- Veterinary Public Health.
- Animal Nutrition.
- Animal Breeding and Genetics including Biostatistics.
- Livestock Production & Management.
- Livestock Product Technology.
- Animal Reproduction, Gynaecology and Obstetrics.
- Veterinary Surgery and Radiology.
- Clinical Veterinary Medicine including Ethics and Jurisprudence.
- Veterinary Epidemiology and Preventive Medicine.
- Veterinary and Animal Husbandry Extension.

The details of syllabus, comprising 187 credits is the minimum requirement for a programme leading to B.V.Sc. & A.H. degree Guidelines for Implementation of Livestock Insurance Scheme: For promotion of the livestock sector, it is important that along with providing more effective measures for disease control and improvement of genetic quality of animals, a mechanism of assured protection to the farmers and cattle rearers is required against eventual losses of such animals. In this direction, the Government of India introduced a Centrally Sponsored Scheme (CSS) on Livestock Insurance on a pilot basis during 2005-06 & 2006-07 in 100 selected districts of the country. For the year 2007-08, the scheme continued in the same format in the same 100 districts. A full fledged scheme on Livestock Insurance, which was approved on 20.11.2008, is being implemented in 100 newly selected districts on a regular

basis. The Government has now extended the scheme to 300 selected districts. The indigenous/crossbred milch cattle and buffaloes will be under the purview of the scheme. Milch cattle/buffalo will include both in-milk and dry as well as pregnant animal, which have already calved once. Benefit of subsidy is to be restricted to two animals per beneficiary per household.

Guidelines concerning the XI Plan Centrally Sponsored Scheme 'Conservation of Threatened Breeds of Livestock: This is a scheme for conservation of threatened breeds of livestock and poultry. Since there is a major ongoing scheme, "National Project for Cattle and Buffalo Breeding (NPCBB)," which covers conservation of indigenous breeds of cattle and buffalo, these bovine species are not intended to be covered under the present scheme. Breeds with population below 10,000 will be covered under the scheme. Indigenous poultry and duck breeds, current population of which is below 1000 will also be covered under the Scheme. Till the time, reliable breed census data is available, national indications from breed surveys and research publications will be considered to decide on threatened status of the breed. It is proposed under the scheme to undertake activities which are germane to conservation of the threatened breeds. Hence, any activity, rather than a prescribed exhaustive list of activities, aimed at bringing the breeds out of threatened status or preventing these from being extinct, including capacity building, will be eligible for assistance under the scheme. Flexibility is also provided towards choice of egg/birds/ fowl /duck conservation projects; ceiling of expenditure on conservation project for different species and duration of projects according to species etc.

A flexible participatory approach will be adopted towards implementing the scheme while attempting to restructure the current stakeholder matrix for conservation of threatened breeds. This will ensure continued

and systematic interventions by local stakeholders towards conservation of the threatened breeds even after lapse of the project period. Such an approach will enable preparation of an exit plan after a reasonable period so far as Government interventions are concerned. Projects sanctioned under the scheme are expected to contribute to the following:

Creation of a stable institutional structure towards conservation of livestock breeds; a watch list of threatened breeds will be available to guide future actions; at least some, if not the majority, of the breeds will be brought out of threatened status; improvement in availability of breeding inputs to breeders of the threatened breeds; availability of at least a nucleus population of threatened breeds to cater to future needs of regeneration of the threatened breeds and development of a skill-pool of Government officials, academicians, scientists as well as non-government officials to further the conservation agenda on a sustainable basis.

State Level Policies/ Regulations

Himachal Pradesh Livestock Improvement Act, 1968: An Act to provide for the improvement of the livestock in Himachal Pradesh. The Government may, by notification, declare any part of Himachal Pradesh to be a specified area for the purposes of this Act, except as provided by or under this Act, no person shall keep a bull which has not been marked in accordance with the provisions of this Act.

Himachal Pradesh Livestock and Bird disease Act, 1968: According to this rule, Himachal Pradesh Government appoints veterinary assistants surgeons to make the livestock and birds disease free and empower them to exercise the powers and perform the duties of veterinary surgeons within their respective Jurisdiction.

Control of the markets, fairs, etc., is provisioned under section 10 of the Act. The following rules shall be deemed to govern the prohibition or regulation of the holding of livestock or bird markets, fairs, exhibition or other concentrations of livestock or birds for the purpose of preventing the outbreak or spread of any scheduled disease, when Government shall have issued a notification under section 10 of the Act:-

In any specified area, where livestock or bird's market, fair, exhibition or such similar gathering or concentration of livestock or birds is to be held:

All livestock or birds brought into or taken out shall use the proper entrance and exit gates to places/areas of such livestock or bird gatherings; inspection posts shall be organised at each entrance and exit under the supervision of Inspector; Inspector shall examine all livestock or birds entering into and going out of the above places of livestock or bird gatherings. If the Inspector on examination finds or suspects any livestock or bird to be suffering from any of the scheduled disease, he shall seize that livestock or birds forthwith and cause it to be removed to segregation camp.

If the Inspector deems it fit, he may also require all the in-contact livestock or birds to be removed to the segregation camp. In the segregation camp, the livestock or birds sent as heretofore provided, it will be dealt with accordance to the rules of the Act on scheduled diseases.

Should livestock or bird certified by the Veterinary Surgeon be infective whether in the isolation pound or not, it shall be the duty of the keepers of the pound to have the carcass of the said livestock or bird, without opening it, either burnt or buried six feet below the surface of the ground away from water course with a layer of unslaked lime not

less than one foot deep both beneath it and above it and afterwards water thrown over it, at Government expenses.

Veterinary Surgeon has confirmed the orders under section 21 of the Act that a certain private place area is an infected place, or where the Government declares any specified area to be an infected area, the following regulations shall apply for the isolation, detention and treatment of livestock or birds and their disposal in relation to an infected place or an infected area.

The Himachal Pradesh Livestock Improvement Rules, 1969: According to this Rule, intimation with regard to the possession of any bull is required to be given to the Livestock Officer within 15 days from the date of the issue of the notification or from the date of coming into possession of the bull, as the case may be.

Officer is of the view that the bull is capable of being used for breeding purposes, he shall certify the bull as approved and cause it to be branded with a mark given below:-

“HP” (On left Thigh)

Where on inspection, the Livestock Officer is satisfied that the bull is effectively castrated, he shall cause it to be branded with the mark as given below:-

“R” (On Right Thigh)

Where on inspection as aforementioned, the Livestock Officer is satisfied that the bull is not fit for being certified as an approved bull, and is also not effectively castrated, he shall order the person keeping the bull to have it castrated within a period of 15 days from the date of the service of the order.

Every bull directed to be castrated under section 6 of the Act shall be effectively desexed from the nearest Veterinary Hospital

free of any charge. If the Livestock Officer is not satisfied with the castration of the bull, he may order the castration to be performed again in a manner approved by the Director of Animal Husbandry, Himachal Pradesh. The bulls should be castrated before attaining the age of 1 ½ years.

Transport of Animals Rules, 1978: There are different rules for the transportation of dogs, monkeys, cows, sheeps, goats, equines. Some common points according to this Rule are:

A valid certificate by a qualified veterinary surgeon to the effect that the animals are in a fit condition to travel by rail or road and are not suffering from any infectious or contagious or parasitic diseases and that they have been vaccinated against rinderpest and any other infectious or contagious or parasitic diseases, shall accompany each consignment.

In the absence of such a certificate, the carrier shall refuse to accept the consignment for transport. The certificate shall be in the form specified in schedule. Cattle shall be loaded after they are properly fed and given water. Cattle in advanced stage of pregnancy shall not be mixed with young cattle in order to avoid stampede during transportation.

Performing Animals Rules, 1973: “Performing Animal” means any animal which is used at, or for the purpose of any entertainment to which the public are admitted through sale of tickets. The rules for performing animals are:

Every application by a person desirous of exhibiting or training any performing animal for registration under the Act shall be in the form and shall contain the particulars set out.

Every application for registration shall be accompanied by a fee of rupees twenty-five which may be paid either in cash or in such other manner as may be specified by the prescribed authority. The certificate of

registration to be issued by the prescribed authority shall be in the form set out in the Schedule.

State level Policies: Panchayati Raj Institutions (PRI) were established as statutory in Himachal Pradesh in the year 1954. All animal husbandry and livestock resources are supposed to be reported to the village level functionaries. Thus, PRI has made the following legislative rules for Animal Husbandry Department. These rules include:

Grazing of livestock should be kept minimum in the areas containing loose sands, heavy plantation etc. Movement of livestock should be completely banned from the infected area (i.e. diseased area) so as to prevent the spread of diseases and thus to maintain the health of animals.

The sale of all poultry products and egg markets/shops within the radius of 10 kms from the infected site should be immediately stopped as soon as the disease symptoms are suspected.

Breeding Policy of the State for Cattle: According to breeding policy of the State, inheritance of exotic blood i.e. Jersey/Holstein is to be kept at 50% and remaining 50% inheritance will be contributed by Pahari/ Hilly cattle. This policy will ensure the benefit of higher milk production potential of exotic breeds and as well as disease resistance and hardiness traits of Hilly and Pahari Cattle to farmers of the State.

Breeding Policy of the State for Buffalo: According to breeding policy of the State for buffalo, genetic makeup of the nondescript buffaloes of the State is to be improved by grading up process using Murrah Breed of buffalo.

Breeding Policy of the State for Sheep: Indigenous Gaddi or Rampur Bushahari ewes are to be crossed with pure bred exotic rams

of Rambouillet or Russian Merino breed so that in F-1 Generation Exotic and indigenous inheritance comes at 50:50 level. In F-2 generation, the progeny of F-1 generation (50% crossed bred ewe) is to be again crossed with purebred exotic ram of Rambouillet or Russian Merino breed so that the progeny thus produced has exotic and indigenous inheritance at 75:25 level. There after, in subsequent generation, Rams with 75% exotic inheritance are to be used for cross breeding to maintain exotic and indigenous inheritance at 75:25 levels.

Centrally Sponsored Schemes in Livestock & Animal Husbandry Sector in Himachal Pradesh: To provide 100% coverage of artificial insemination to breedable cattle & buffaloes of the State and to provide doorstep delivery of artificial insemination services at farmer's premises :-

National Project on Cattle and Buffalo Development: National Project on cattle and buffaloes' development has been sanctioned by the Government of India on 100% central assistance for 3 years. In the first phase (2002-03 to 2006-07) of this project, an amount of Rs. 12.75 Crores was sanctioned, out of which an amount of Rs. 12.68 lakhs was released which stands fully utilised. Under the 2nd Phase of this project (200-08 to 2011-2012), an amount of Rs. 14, 15, 64000/- has been sanctioned, out of which an amount of Rs. 8, 34, 13000/- stands released and utilised till date. The project aims at strengthening of the following activities of Animal Husbandry Department:

1. Strengthening of liquid nitrogen storage, transport and distribution.
2. Strengthening of sperm stations, semen banks and artificial insemination centres.
3. Acquisition of high pedigree bulls for sperm stations and for natural service in remote areas.
4. Strengthening of training facilities.
5. Computerisation.

Assistance to State for Control of Animal Diseases (ASCAD): Due to large scale inter-state migration from adjoining States and inadequacy of nutrition grasses and fodder due to hilly topography, most of the animals are prone to various livestock diseases. Central Government has provided assistance to State Government for control of contagious diseases under ASCAD which is on the pattern of 75% Central share and 25% State's share.

Haemorrhagic septicemia disease has been selected to be eradicated from the State during the period of the 10th Five Year Plan under this project. Other diseases for which free vaccination is being provided to livestock owners under this project are FMD, BQ, Enteroloxaemia, PPR, Ranikhet Disease Marek's disease and Rabies.

Centrally Sponsored Schemes under District Rural Development Agency (DRDA): Under Swarna Jayanti Swarojgar Yojna (SGSY) dairy development projects are being implemented by DRDA. A dairy animal improvement project is being implemented in District Solan since 2001. On the same pattern, Dairy Development Projects have been sanctioned for four more Districts on 75:25 (Central Share: State Share) pattern and first installment of Central share has been released to respective districts. Details of Projects is given in Table 1.

Table 1: Dairy Development Projects in H.P.

Sr. No.	Name of District	Amount
1	Chamba	6.25 Crores
2	Hamirpur	5.87 Crores
3	Kangra	13.01 Crores
4	Mandi	5.03 Crores

Activities being covered under these projects are as under:

1. Genetic improvement.
2. Milch livestock improvement.
3. Improved feed and fodder development and management.
4. Marketing.
5. Improvement of breeding efficiency.
6. Extension and training.

Centrally Sponsored Schemes in Poultry Sector: In order to develop poultry sector in Himachal Pradesh, Department of Animal Husbandry is running following poultry development schemes especially in rural areas of the State.

Back Yard Poultry Development Scheme: The Animal Husbandry Department has introduced Backyard Poultry Scheme under the Centrally Sponsored Scheme "Assistance to the State Poultry farms" which is a 80:20 Scheme. The State share is in kind i.e. land, infrastructure, staff etc. Since the medium and the large poultry farms have come up of late in the State due to the efforts of the Department whereby training and other help in the form of project reports and opening of the units under subsidy have been provided to the poultry farmers. Therefore, the Department tried to give more attention to the small and marginal poultry farmers who have specific requirements with respect to the strain of the poultry bird provided. This is important because with the limited resources such group of poultry farmers need a disease resistant strain with local availability. This was ensured under the backyard scheme where low input technology bird of coloured strain but disease resistant type are supplied to the farmers of the state @Rs. 15.00/- (day old) to Rs. 20.00/- chick upto 2- 3 weeks age to prevent the early mortality. This scheme has been an instant success because it not only supplements the income of the poor farmers of the state but also provides nutrition of high order to them which is amply clear from the fact that in 2009-2010 a total of 2,65,379 chicks were distributed under the scheme.

Under the CSS-Backyard Poultry Scheme, the Government of India has sanctioned the following projects as given in Table 2.

Table 2: CSS Backyard Poultry Scheme in HP

Sr. No.	Year	Poultry Farm	Amount
1	2001-02	Poultry Farm, Nahan	Rs. 21.05 lakhs
2	2002-03	Poultry Farm, Sundernagar	Rs. 59.87 lakhs
3	2003-04	Poultry Farm, Chauntra	Rs. 27.40 lakhs
4	2004-05	Poultry Farm, Palampur	Rs. 25.00 lakhs
5	2005-06	Poultry Farm, Una	Rs. 58, 72,500/-
6	2006-07	Poultry Farm, Chamba	Rs. 58, 72,500/-
7	2007-08 (onwards)	Poultry Farm, Kamlaahi, Shimla	Rs. 56, 00,000/-

Centrally Sponsored Schemes in Sheep Development: In Himachal Pradesh because of ideal agro climatic conditions, sheep rearing is a major occupation with the majority of agricultural households. To bring desired results increase in quality and quantity of wool, various centrally sponsored schemes are being run in the state by “H.P. State Co-Operative Wool Procurement and Marketing Federation”.

(I) Shepherd Insurance Scheme: Central Wool Development Board Jodhpur, Ministry of Textiles, Government of India has introduced a Shepherd Insurance Scheme during 2007-08, under Social Security Scheme during 11th plan period for the shepherds in the wool producing States. Objective of the scheme is to provide insurance cover to the male and female sheep breeders in case of natural as well as accidental deaths and in case of total or partial disability. All sheep breeders, whether male or female between age group of 18-59 years are eligible under this scheme. All insurance has been made through Life

Insurance Company India. Benefits of the scheme are given in Table 3.

Table 3: Insurance Benefit

Sr. No	Particulars	Benefits
1	Natural Death	Rs. 60,000
2	Accidental death	Rs.1,50,000
3	Total Disability	Rs.1,50,000
4	Partial Disability	Rs. 75,000

The premium of Rs. 330.00 per annum per breeder will be borne in the following ratio:

GOI Contribution	Rs.150/-
Sheep Breeders Contribution	Rs. 80/-
LIC contribution	Rs.100/-
Total Premium	Rs. 330/-

About Rs. 2.00 Crores as Government of India share has been deposited with LIC India. About 15000 shepherds are to be covered under this scheme.

(ii) Integrated Wool Improvement Programme: This project has been sponsored by Central Wool Development Board, Jodhpur for a period of 4 years on the 100% Central Assistance pattern. This project is being implemented in District Chamba, Kangra & Kullu. Rupees 1.25 Crores as first year installment has been received by Wool Federation and is being spent on the activities: Breed Improvement, health care, training camps for sheep breeders, assistance for marketing and product development of wool and establishment of multipurpose extension centres.

iii) Integrated Sheep and Wool Development Projects (ISWP): Integrated Sheep and Wool Development Project has been sponsored by Central Wool Development Board, Jodhpur on 100% Central Assistance. These projects are for a duration of 3 years and are being implemented in the following districts:

Sr. No.	Name of District	Grant released during year 2003-04
1	ISWDP Chamba -III	12.84 lakhs (Bharmour)
2	ISWDP Kangra -III	11.97 lakhs (Palampur/Dharamshala)
3	ISWDP Shimla	12.88 lakhs (Rohru/Chirgaon)
4	ISWDP Kinnaur -I	4 13.00 lakhs
Total		50.69 lakhs

About 50,000 sheep are being covered in each district and facilities like breed improvement, health care, product development, marketing assistance, training camps for sheep breeders are being provided to the registered breeders.

(iv) Continuous fibre dryer plant: Rupees 7.55 lakhs has been received by H.P.Wool Federation as 100% Central Assistance from Central Wool Development Board, Jodhpur for installation of continuous fibre dryer plant as an attachment to mini wool scouring plant, Palampu.

Integrated Angora Development Project: Integrated Angora Development Project is being run in District Kullu and Sirmaur by the Department of Animal Husbandry. This project is being sponsored by Central Wool Development Board, Jodhpur on 100% Central Assistance Pattern.

A Germplasm Centre and Health & Nutrition Laboratory has been established at Nagwain, District Mandi under this project and interested farmers are being provided a unit of 4 female + 1 male rabbit free of cost along with feed, medicines and cages. 50 units have been sanctioned for both the districts. Project duration is of 3 years.

National Biogas and Manure Management Programme (NBMMP): Ministry of Non-Conventional Energy Resources (MNES) is the nodal Ministry in the Government of

India for the development of non-conventional energy. For promotion of indigenously developed simple- to-construct and easy-to-operate family type biogas (gobar gas) plants, a Centrally Sponsored Scheme—National Project on Biogas Development was launched in 1981-82. It was renamed as National Biogas and Manure Management Programme (NBMMP) in 2002-03 for implementation during the Tenth Plan.

The objective of this programme is to manage the animal waste in proper beneficial manner; to provide fuel for cooking purpose and organic manure to rural households through family type biogas plants; to mitigate drudgery of rural women, reduce pressure on forests and accentuate social benefits and to improve sanitation in villages by linking sanitary toilets with biogas plants.

Capitalisation of Livestock Programme Experiences India (CALPI): CALPI (Capitalisation of Livestock Programme Experiences India) is a programme initiated by SDC together with the IC in 2001 to capitalise on the rich experiences, goodwill and credibility they gained over the years in the livestock sector. The Swiss Agency for Development and Cooperation (SDC) is a major development organisation, among others, for livestock related development issues in India for over four decades. In the dynamic livestock scenario emerging in India, a programme like CALPI fitted well as it acted as an interface between policy makers and the poor livestock communities and inspired them to invest in changing the frame conditions that are sensitive to the poor as well as the natural resources. The objective of the programme is to support Government and other stakeholders in the livestock–livelihood–environment domains to adjust the frame conditions in favour of poor livestock keepers.

Chapter 3: Environmental and Social Issues of Sectors

3.1 Forests & Wildlife

Himachal Pradesh being a predominantly mountaineers State has congenial climate for forests. Forest is the major land use in Himachal Pradesh. Covering an area of 37033 sq. km. which forms 66.5% of total geographical area. Owing to a wide range of altitude, temperature and rainfall, Himachal Pradesh supports diverse types of forests, which interior valleys. The mainstay for rural life and livelihood. 13.10 lakhs households (comprising 89.96% of the total population of 68.56 lakhs) are located in rural areas and depend largely on the forests for their fuel, fodder and grazing of their cattle. The net demand for fuel wood from the forests is estimated to be 27.6 lakhs tonnes and that of fodder 92 lakhs metric tonnes per annum. In addition, 1.06-lakhs m³ of timber and 1162 metric tonnes of non-timber forest products are also removed from the forests annually by right holders. All this put a great pressure upon the resources and exploitation of these forest products become unsustainable. Considering that the entire brunt of demand, be it of timber, fuel, fodder or Non Timber Forest Products (NTFP) is borne only by a few choice species, the threat to their continued survival becomes much more evident. Now with the blanket ban on green felling, the availability of timber and other forest products has declined which calls for greater role for farm forestry and agro forestry. The tree outside forest resources is of prime importance. The State Government is committed to increase the tree plantation through various schemes. However, in order to make it really a people centred movement more efforts are required to be made by way of policy and fiscal incentives.

It is estimated that almost 3295 species of vascular plants occur in the forests of

Himachal Pradesh. Of these, only about 100 odd species are commonly utilised for timber, farming implements, fuel, fodder and NTFP, including medicinal use. Which shows the extremely limited use of plant resources in the State. Of the estimated 5721 species of vertebrate and invertebrate fauna listed in the State, perhaps only about 100 species are commonly observed and reported upon regularly.

Forests and groves are the general dwellings of a variety of faunal biodiversity. Due to destruction and conversion of forests, the natural habitats of numerous types of wild animals have been disturbed. Local communities take the largest claim on the natural resources around habitations, especially forests. Destruction of forests and other natural resources on which their traditional livelihood depended, results in migration of local to seek employment elsewhere. Besides agricultural land and pasture, local communities are dependent on there sources collected in the wild for construction, timber, food, fibre, fertiliser, fodder, fuel- wood and medicinal herbs/plants. While the forest boundaries are shrinking due to growing urbanisation and unsustainable development (e.g. Hydel power projects, road widening and other industrial projects etc.) local seek alternative livelihood opportunities. The exploding population vis-à-vis maintenance of green cover have to be balanced. Any effort to out do one aspect will have disastrous consequences. In view of the non availability of land for expansion of forest and the fact that the State has yet to achieve the national goal of two-third are a under forest extensive tree planting in urban as well as in the rural areas to enhance green cover seems the only solution.

Vulnerability analysis indicates that at district level, Shimla has the maximum number of critical natural habitats followed by Kangra, Mandi, Chamba, Una, Kullu, Hamirpur, Lahaul & Spiti, Bilaspur, Kinnaur, Sirmaur and Solan. Critical natural habitats included land under forest cover, reserved forest, protected forest, sulphur springs, national parks, wildlife sanctuaries, bird sanctuaries & wetlands. Roads, tourism, demography and utilities and infrastructure are habitats in all the districts. However, industry may impact critical natural habitats in Una, Bilaspur & Solan. Agriculture may also impact critical natural habitats in Shimla, Kangra, Kullu, Bilaspur, Kinnaur, Sirmaur & Solan. Hydropower may impact the environment in a major way in Distt. Kinnaur, Lahaul Spiti or Sirmaur. If restorative, precautionary measures are ignored. Following issues and problems are emerging out as the major threats to the forests and wildlife in the State.

Forest degradation

As per Himachal Pradesh Development Report, during the immediate post Independence period, planners identified the forests of the State only as a source of timber and other forest products. This led to large scale felling and clearing of forest areas. Forest statistics show a decline in the total forest area from 37,591 sq km in 1990-91 to 37,033 sq km in 2008-09. However, actual forest cover (dense and open forest) showed an increase of about 20% from 11780 sq km in 1990-91 to 14679 sq. km. as per SFR 2011. This has been attributed to ban on green felling and inclusion of horticulture trees into the forest cover in the State.

Earlier Private contractors carried out harvesting of forests which were auctioned by Forest Department after demarcation and marking of trees as per prevailing management plans. However, the working by contractors often resulted into illicit felling and damage to unmarked standing trees. Until

1970, when forest coupes were auctioned, timber removal invariably exceeded the annual prescribed yield, which was unsustainable. To overcome this short coming, the Government of Himachal Pradesh established the Himachal Pradesh State Forest Corporation, which was entrusted with all harvesting operations in the forests. As a result, since 1975, the annual removal from the forests has always remained below the prescribed yield. Timber measuring 470,000m was extracted annually from the forests of the State during the last five decades of the previous century (1950-2000). The average timber removal was the highest in the decade 1980- 90.

High Population Pressure (Human and Livestock) on Forest Resources (Fuel wood extraction)

A large number of villages in the State are located in remote areas and connected by tracks, village paths or by village roads. Moreover, the villages are either adjacent to or surrounded by forests, which are thus deeply integrated with the livelihood of the local people. They depend on the forests for timber, for the construction of houses, firewood, agricultural implements, fodder and a variety of other products and services, including certain medicinal herbs. It has been found that the per capita availability of forests in the State was about 0.23 ha during 1991-2001. However, the population growth in the coming decades, exceeded the growth in forest resources. This resulted in unsustainable extraction and use of resources. As per SoE report, District Kinnaur has 0.78 ha as the highest per capita availability of forest while district Hamirpur has the 0.06 ha as the lowest per capita availability of forests in 2001. District Kullu and Mandi having higher number of critical natural habitats which may have significant impact on demography. Other districts include Shimla, Kangra, Una, Hamirpur, Bilaspur, Kinnaur, Solan and Sirmaur.

In Himachal Pradesh about 89.96% of the population is rural and they mostly depend upon fuel wood for their day-to-day energy requirements. The annual fuel wood requirement for sixty eight lakhs people is about 4 million tonnes. The manner in which the fuel wood is obtained is highly damaging. Right holders and the resident population are supposed to collect only dry and fallen wood and twigs, or lop lower branches of permissible tree species. In practice, however, even young poles are hacked and trees are badly lopped. This severely impairs the regeneration and protective capacity of the trees and the development of the forests. Forests that are in the vicinity of habitations are the most affected. The greatest pressure is perhaps on the “Ban-Oak” trees. These are lopped for fuel wood as well as for fodder.

Increase in number of Timber Distribution Rights: New Timber Distribution Policy (TDP, 2010) has come into force to regulate and rationalise the timber distribution practices in the State. ‘Timber Distribution’ as the policy of distribution of timber to the right holders as per record of rights recorded in the Forest Settlement Reports; and ‘Timber Distribution Rights’ as a right of a right holder having cultivable lands for grant of timber for construction of residential house and cow shed etc. for bonafide domestic use of the right holder, recorded in the Forest Settlement Report of the area concerned. The new policy states that Timber Distribution Rights shall be subject to co-operation and participation of right holders in forest conservancy. In case any right holder fails to perform his duties for apprehending offenders, extinguishing fire or commits any forest offence as contained in the forest settlement report, his right of timber distribution shall be suspended upto 10 years; and Timber Distribution Right of a right holder shall be suspended upto 10 years if he is found to have misutilised the timber.

Unsustainable harvesting of Forest Produce: Villagers and farmers inhabited in the vicinity of the forests traditionally collect various NTFPs, such as anardana, chilgoza, guchhi and various medicinal and aromatic plants, either free or on payment of some nominal fee. The chilgoza or neozapine, (*Pinus gerardiana*), is a compact medium-sized tree. In Himachal Pradesh, it occurs naturally in dry temperate zone, i.e. parts of Kinnaur and Chamba (Pangi) Districts covering an area of about 2,060 ha. It has been estimated that only five percent of seed bearing cones (inaccessible sites) are able to survive the greed of people and become available for natural regeneration. The cones are devoured by a large number of pests, birds, squirrels, rodents and cone borers. Severe lopping practices, browsing by sheep and goats, extraction of torchwood or fuel wood are the major factors detrimental to the regeneration of chilgoza trees. According to an estimate about 14 to 17 tonnes of chilgoza seeds are collected annually in Kinnaur District. Which is also an important source of income in the area. Due to excessive exploitation, *pinus gerardiana* is facing the threat of extinction and has already been listed as an endangered species. Similar is the case with several other NTFPs which have been harvested to near- extinction in the wild.

The State Forest Department issues permits for the collection of other non-timber products. Power has been given to the Pradhans at panchayat level also. Medicinal and aromatic plants are of special value. Some of these herbs are found only in Himachal Pradesh and there might be many still undiscovered. The main concern at present is the unscientific harvesting and excessive and ruthless exploitation of these resources mostly triggered by private pharmaceutical companies, whose sole motive is to maximize their profits. These companies have often little interest in the regeneration and sustainable management of the forests. They also appear quite neutral to the socio-

economic conditions of the NTFP gatherers and as a result they often pay them non remunerative prices and compel them to collect maximum products at times by destructive and unsustainable harvesting. As a result in several species of medicinal and aromatic plants are either facing extinction or being listed as endangered species.

During the year 1999-2000, such produce was worth Rs. 12.29 Crores, of which medicinal herbs alone accounted for 57.43 percent, that is Rs. 7.06 Crores and these forest produce need to be exploited scientifically using modern management methods. 21,982 quintals were exported outside the State during the year 1998-99. The main product were muskbala/nihani, pathin, rakhaldorig has and neoza. The State has introduced Lavender, which yields high value aromatic oil at Saloon in Chamba District along with setting up of an oil extraction unit. A Lavender bush remains productive for 15 years and starts yielding flowers for oil extraction in the second year of its cultivation. The processing of Lavender oil and its consequent use in production of agarbati, dhoop and cosmetic creams could earn additional income, as the current Indian demand for Lavender oil is 40 tonnes annually. Sea buck-thorn is another wild plant, of immense medicinal and environmental value that can be grown in abundance in Lahaul & Spiti, Pangi and Kinnaur. As such, some medicinal plants which are not regularly cultivated and are being collected from the wild are becoming scarce and threatened with extinction.

Livestock population pressure on forest resources (Fodder): According to an estimate, 51.10 lakhs cattle graze in or on the fringes of forests the year round. Almost 90% of the forests of the State, other than areas taken up for regeneration and plantations, are open to grazing. Cultivation of green fodder in agricultural fields is virtually non-existent. The forest areas being openly grazed through

out the year. Diminishes productivity and give rise to growth of inferior grasses and weed plant species like Lantana, Parthenium and Ageratum species.

Due to lack of fencing and indiscriminate visits of scrub animals in the planned areas, there is a large scale damage to the plantation area. Vulnerability analysis indicates that tehsils namely Chaupal, Rampur, Kumarsain, Nankhari, Shimla rural and Junga in Shimla District; Indora, Kangra, Dharamshala and Deragopipur in Kangra District; Padhar, Jogindernagar, Mandi & Karsog in Mandi District; Chamba & Churah in Chamba District; Una Tehsil in Una District; Manali Tehsil in Kullu District; Hamirpur Tehsil in Hamirpur District; Ghumarwin Tehsil in Bilaspur District, Nahan Tehsil in Sirmaur District and Kasauli Tehsil in Solan District which have significant forest cover may face pressure from livestock population.

Forest Encroachment: The incidence of encroachment are mostly reported in the undemarcated protected forests that are without boundary pillars as these adjoin private lands. There are about 9600 encroachment cases that involve about 1850 ha of forest area. Previously, cases for eviction of forest encroachments were challaned in the Revenue courts and from 1994 onwards, powers for this purpose have been given to DFOs under H.P. Public Purposes Act with JFM in place there currence of forest encroachment is bound to be declining. To decline the is making efforts to make JFM more functional through empowerment of local communities.

Inhibited natural regeneration due to ban on Green felling: The blanket ban on green felling has adversely impacted the forests of the State, which is further reinforced by various Supreme Court pronouncements. The complete ban on green felling in the forests imposed by the Government is not conducive to the development of forests because natural

regeneration is possible only when an optimum opening in the canopy is made, and the areas are closed to grazing. Therefore, regeneration felling and thinning has to be carried out to induce regeneration and to remove congestion in the crops. Lack of felling leads to the death and decay of mature trees in course of time with no young growth to replace them. Apart from this, a fall in crown density implies a fall in sustainable yield of the forest products and services including industrial wood and fuel wood as well.

Diversification in forest plantation: Trees are planted mostly on forest land and on community lands to supplement regeneration efforts in order to increase the tree cover. The various coniferous species tend to become monoculture on account of their silvicultural characteristics particularly on higher elevations. Down the hills and in plains, the efforts need to be made to increase the area under species mix. This has to be well planned so that the resultant forest growth is conducive to the development of eco-system services as well as to meet the varying demand of local communities.

As per the record of Forest Department (2005-06), Chil is the single largest species with about 30% of the area planted by the department. Deodar forms only 12% of the total area planted during 1950-1951 to 2003-2004 (total plantation up to 31-03-2004). Recently, a large number of broad-leaved species, including walnut, poplar, shisham etc. were planted under different projects. Even the community participation in new plantation schemes have been the highlight of State's initiatives to include broad leaved species to the interests of local people.

Loss of Forest cover from forest fires: Each year thousands of ha of forest area get affected by forest fire, especially in the "Chil" belt, primarily due to man-made reasons. Fires are very common in the high altitude

"Blue Pine" forests during November and early December. This is when the weather is very dry and winter rains are delayed. Forest fire is one of the several causes of forest degradation. Some of the common damages are destruction of young poles, the drying up of trees, the retardation of increment, the burning of pine needles and humus. This exposes the soil to wind and rain leading to soil erosion wash away of fertile and nutrient rich soil. It also affects the recharging of groundwater and springs. Biodiversity is severely affected both above and below ground level.

As per Annual Administration Report on Forestry Activities under Finance and Planning Wing for the year 2009-2010, the total number of reported fire cases was 1906; total area affected was 24849.52 ha and an estimated loss of over Rs 255.29 million was reported. The main reasons for the forest fire have been attributed to natural causes, carelessness or accidental forest fires by villagers/travelers, lighting or fire balloon and intentional setting of grassland on fire in the forest area.

Diversion of forest for non forestry purposes

Forest land is often requested for diversion for different development projects of Public Work Department, road constructions, hydro electric projects, mining, irrigation, transmission line etc. During 1981 to 2009, about 8733.030 ha forest area has been diverted mostly for Hydro- electric projects (44%), followed by Transmission Lines (25%), Public Work Department roads (4%), Mining (9.5%), Others and other roads (2%), Irrigation and Railway Lines.

There are four districts, Kangra, Kullu, Hamirpur and Shimla, where forest area has declined since 1977. This could be because of the expansion of towns, road network, infrastructural development, housing and

tourism. As per 2011 assessment by FSI, (in comparison SFR 2009), each Kangra, Mandi, Sirmaur and Una districts recorded 2km increase in forest cover while Kinnaur recorded decrease of 2km area of forest cover, similarly an increase of 1km area forest cover observed in Chamba, Kullu, L&S and solan distt. but in hamirpur 1% decrease in forest cover observed. The said assessment recorded no change (increase/decrease) in forest cover of Bilaspur district.

The present situation in the Protected Area Network (PAN) in Himachal Pradesh: HP has a PAN comprising 33 wildlife sanctuaries and 2 national parks spread over 5 Bio-geographic zones in the State. This is about 13.65% of the State's geographical area. Of the 33 wildlife sanctuaries there are habitations within 24 wildlife sanctuaries. These inhabited villages are 793 in number with a human population of 1,16,658 (2001 Census) and a livestock of 183891. Most of the inhabitants and their livestock is forest dependent and much of the village economy is linked to access and harvest of NTFPs, grazing and so forth in forests surrounding the villages. Over the years these people have witnessed (and borne the brunt of) increasing restrictions on their livelihood related activities as also on getting development works approved and implemented. They are the ones who continue to pay the price for wildlife conservation – in national or global interest. Areas without or outside PAs on the other hand, continue to enjoy rights/privileges/development/better infrastructure and faster economic growth. Quite naturally then there is a growing anti-PA constituency and a vocal political lobby effectively blocking wildlife conservation.

Rationalising the PAN makes a strong case for willing wildlife conservation: Rationalisation of the PAN offers a way out of this impasse. It simply means re-drawing the boundaries of wildlife sanctuaries and national parks to exclude villages/hamlets

along with those forests that are heavily encumbered with people's rights. By doing this the major grouse of local people in terms of exercise of traditional rights and implementation of development schemes is sorted out. The other laws such as the FCA, 1980 will remain applicable to the excluded areas, but there will be parity with other rural areas. Secondly, and most importantly, a multitude of unnecessary problems around "what is allowed" or "not allowed" within PAs gets circumvented. Development departments like public works, irrigation and rural development should over time become more amenable to the idea of conservation. A crucial difference that rationalisation of the PAN will make is that a chronically understaffed and poorly trained wildlife department will actually begin to get time to first get trained and then start looking at wildlife issues and problems. The other and perhaps the last opportunity is that through the process of rationalisation good forest/wildlife tracts can be brought into the PAN and this would greatly enhance the representation of biodiversity within the PAN, which is long overdue.

After formal approval including merger of Sainj & Tirthan Wildlife Sanctuaries in the Great Himalayan National Park, there will be 24 Wildlife Sanctuaries, 5 National Parks, 3 Conservation Reserves comprising of 8409 sq kms which is more than 15% of the total geographical area of Himachal Pradesh.

The PAs in Himachal Pradesh are spread over 10 districts. Una and Hamirpur has no PA. The focus of PAs should be to cover all bio-geographic zones in the State and all forest types so that all assemblages of species are conserved and managed in their natural environment and eco-system type.

Ex-situ conservation of wild animals in the State is managed in the Himalayan Nature Park at Kufri, Rescue and Rehabilitation Centre at Tutikandi, Shimla and zoos/

pheasantries at Renuka, Riwalsar, Gopalpur and Sarahan Bushahr. There are also some pheasantries and a viaries for the conservation of birds. Conservation breeding of Chir Pheasant and Western Tragopan has been attempted. These centres are located at Chail, Shimla (Raj Bhawan), Sarahan Bushahr and Manali. Efforts to breed musk deer at Kufri and Western Tragopan and other pheasants at Sarahan Bushahr in Shimla District are slow because of paucity of funds and lack of modern technology.

Crop damage by wild animals: In the past, wild animals used to feed on wild fruits and other natural food resources and did not interfere with the agricultural crops. However, due to increases in their population and shrinking of their natural food resources, wild animals have become more aggressive resulting in human animal confrontation. Monkey sterilisation has been set up in the State to check monkey menace. About 30,000 monkeys have been sterilised and released so far.

Stress on wildlife population: Hunting of wild animals is one of the reasons for the decline of wildlife population in some areas. However, the State has taken many conservation initiatives to check poaching and unsustainable extraction of flora and fauna. Conservation breeding of pheasants and sterilisation of monkeys are both a conservation measure as well as a rational approach to regulate the growth of certain

species. Since 1982, the Government of H.P. has imposed a complete ban on the hunting and killing of wild animals in the State. However, incidents of the illegal hunting of barking deer, goral, wild boar, rabbits, partridges and red jungle fowl by villagers for food are occasionally reported in many areas. Some of the other poached animals include leopard, black and brown bears, musk deer and monal. The poachers are believed to kill these animals by shooting or trapping or even by poisoning

Loss of naturally occurring vegetation due to spread of alien and invasive species: Trees felled by right holders or removed after they dry up or fall due to vagaries of weather (salvage) have created gaps in the canopy, which has result edinpreponderan ceofinvasive species Parthenium hysterophorus, Ageratum conyzoides etc. and a change in the vegetation mix in all types of forests in the State. The resultant growth even though serves the purpose of soil and water conservation, but also effectively eliminates the emergence of tree seedlings and smothers the naturally occurring grasses and herbs in the affected areas.

Forest & Wildlife sector and cross sector policy framework at State level shows the intent of the State Government to address identified issues. A mapping of these issues and policy and programme framework is described in Box 1.

Box 1: Policies mapped with the issues in Forest and Wildlife sector

Issues	Policy/Plan/Programme
1. Forest degradation due to tree felling and forest land diversion.	National Afforestation Programme National Forest Policy, 1988 State Forest Policy, 1980 H.P. Forest Sector Policy & Strategy, 2005 Forest Conservation Act, 1980 and Rules, HP Land Preservation Act, 1978, HP Municipal Act, 1994 Afforestation programme: Social and Farm Forestry including Externally aided Projects and Soil Conservation Schemes. State and Centrally Sponsored and Externally aided

Issues	Policy/Plan/Programme
	Projects schemes for rehabilitation of degraded forest lands, the village common lands and wastelands. Improvement of Tree Cover: a: Afforestation Scheme; b: Enrichment Planting and c: Re- afforestation of Scrub areas
2. High Anthropogenic pressure on forest resources	H.P. Participatory Forest Management Regulations, National Forest Policy, 1988 The Indian Forest Act, 1927 Forest Conservation Act, 1980 The Indian Forest Act (H P Second Amendment Act), The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 and its Rules Joint Forest Management (JFM) Order, 1990 and 2000. HP Participatory Forest Management Regulation, 2001. HP Forests (Protection from Fire) Rules, 1999. Social and Farm Forestry Schemes Catchment Area Treatment Plan
3. Timber distribution rights	National Forest Policy, 1988 Himachal Pradesh Forest (Timber Distribution to the Right Holders) Rules, 2010. The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 and its Rules.
4. Unsustainable harvesting of Forest Produce	The Indian Forest Act, 1927 The Indian Forest Act (H P Second Amendment Act), State Medicinal Plants Policy, 2005 Joint Forest Management (JFM) Order 1990 & 2000 HP Participatory Forest Management Regulation 2001 CAMPA H.P. Forest Produce Transit (Land Routes) Routes
5. Increasing livestock pressure on forests	National Forest Policy, 1988 The Indian Forest Act, 1927 The Indian Forest Act (H P Second Amendment Act), The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 and its Rules Joint Forest Management (JFM) Order 1990 & 2000. HP Participatory Forest Management Regulation 2001 Social and Farm Forestry.
6. Forest Encroachment	Indian Forest Act, 1927 Urbanisation Policy, 2009 HP Public Premises and Land (Eviction and Rent Recovery) Act, 1994 The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 and its Rules
7. Inhibited natural regeneration due to ban on Green felling	National Forest Policy, 1988 The Indian Forest Act, 1927 The Indian Forest Act (H P Second Amendment Act),

Issues	Policy/Plan/Programme
	State Forest Policy, 1980 The Forest Sector Policy, 2005 Special assistance from the Central Government to offset loss of revenue on account of moratorium on green felling. Joint Forest Management Programme as GR of 1990, 2000 & 2001
8. Diversification of forest plantations	Afforestation Schemes Working plan prescriptions and silvicultural basis. Lack of technological refinement on raising of nursery and plantation of many miscellaneous species.
9. Forest damage due to forest fire and other natural and man made hazards	HP Forests (Protection from Fire) Rules, 1999 Forest Conservation and development: Forest Protection from fires, development of effective and adequate infrastructure
10. Diversion of forest for non forestry purposes	Forest Conservation Act, 1980 and Rules. Compensatory Afforestation Fund Management and Planning Authority (CAMPA).
11. Fragmented Protected Area Network	National Forest Policy, 1988 National Environment Policy, 2006 Wildlife Protection Act, 1973 and amendments. Assistance for development of PAs in the State Development of Pin Valley National Park. State Plan Schemes for Improvement and Development of Wildlife Sanctuaries covers wildlife surveys, habitat improvement, fodder and pasture improvement, plantation and soil conservation works, census of animals/birds and construction of infrastructure. Integrated Conservation and development projects
12. Crop damage by wild animals	Wildlife Protection Act, 1972
13. Damage to wildlife due to unsustainable practices.	Wildlife Protection Act, 1972 Development of Himalayan Zoological Park Central Sector Schemes Breeding projects of Endangered Species: Western Tragopan, Tahr, Monal, the Chir pheasant, and Brown Restoration of degraded habitats of animal biodiversity. Wildlife and Nature Conservation Forest Protection Eco-tourism
14. Impact of obnoxious weeds, alien and invasive species on forest eco-system	National Forest Policy, 1988 National Environment Policy, 2006 The Environment (Protection Act), 1986 Biological Diversity Act, 2002 and Biological Diversity Rules, 2004 Improvement of Tree Cover: Re-afforestation of Scrub areas including those covered by bushes and weeds like Lantana, Parthenium (Eupatorium), Ageratum sp.

Pressure on account of increasing threats and slow pace and inadequate implementation of policy, programmes, plans and projects is leading to emergence of sector specific issues and risks/impacts. An analysis of the issues, causes and impacts has been carried out and summarised in Table 1.

Issues	Causes	Impacts/risks
1. Forest degradation and diversion for non-forestry purposes	• Excessive demand for timber and other forest produce often led to felling of tree far in excess of the Annual Allowable Cut (AAC). This led to forest degradation. • Illegal felling of trees • Forest Fires	• Reduced biodiversity due to loss of habitat for a particular type of flora and fauna. • Irregular water flow, drying up of natural springs and increased vulnerability to flash floods during rains. • Loss of soil fertility associated with soil erosion, resulting in the reduction of agricultural productivity down stream.
2. High Anthropogenic pressure on forest resources.	• About two third of the State's geographical area is under recorded forests, but a substantial part of this is not conducive for tree growth, being under permanent snow, glaciers and cold deserts. • About 90% population is rural who mostly depend upon fuel wood and other forest products for their day-to-day energy requirements. • In practice, however, even young poles are hacked and trees are badly lopped.	• Less regeneration and protective capacity of the trees and the development of the forests. • Loss to Biodiversity due to over exploitation • Extinction of species • Disturbance to food chain
3. Increasing livestock pressure on forest	• Substantial forest areas of the State, other than areas taken up for regeneration and plantations, are open to grazing. Cultivation of green fodder in agricultural fields is virtually non-existent, are stall-feeding practices.	• Loss to biodiversity • Continuous grazing diminishes productivity and gives rise to spread of inferior grasses and unpalatable bushes like Lantana camara, Parthenium and Ageratum species which due to allelochemicals inhibits growing of other gasses.
4. Timber Distribution Rights	• Due to the division of the families, the number of right holders is multiplying and the forests are depleting. Almost half of the yield prescribed annually from the forest is distributed to the timber distribution right holders.	• Selective harvesting of certain species leads to change in forest composition and depletion of desired species.
5. Forest encroachment	• The incidence of encroachment is alarming in the un-demarcated protected forests that are without boundary pillars. As these adjoin private lands, they are prone to encroachments.	• Loss of forest land and forest cover. • Loss to economy of Forest.
6. Unsustainable harvesting of Forest Produce	• Unsustainable harvesting often results into over-exploitation of forest lack of proper check on Harvesting forest Produce resources. • It has been estimated that only 5 percent of seed bearing cones (inaccessible sites) are able to survive the wrath of people and become available for natural regeneration. Severe lopping practices, browsing by sheep and goats,	• Several species of medicinal and aromatic plants are either becoming extinct or being listed as endangered species.

Issues	Causes	Impacts/risks
	extraction of torchwood or fuel wood etc. are the factors detrimental to the regeneration of trees. Exploitation of other forest species especially NTFPs has also resulted into unsustainable yields.	
7. Lack of silvicultural operations in areas restricted for green felling	The complete ban on green felling in the forests is not conducive for the sustainable development of forests.	Degradation of forest due to loss of regenerative capacity of forest.
8. Forests are becoming mono culture	- Natural habit of certain conifers and lack of refined technology for raising of mixed miscellaneous species is making the forests as monoculture. - Planting of trees as per the demand or requirement of the population.	- Imbalance in natural diversity in forest plantation which promotes monoculture plantations. - Increase in incidences of plant diseases / Pest attack resultant threat to forest. - Long term impact on plant and animal species. - Lack of undergrowth for grazing.
9. Forest damage due to forest fire and other natural and man made hazards	- Natural, accidental and sometimes intentional fires in forest areas. - Lightening leading to forest fires - Each year substantial forest areas are visited by annual forest fire. Fires are very common in the high altitude "Blue Pine" forests during November and early December. This is when the weather is very dry and winter rains are delayed. - Campfire Sparks	- Loss of forest cover, flora & fauna. - Adverse impact on soil and characteristics increased soil erosion. - The microclimate is also adversely affected. - Source of Air Pollution - Altering wildlife habitat
10. Diversion of forest for non forestry purposes	- Forest diverted for various user/ departments namely PWD, Other Roads/ Hydroelectric projects/ mining, irrigation/TL/ RL and others. - Tourism & Recreational Facilities	- Degraded quality of catchment area - Loss of forest cover, soil erosion, water resources flora and fauna. - Increased sedimentation from clear felling, mining and other activities. - Disturbance to wildlife
11. Protected Area Network	Protected areas are few and far in between and do not protect full assemblage of gene, species and eco-system level diversity in the State	With rationalisation of boundaries the PA network is becoming more comprehensive for better scientific management. There sult has been increased area under PA network.
12. Crop damage by wild animals	- Habitation and settlements and cropping practices (agri-horticulture) close to forest and protected areas. Wild boar, blue bull, rabbit, monkey, cause most of the damage. - Shrinkage of wildlife habitat - Deforestation - Human Interference with the feeding habit	- Increase in Human- Wildlife conflict. - Change in feeding habits - Poaching / Killing of wild Animal
13. Stress on wild life population	- Habitat loss - Hunting of wild animals is one of the main areas of concern for the loss and decline of wildlife in the State. Black bear, leopard, wild boar, red jungle fowl, monal, white crested khalij pheasant, sparrow, rabbits are rare and threatened. - Illegal poaching / Hunting	- Decline in population of species and even extinction of threatened wild life in the long term is likely. - Loss of Biodiversity - Imbalance of Food Chain

Issues	Causes	Impacts/risks
14. Impact on naturally occurring vegetation due to spread of alien and invasive species	• Lantana camara, Ageratum spp. Parthenium spp. have spread far and wide in the State as a result of clear felling and wherever there is opening in the natural forest cover. • Lack of eradication, rehabilitation and alternative use of exotic weeds • Import of Exotic plants/seeds/animals	• Degraded habitats due to extensive colonisation of open areas by alien species replace native species in the long term and would also affect area under cropping. • Encroachment to crop feed by the weed species • Inhabit growth of palatable grass species

3.2 Wetlands

Wetlands are one of the most treated habitats of the world. Wetlands are facing several anthropogenic pressures from expanding human population, large scale changes in landuse/land covers, burgeoning development projects and improper use of watersheds. Wetlands are affected by the condition of their watersheds, immediate surroundings as well as certain features downstream. For e.g. change in species composition of birds or fish downstream may affect the eco-system of the wetland as these organisms move locally/regionally dispersing floral seeds and at times pathogens or fish also. Major environmental and social issues and problems related to wetlands in Himachal Pradesh are given below.

Shrinking of wetland area due to change in land use, human & livestock activities: Anthropogenic activities, unplanned urban and agricultural development, industries, road construction, impoundment, resource extraction and dredge disposal is leading to continuous shrinking of wetland area. Encroachment because of unclear land tenure and lack of property rights of the wetlands and surrounding areas is the major reason for shrinkage of the wetland area. All these activities exert biotic pressure on micro-habitats and riparian forests.

Deforestation/removal of vegetation/grazing in the catchment is leading to soil erosion and siltation of the wetland: The vegetation in the catchment of the wetland varies from

wooded/forested area to herbaceous meadows depending on altitude and climatic conditions. Continuous deforestation both legal & illegal in the catchment is leading to declining forest cover and productivity of forests and support lands. Further, uncontrolled grazing in meadows & pasture land is leading to increased pressure and reduced water holding capacity of forests and other lands. This is causing continuous soil erosion & siltation e.g. the draw down areas of Pong reservoir is occupied by nomadic grazers and gujjars during March-June. Besides stray cattle also graze in the fringe area. As per Wetland Management Plan, Pong Dam Lake, Department of Forest and Wildlife, about 20000 grazing cattle and livestock (of which 6000 belongs to nomadic grazers) graze in the core area. Similarly, migratory grazers who pass through the Chandra valley with huge flocks of sheep and goats graze the meadows. The combined effect of the visitors and graziers contribute to increased siltation and organic influx into the wetland. However, the increase in siltation and organic influx load to the Chandratat wetland in Chandra valley need to be assessed and compared with the baseline data before anthropogenic activities and/or any other high altitude wetland with no human interference.

In Pong Dam wetland area unchecked, high incidences of grazing poses serious threat to the biodiversity of the sanctuary area. A large number of cattle graze on the basic core zone of the reservoir after the water recedes to the minimum water level. The natural habitat

linked by the migratory birds is thus destroyed by the hoofs of the cattle. Thus, the growth of the grasses, molluscs, pila, snails etc. is checked due to destruction of the habitat which are in turn linked to decline in habitat of majority of the migratory birds. The status of Biodiversity in Pong Sanctuary area before the high incidence of grazing and the existing status is required to be known to estimate the biodiversity loss in relation to the habitat destruction so that conservation measures be suggested accordingly.

In the catchment area of wetlands, activities like blasting of the hard rocks, tunnel construction, deforestation of the area, throwing of muck in the water stream, cement concreting in the Hydel projects have caused air, water and noise pollution. These have badly affected the flora and fauna of the area. Siltation besides shortening the life of reservoir adversely affects the water quality and quantity which adversely impact wetland. EIA studies are needed to assess the effects on the flora and fauna of the area as well on water quality.

Agriculture-Horticulture activities in the wetland buffer zone and fringe areas: Shift in land use and agricultural production patterns in the catchment area, buffer zone and fringe areas is leading to adverse impacts on wetlands in Himachal Pradesh. Shoreline of lakes/wetlands are farmed during the draw down phase e.g. Pong Wetland. Although, there is a shift in land use and agriculture production in the catchment, but the adverse impacts, if any, are to be identified and categorised depending upon their nature, composition and mode of action before suggesting the conservation measures.

Unrestricted dumping of sewage, solid wastes and toxic chemicals from households, tourists destination, industries and agriculture leads to pollution and eutrophication of wetlands, silting and weed infestation: Infrastructure development

and poor management of waste (municipal solid waste, construction and demolition waste and waste water) in the catchment and in vicinity of wetland leads to water pollution and increased influx of organic waste which leads to water pollution & eutrophication. Dumping of dung of horse and ponies near wetlands frequented by tourists (e.g. Khajjiar) also contributes to water pollution & eutrophication. Increased runoff in the degraded catchment areas of wetlands leads to siltation and weed growth, water pollution & eutrophication. Littering of non-biodegradable materials by pilgrims and tourists increases pollution load in the wetland.

Increased health risk in the surrounding area of wetland due to pollution: Deteriorating water quality due to pollution has also led to the spawning of mosquitoes in the absence of predators, such as *Gambusia affinis* & killifish, which prey on mosquito larvae. This poses a major health risk in the vicinity of wetland.

Depletion of wetland's flora and fauna due to congestion, pollution/ dredging/desilting introduced and invasive plant species: Congestion of natural outdoor recreational sites is leading to depletion of wetland flora & fauna. *Eichhornia crassipes* (Water Hyacinth), *Azolla* and *Salvinia molesta* clog waterways and compete with native vegetation, leading to loss of wetland's area and depletion of wetland's flora and fauna. Further, natural species also assumes weedy proportions e.g. *Typha*, *Trapa* *Thalia*, *Echinodorus* etc. Removal of natural vegetation spurs spread of alien and invasive species e.g. *Lantana*, *Adhatoda*, etc. This leads to reduction of area under palatable grasses grazed by wild animals and domesticated cattle and livestock. Indiscriminate introduction of new species of fish for commercial exploitation, over harvesting of particular species and fishing methods are leading to depletion of wetland's fauna. Commercial fisheries leads to change in

composition of fisheries for instance increase in the carnivorous fish. Several fish species have disappeared due to over exploitation and introduction of carps.

The fertilisers and insecticides i.e. such as CAN, Urea, 12-32-16, DAP, Super-Phosphate etc. pollute water of the reservoir wetland and this deteriorates aquatic flora and fauna. The polluted water keeps away the migratory birds due to non-suitable habitat. Desilting & dredging of wetlands further leads to disturbance of ecology of wetland and depletion of wetland's flora & fauna.

Change in natural flow/hydrology and water dynamics of the reservoir/ wetland: Construction of a large number of reservoirs, canals and dams; diversion of streams and rivers to meet agricultural needs lead to reduced flow into wetlands. Small hydropower projects and other infrastructure development projects requiring water diversion also change the hydrology of the wetland.

Uncontrolled/Unregulated tourism in the buffer zone leads to disturbance to ecology and critical habitat: Tourists feed fish and

turtles with bread, biscuits, wheat, flour, grains, nuts etc. thereby changing the behavior and ecology of the wetland. Movement of high speed motorised boats of tourists, allied activities of water sports like training programmes and fishing vessels, poor camp management and waste disposal Pose threat to wetland ecology. The change in the behavior and ecology of wetlands needs to be comprehensively observed and studied with by scientific backing so that mitigation and adaptive measures are suggested accordingly.

Poor Enforcement of regulatory provisions due to jurisdiction issues on account of unclear land tenure: Some of the uncontrolled activities include poaching of avifauna, illegal harvesting of crops and commercial fishing e.g. introduction of fish seeds/varieties and commercial activities without permission of Chief Wildlife Warden, Department of Forests, Government of Himachal Pradesh. Further, being remote and inaccessible areas, lack of trained enforcement staff, lack of enforcement infrastructure and lack of co-ordination leads to poor enforcement of the rules.

Box 2: Policies/Plans/Programmes/Projects mapped with the issues in Wetlands

Issues	Policy/Plan/Programme/Project
1. Shrinking of Wetland area due to change in land use, human & livestock activities	National Water Policy 2002 and State Water Policy (Draft) National Environment Policy (NEP), 2006 Wetlands (Conservation and Management) Rules, 2008 (draft) National Wetlands Conservation Programme Guidelines for National Lake Conservation Plan State Urbanisation Policy, 2009 EIA notification September 14, 2006 and subsequent amendments
2. Deforestation/ removal of vegetation/grazing in the catchment is leading to soil erosion and siltation of the wetland	Indian Forest Act, 1927 Forest (Conservation) Act, 1980 HP Forest Sector Policy & Strategy, 2005 National Biosphere Reserve Programme. National Afforestation Programme Integrated Development of Wildlife Habitat. Catchment area Treatment Plans
3. Agricultural- Horticulture activities in the wetland buffer zone and fringe areas.	Wetlands (Conservation and Management) Rules, 2010 National Wetland Conservation Programme, 2009.
4. Unrestricted dumping of	National Water Policy 2002 and State Water Policy (Draft).

Issues	Policy/Plan/Programme/Project
sewage, solid wastes and toxic chemicals from households, tourists destination, industries and agriculture leads to and eutrophication of wetlands, silting and weed infestation pollution.	Tourism Policy-2005. Revised Policy on Development of Eco-tourism in Himachal Pradesh, 2005 The Water (Prevention and Control of Pollution) Act, 1974, Amended -1988 The Environment (Protection) Act, 1986 Himachal Pradesh Non-Biodegradable Garbage (Control) Act, 1995 Himachal Pradesh Non-Biodegradable Garbage (Control) Rule, 1996 Wetlands (Conservation & Management) Rules, 2010
5. Increased health risk in the surrounding area of wetland due to pollution	Wetlands (Conservation & Management) Rules, 2010 • National Water Policy 2002 and State Water Policy (Draft) Tourism Policy-2005 Revised Policy on Development of Eco-tourism in Himachal Pradesh, 2005 The Water (Prevention and Control of Pollution) Act, 1974, Amended -1988 The Environment (Protection) Act, 1986 Himachal Pradesh Non-Biodegradable Garbage (Control) Act, 1995 Himachal Pradesh Non-Biodegradable Garbage (Control) Rule, 1996
6. Depletion of wetland's flora and fauna due to congestion, pollution/ dredging/desilting introduced and Invasive plant species	Biological Diversity Act, 2002 and Biodiversity Rules, 2004 The Wildlife (Protection) Act, 1972 National Biodiversity Action Plan, 2008 Water (Prevention and Control of Pollution) Act 1974 / 1988 Himachal Pradesh Fisheries Act, 1976 Himachal Pradesh Fisheries Rules, 1979 Himachal Pradesh Fisheries (Fourth Amendment) Rules
7. Poor Enforcement o regulated activities due to jurisdiction issues on account of land tenure	National Forest (conservation) Act Wildlife Protection Act 1973 HP Forest Sector Policy, 2005 National Wetlands Conservation Programme Wetlands (Conservation & Management) Rules, 2010
8. Change in natural flow/ hydrology and water dynamics of the reservoir/ wetland	National Water Policy 2002 State Water Policy (draft)
9. Uncontrolled/ Unregulated tourism in the buffer zone leads to disturbance to ecology and critical habitat	State Tourism Policy, 2005 Eco-Tourism Policy, 2005 National Lake Conservation Plan, 2001 Urbanization Policy

The cause and impacts/risks associated with the issues related to wetlands as identified in Box-2 can be correlated with pressure on account of increasing gaps, lack of comprehensive Wetlands Policy at National and State level, tardy pace of implementation of programmes, plans and projects which further exacerbates issues related to and associated risks/ impacts. An analysis of the issues, causes and impacts has been carried out and summarised in Table 2.

Table 2: Issues, Causes and Impacts/Risks

Issues	Causes	Impacts/risks
1. Shrinking of Wetland area due to change in land use and human & livestock activities.	Anthropogenic activities, unplanned urban and agricultural development, industries, road construction, impoundment, resource extraction and dredge disposal are leading to continuous shrinking of wetland area. Encroachment because of unclear land tenure and lack of property rights of the wetlands and surrounding areas is the major reason for shrinkage of the wetland	Catchment degradation Loss of wetlands and their productive functions Exert biotic pressure on the immediate environment micro habitats and riparian forests. One instance of encroachment spurs more

Issues	Causes	Impacts/risks
2. Deforestation/ removal of vegetation in the catchment leading to soil erosion and siltation of the wetland:	area. Continuous deforestation both legal & illegal in the catchment is leading to declining forest cover and productivity of forests and support lands. Further, uncontrolled grazing in meadows & pasture land is leading to increased pressure and reduced water holding capacity of forests and other lands. This is causing continuous soil erosion & siltation. The combined effect of the visitors and graziers does contribute to increased siltation and organic influx into the wetland. Excessive & uncontrolled grazing pose serious threat to the biodiversity of the sanctuary area. The natural habitat linked by the migratory birds is thus destroyed by the hoofs of the cattle. The blasting of the hard rocks, tree felling from project area, throwing of muck in the River stream, cement concreting etc. in the Hydel projects.	encroachments Loss of wetlands and their productive functions Siltation leading to reduction to capacity of reservoir/dam. Loss of habitat. Feeding and breeding of aquatic fauna and birds. Disturbance to breeding and nesting of birds. Ecological degradation due to the vast quantity of sediments that flow into water body from the degraded uplands. Silt on the edge of the lake subsequently provides fertile ground for the growth of the weeds Contamination of water Deterioration of aquatic eco-system
3. Agricultural-Horticulture activities in the wetland buffer zone and fringe areas	Shift in land use and agricultural production patterns in the catchment, buffer zone and fringe areas. Shoreline of lakes/wetlands are farmed during the draw down phase	Disturbance/loss of feeding nesting and breeding of aquatic fauna and birds including fishes. Increased siltation due to tilting.
4. Unrestricted dumping of sewage, solid wastes and toxic chemicals from households, tourist destinations, industries leads to pollution and eutrophication of wetlands, silting and weed infestation:	Infrastructure development and poor management of waste (municipal solid waste, Construction and demolition waste and waste water) in the catchment and vicinity of wetland leads to water pollution & eutrophication open. Dumping of animal dung of horse and ponies near wetlands frequented by tourists (e.g. Khajjiar) also of organic influx into wetland. Increased runoff in the degraded catchment areas leading to siltation and weed growth. Excessive nutrient influx into wetlands contributes to water pollution eutrophication and algal growth. Littering of non-biodegradable materials by pilgrims and tourists increases pollution load in the wetland.	Impairment of water quality Loss of wetland and its productive function. Weed infestation and proliferation. Health risk to public & livestock. Decrease in value of public amenities (tourism, recreation)
5. Increased health risk	Deteriorating water quality due to	Major health risk in the

Issues	Causes	Impacts/risks
in the surrounding area of wetland due to pollution	pollution led to the spawning of mosquitoes in the absence of predators, such as <i>Gambusia affinis</i> & killifish, which prey on mosquito larvae. This poses a major health risk.	vicinity of wetland. Spread of vector borne diseases
6. Depletion of wetland's flora and fauna due to congestion, pollution/dredging/desilting introduced and Invasive plant species	Congestion of natural outdoor recreational sites e.g. <i>Eichhornia crassipes</i> (Water Hyacinth), <i>Azolla</i> and <i>Salvinia molesta</i> which clog waterways and compete with native vegetation. Further, natural species also have weed plants in proportions e.g. <i>Typha</i>, <i>Trapa Thalia</i>, <i>Echinodorus</i>, etc. Removal of natural vegetation spurs spread of alien and invasive species e.g. <i>Lantana</i>, <i>Adhatoda</i>, etc. This leads to reduction of area under palatable grasses consumed by wild grazing animals. Indiscriminate introduction of new species of fish for commercial exploitation, over harvesting of particular species and fishing methods. Change in composition of fisheries in commercial fishery. Excessive usage of fertilizers and insecticides such as CAN, Urea, 12-32-16, DAP, Super- Phosphate etc.	Damage to the function and health of wetlands by Introduced and Invasive species. Extinction of indigenous species and replacement of native species by other species. Loss of biodiversity and reduced ecosystem stability. Disturbance to wetland/ ecology and disruption of breeding and nesting feeding Reduction in agricultural productivity, livestock, disruption of eco-system services and reduction in land values. Alteration in nutrient cycling. Change in habitat morphology. Alteration in water flow. Decrease in water retention.
7. Poor Enforcement of regulatory provisions due to jurisdiction issues on account of unclear land tenure	Some of the uncontrolled activities include poaching of avifauna, illegal harvesting of crops and commercial fishing e.g. introduction of fish seeds/ varieties and commercial activities without permission of Chief Wildlife Warden. Further, remote and inaccessible areas, lack of trained enforcement staff, lack of co-ordination among institutions, lack of enforcement infrastructure.	Unabated poaching and wildlife trade can deplete flora and fauna and further threaten species. Loss of wetland due to institutional gaps. Extinction of species Disturb the balance of ecosystem.
8. Change in natural flow/ hydrology and water dynamics of the reservoir/ wetland	Introduction of fish in wetlands (e.g. <i>Renuka</i> and <i>Khajjiar</i> wetlands) led to fish feeding. Tourists feed fish and turtles with bread, biscuits, wheat flour dough, grains, nuts, etc. Small hydropower projects and other infrastructure development projects requiring water diversion	Changes in Hydrological regime leading to variation in ecology of the small stream/khud which in turn affects large streams and rivers and its aquatic flora, fauna and fisheries.
9. Uncontrolled/ Unregulated tourism in the buffer zone leads to	Movement of high speed motorised boats of tourists, allied activities of water sports like training	Water, air & noise pollution public health risk & safety.

Issues	Causes	Impacts/risks
disturbance to ecology and critical habitat	programmes and fishing vessels. Poor camp management and waste disposal	

3.3 Fisheries

Shrinking of wetland/water body/ reservoirs area due to change in land use, human & livestock activities: Anthropogenic activities, unplanned urban and agricultural development, industries, road construction, impoundment, resource extraction and dredge disposal is leading to continuous shrinking of wetland/water body/reservoirs' area. Encroachment because of unclear land tenure and lack of property rights of the wetlands and surrounding areas is the major reason for shrinkage of these areas. This leads to loss of eco-system function, fish species and fish productivity.

Deforestation/removal of vegetation/ grazing in the catchment is leading to soil erosion and siltation of the wetland/water body/ reservoir: Continuous deforestation both legal & illegal in the catchment is leading to declining forest cover and degradation of support lands. Further, uncontrolled grazing in meadows & pasture land is leading to increased pressure and reduced water holding capacity of forests and other lands. This is causing continuous soil erosion & siltation. Further, the destruction and leading of habitat of fish including mollusks (pila, snails etc.), phytoplankton and zooplankton/grasses lead to loss of fish productivity and species. The reduced depth of reservoirs due to siltation further adds to loss of fish productivity and species. For example in Pong reservoir it has been observed that due to heavy siltation, shallow areas get choked in the periphery leading to destruction of fish feeding grounds. Some of the fish species, which either disappeared or dwindled, include *Labio dyocheilus*, *L. gonius*, *Schizothorax plagiostomus*, *Mastacembelus* sp. *Salmo trutta fario*, *Tor putitora*, *L. dero*, *Puntius sophore*,

Puntius spp., *Wallago attu*, *Notopterus notopterus*. The draw down areas of Pong reservoir is occupied by nomadic graziers and gujjars during March-June. Besides, stray cattle also graze in the fringe area.

Agriculture-horticulture activities in the wetland/reservoir/water body buffer zone, fringe areas and catchment area: Shift in land use and agricultural production patterns in the catchment, buffer zone and fringe areas is leading to adverse impacts on wetlands/ reservoir /water body in Himachal Pradesh e.g. shorelines of lakes/ wetlands are farmed during the draw down phase in Pong reservoir. The water bodies become recipient of insecticides, pesticides, fertilisers and heavy metals. Depleted oxygen and higher nutrients level may lead to decline in fisheries. Further, bio accumulation may lead to potential health risk. It has been reported in Pong Wetland report of Forest Department that the chemicals such as CAN, Urea, 12-32-16, DAP, Sulphur Phosphate and insecticides such as nuvan etc. pollute reservoir which resultantly impact flora and fauna.

Poor surface water quality due to unrestricted dumping of sewage, solid wastes and toxic chemicals from households, tourists' destination and industries which leads to water pollution and eutrophication of wetlands/water body/reservoir: Infrastructure development and poor management of waste (municipal solid waste, construction and demolition waste and waste water) in the catchment and in vicinity of wetland/water bodies/reservoirs leads to water pollution and increased influx of organic waste, which leads to water pollution & eutrophication. Dumping of dung of horse and ponies near wetland/water bodies/reservoirs frequented by tourists (e.g. Khajjiar) also contributes to

organic pollution resulting in decreased dissolved oxygen and high BOD. Increased runoff in the degraded catchment areas of wetlands leads to siltation and weed growth, water pollution & eutrophication. Littering of non-biodegradable materials by pilgrims and tourists increases pollution load in the wetland/water body/ reservoir. This increased pollution load decreases dissolved oxygen levels leading to fish mortality.

Depletion of benthic flora and fauna in wetlands/reservoir/water body due to dredging/desilting: Dredging/desilting leads to high TDS/ turbidity and decreased oxygen level thereby increasing fish mortality. Further, disturbance in benthic flora and fauna leads to decreased fish productivity.

Depletion of fisheries also occurs due to introduction of invasive plant and fish species. Congestion of natural outdoor recreational sites is leading to depletion of wetland/water body/reservoir flora & fauna. *Eichhornia crassipes* (Water Hyacinth), *Azolla* and *Salvinia molesta* clog waterways and compete with native vegetation, leading to loss of wetland's area, and depletion of wetland's flora and fauna. Indiscriminate introduction of new species of fish for commercial exploitation, over harvesting of particular species and fishing methods are leading to depletion of wetlands/reservoir/ water body fauna. Commercial fisheries leads to change in composition of fisheries for instance increase in the carnivorous fish. Several fish species have disappeared due to over exploitation and introduction of carps.

Poor Enforcement of regulated activities due to jurisdiction issues on account of unclear land tenure and other aspects related to fisheries: Indiscriminate hooking, netting, dynamiting and electro cutting have greatly affected the qualitative and quantitative availability of fish in the rivers, streams, lakes and reservoirs. Taking advantage of the

ascending nature of mahseer fish, during breeding season, high tension wires are put into the water for electrocuting the fish. Similarly, it is a common practice in Himachal Pradesh to poison the water with Tejpahl seeds or DDT, which kill the whole progeny of fish over considerable stretches of rivers. Catching by specially designed traps 'Chips' and dragnet in conjunction with stake net and cast nets have caused serious damage to the mahseer resources of the State. In pursuit of more and more catches, the commercial fishers have not spared even some of the declared sanctuaries. Further, due to reduction in the large-sized fish, fishing pressure has shifted to the juveniles, with the result that streams earlier assuring a bountiful of variegated fish fauna have started presenting a dismal picture and may turn into aquatic deserts, if corrective steps are not taken. Some of the other uncontrolled activities include poaching of avifauna, illegal harvesting of crops and commercial fishing e.g. introduction of fishseeds/varieties and commercial activities without permission of Chief Wildlife Warden. Further, remote and inaccessible areas, lack of trained enforcement staff, lack of enforcement infrastructure and lack of coordination leads to poor enforcement of the rules.

Change in natural flow/hydrology and water dynamics of the reservoir/ wetland/ water body: Construction of a large number of reservoirs and dams; diversion of streams and rivers and hydro-electric projects lead to reduced flow into wetlands/water bodies/reservoir. Small hydro-power projects and other infrastructure development projects requiring water diversion also change the hydrology of the wetland/water body/river. The reduced down stream ecological flow leads to ecological imbalance in aquatic flora and fauna including fisheries.

Uncontrolled/unregulated tourism in the buffer zone leads to disturbance of fish feeding and breeding habitat: Tourists feed

fish and turtles with bread, biscuits, wheat, flour, grains nuts etc. which leads to disturbance and decline of habitat and fish productivity. Poor camp management and waste disposal also add to the same.

Fisheries sector and cross sector policy and regulatory framework at State level shows the intent of the State Government to address identified issues. A mapping of the issues and policy and programme framework is described in Box 3.

Box 3: Policies mapped with the issues in fisheries sector

Issues	Policy/Plan/Programme/Project
1. Shrinking of Wetland/water body/reservoirs area due to change in land use, human & livestock activities.	National Water Policy 2002 and State Water Policy, (Draft) National Environment Policy (NEP), 2006 Wetlands (Conservation and Management) Rules,2010 National Wetlands Conservation Programme, 1986 updated in 2009 Guidelines for National Lake Conservation Plan, 2008 State Urbanisation Policy, 2009 EIA notification September 14, 2006 and subsequent amendments Indian Forest Act,1927 HP Forest Sector Policy and strategy, 2005 Forest (Conservation) Act, 1980 and subsequent amendments National Afforestation Programme Integrated Development of Wildlife Habitat. Catchment Area Treatment Plan
2. Agriculture- horticulture activities in the wetland/ reservoir/ water body buffer zone, fringe areas and catchments area.	Wetlands (Conservation and Management) Rules, 2010 National Wetlands Conservation Programme, Guidelines for conservation and management of wetlands in India
3. Poor surface water quality due to unrestricted dumping of sewage, solid wastes and toxic chemicals from households, tourists destination and industries which leads to water pollution and eutrophication of wetlands/water body/reservoir.	National Water Policy 2002 and State Water Policy, 2005 Tourism Policy-2005 Revised Policy on Development of Eco-tourism in Himachal Pradesh, 2005 The Water (Prevention and Control of Pollution) Act 1974, Amended -1988 The Environment (Protection) Act, 1986 Himachal Pradesh Non-Biodegradable Garbage (Control) Act, 1995 Himachal Pradesh Non-Biodegradable Garbage (Control) Rule, 1996
4. Depletion of benthic flora and fauna in wetlands/ reservoir/waterbody due to dredging/ desilting.	Biological Diversity Act, 2002 and Biodiversity Rules, 2004 Wildlife Protection Act,1972 and amendments National Biodiversity Action Plan, 2008 The Water (Prevention and Control of Pollution) Act 1974/1988 Himachal Pradesh Fisheries Act, 1976 Himachal Pradesh Fisheries Rules, 1979 Himachal Pradesh Fisheries (Fourth Amendment) Rules
5. Poor Enforcement of regulatory activities due to jurisdiction issues on account of unclear land tenure and other aspects related to fisheries.	National Forest (Conservation) Act, 1980 and subsequent amendments Wildlife Protection Act, 1972 HP Forest Sector Policy & strategy, 2005 National Wetlands Conservation Programme
6. Change in natural flow/hydrology and water dynamics of the reservoir/ wetland/ water body.	National Water Policy 2002 State Water Policy, 2002 (Draft) State Hydropower Policy, 2006
7. Uncontrolled/ unregulated tourism in the buffer zone leads to disturbance of fish feeding	Biological Diversity Act, 2002 and Biodiversity Rules, 2004 Wildlife Protection Act,1972 and amendments

Issues	Policy/Plan/Programme/Project
and breeding habitat.	Water (Prevention and Control of Pollution) Act 1974/1988 Himachal Pradesh Fisheries Act, 1976 Himachal Pradesh Fisheries Rules, 1979 Himachal Pradesh Fisheries (Sixth Amendment) Rules, 2008.

The cause and impacts/risks associated with the issues related to fisheries as identified in Box-3 and can be correlated with pressure on account of increasing gaps, lack of comprehensive fisheries policy at National and State level, tardy pace of implementation of programmes, plans and projects which further exacerbates issues related to and associated risks/ impacts. An analysis of the issues, causes and impacts has been carried out and summarised in Table -3.

Issues	Causes	Impacts/risks
1. Shrinking of Wetland/ degradation water body/reservoirs due to change in land use, human & livestock activities	Anthropogenic activities, unplanned urban and agricultural development, industries, road construction, impoundment, resource extraction and dredge disposal. Illegal encroachment because of unclear land tenure and lack of property rights of the wetland/ water body/reservoir and surrounding areas is the major reason for their shrinkage.	Loss of Eco-system function, fish species and productivity.
2. Agriculture- horticulture activities in the wetland/reservoir/ water body buffer zone, fringe areas and catchment areas	Shift in land use and agricultural production patterns in the catchment, buffer zone and fringe areas. It has been reported in Pong wetland report of forest department that the chemicals such as CAN, Urea, 12-32-16, DAP, Sulphur Phosphate and insecticides etc. pollute water for reservoir and deteriorates flora and fauna.	Potential health risk across the entire food chain. Fish mortality and decline in productivity. Bioaccumulation Fish Mortality
3. Poor surface water quality due to unrestricted dumping of sewage, solid wastes and toxic chemicals from households, tourists destination and industries which leads to water pollution and eutrophication of wetlands/water body/reservoir.	Infrastructure development and poor management of waste (municipal solid waste, Construction and demolition waste and waste water) in the catchment and in vicinity of wetland/water bodies/ reservoirs. Influx of organic waste Degraded catchment areas of wetlands leads to siltation Littering of non- biodegradable materials by pilgrims and tourists.	Impairment of water quality Loss of aquatic flora and fauna. Decrease in value of public amenities(tourism, recreation) Potential health risk across the entire food chain. Fish mortality and decline in productivity.
4. Depletion of benthic flora and fauna in wetlands/ reservoir/ water body due to dredging/desilting.	Introduction of invasive plant and fish species. In discriminate introduction of new species of fish for commercial exploitation, over harvesting of particular species and fishing methods.	Siltation and weed growth Damage to the function and health of wetlands by both introduced and invasive species. Local or regional fish species extinction and replacement by other fish species Disturbance to wetland/ ecology and food chain. Disruption of breeding and feeding of

Issues	Causes	Impacts/risks
		fish. Alteration in water flow & decrease in water retention leads to high TDS/turbidity and decreased oxygen level thereby increasing fish mortality.
5. Poor Enforcement o regulatory provisions	In discriminate angling hooking, netting, dynamiting and electrocuting have greatly affected the qualitative and quantitative availability of fish in the rivers, streams, lakes and reservoirs.	Loss of fish species. Ecological imbalance in aquatic flora and fauna including fisheries. Loss of wetland/water body/reservoir area due to institutional gaps. Deteriorate surface water quality. Further, due to reduction in the large-sized fish, fishing pressure has shifted to the juveniles.
6. Change in natural flow/ hydrology and water dynamics of the reservoir/ wetland/ water body	Construction of a large number of Dam reservoirs; diversion of streams and rivers and hydro-electric projects lead to reduced flow into wetlands/water bodies/reservoir. Further, release of impounded water by dam/reservoir depends on the management authority. Small hydro-power projects and other infrastructure development projects requiring water diversion also change the hydrology of the wetland/water body/ river.	Changes in hydrological regime leading to variation in ecology of the small stream/khud which in turn affects large streams and rivers. Ecological imbalance in aquatic flora and fauna including fisheries.
7. Disturbance to fish.	Unregulated tourism in the buffer zone due to water sports, fishing vessels and waste dumping in open. Change in fish feeding habit	Water, pollution leading to public health risk & safety issues. Disturbance in feeding and breeding of fish. Change in balanced proportion of species Organic waste pollution resulting in fish mortality

3.4 Horticulture

During the year 1950-51, the total area under all kinds of fruits was 792 ha, with an annual production of 1200 tonnes which has been increased to 1.92 lakhs ha with production reaching the figure of 6.96 lakhs MT in the year 2005-2006. The major environmental and social issues and problems related to horticulture in Himachal Pradesh are given below.

Predominant rain fed horticultural crops:
Rainfall is a crucial factor for the success of

crop production. In Himachal Pradesh 81.3 % of the area is still not irrigated and is totally rain dependent. The abnormal pattern of rainfall over the past few years has caused great fluctuations in crop production. The performance of crops is directly related to rainfall received during the crop season. The rainfall in different districts is shown in Table 4. It has shown variation in different districts, in some it was excess while in other it was deficient.

Table 4: District-wise Rainfall (in mm)

District	2005	2006	2007	2008	2009	2010
Bilaspur	724.8	1069.4	786.6	867.9	811.1	1079.7
Chamba	1,952.7	1583.7	706.4	857.2	1019.0	1117.5
Hamirpur	1,162.4	1570.0	1448.2	1414.6	1179.2	1247.1
Kangra	1,765.1	1930.0	1756.3	1947.9	1386.0	1619.6
Kinnaur	1316.4	348.6	310.9	354.1	269.4	1107.8
Kullu	992.2	814.8	886.6	1215.3	825.1	1732.5
Lahaul & Spiti	795.4	490.8	336.0	411.6	706.3	847.1
Mandi	1309.0	1313.3	1169.7	1173.8	775.0	1495.4
Shimla	1133.8	1177.1	967.4	1211.4	825.6	1272.3
Sirmaur	1244.4	1299.1	1431.0	1432.6	905.9	1896.9
Solan	921.6	829.8	1076.4	1368.2	862.8	1377.1
Una	956.8	69.2	1131.0	1437.4	1329.8	1182.3
HP	1189.6	1102.5	1000.5	1141.0	907.9	1242.8

Source: Statistical Outline HP-2010-11

Shift in cropping pattern by market driven forces:

According to Economic Survey, 2009-10, Himachal Pradesh has witnessed shifting of land use pattern from agriculture to horticulture (fruit crops) in the past few decades. The area under fruits, which was 792 ha in 1950-51 increased to 2,11,295 ha during 2010-11. During 2011-12, it was envisaged to bring 4,000 ha of additional area under fruit plants against which 4,328 ha of area was brought under plantations and 10.48 lakhs fruit plants of different species were distributed upto 31st December 2011. Area under apple has increased from 400 ha in 1950-51 to 3,025 ha in 1960-61 and 1,01,485 ha in 2010-11. The area under temperate fruits other than apple has increased from 900 ha in 1960-61 to 27,063 ha in 2010-11. Nuts and dry fruits exhibit area increase from 231 ha in 1960-61 to 11,022 ha in 2010-11, citrus and other sub tropical fruits have increased from 1,225 ha and 623 ha in 1960-61 to 21,588 ha and 49,420 ha in 2010-11, respectively. Unfortunately the production of other fruits has not steadily increased over the years.

Threats of wildlife to horticultural crops: In the past, wild animals used to feed on wild fruits and other natural food resources and did not interfere with the horticulture crops. However, due to increases in their population and decrease in their natural food resources, these wild animals move outside their natural

habitat resulting in human animal confrontation. Monkey sterilisation centres have been set up in the State to keep check on monkey population.

About 30,000 monkey have been sterilised and released so far.

Inadequate soil and water conservation measures: A study conducted by National Bureau of Soil Survey on 'Soils of Himachal Pradesh: Land capability classification and assessment of soil degradation status for suggested land use' established that only 21.4 percent of the State's land area was moderately and marginally suitable for growing climatically adopted crops.

HP Horticulture University, Solan, in a separate study 'Erodibility Status of Soils under different land uses in Shiwalik Hills of Himachal Pradesh' recommended that 'margin all and as such as barren and scrub lands in Shiwalik hills need special management practices for soil and water conservation to check further degradation. More effective oil and water resource conserving systems like agro-forestry, agri-horticulture, silvi-pasture, controlled and rotational grazing and enclosure of degraded sites for natural regeneration needs to be done. About 78 percent of the population in the State sustains on agriculture

or horticulture. Impact on 34 per cent soil is so immense that it is on the verge of losing its fertility. Use of agri-horticulture crop species can assist to promote soil conservation. Inadequacy of knowledge on this issue has not catalysed its wide spread usage.

Use of Agro Chemicals in horticultural crops: Widely used chemicals in the State include agriculture fertilisers (N+P+K), chemical pesticides fungicides and herbicides or weedicides. These are playing havoc because of their indiscriminate use, excessive quantities and sub standard quality or quantity. For pesticides, toxicity level is hardly taken care of. Substandard fungicides and pesticides are on sale because of their cheap rates and used by farmers in large amounts.

The use of fertilisers has increased in the State to a great extent since the late fifties and early sixties when fertiliser use was introduced in HP. Then onwards the use of fertilisers has been constantly increasing. The consumption of fertilisers in 1986-86 was 23,664 tonnes, which increased to 57,363 MT in 2008-09. The trend in the use of fertilisers is depicted in Table 5 below:-

Table 5: Consumption of fertiliser (in MT)

Year	Kharif (N+P+K)	Rabi (N+P+K)	Total
2004-05	18244	28009	46253
2005-06	19197	28776	47973
2006-07	18592	30389	48981
2007-08	20597	29361	49958
2008-09	23768	33595	57363
2009-10	20874	32364	53238
2010-11	19811	35322	55133

Source: Statistical Outline- HP, 2010-11

The use of pesticides has shown a sharp rise particularly in vegetable crops. There is also more use of herbicides or weedicides. The use of pesticides brings in two concerns (i) sub standard or outdated pesticides act as booster and not as killer and (ii) toxic residual effects remain unnoticed. Pesticides causes pollution from manufacturing, handling and during and

after application in the fields. Average use of pesticides is low in Himachal Pradesh but their use is high in areas where cash crops are grown. The trend indicates that cropping area decreased from 8% to a mere 2% under gram and lentil and rise of fertiliser and pesticides consumption has been reported.

Pesticides residues in the food items is reported to have increased in Himachal Pradesh with increasing use of pesticides which is growing at the rate of 10-15% per annum. In 1977-78, 50630 kgs. pesticides were used which went up to 260000 kgs. in 1995-96. In 1990, fruits & vegetables were grown on 1, 93, 490 ha of land and 97,500 kgs. pesticides were sprayed of which 65,000 kgs. was Mancozeb. Residues of various pesticides have been recorded in milk, milk products & various fruits from the fields in Shimla, Solan, Sirmaur, Bilaspur, Hamirpur, Una, Kangra, Kullu, Lahaul, Kinnaur & Chamba Districts for organochlorine, organophosphorus, carbamate, dodine etc.

Threat from obnoxious weeds: In the recent year, crop growing has faced a serious threat from rogues. These are Lantana, Ageratumconyzoides, Parthenium hysterophorus among plants and wild animals. Their population has increased tremendously but no data has been available on them.

Genetically modified seeds: There is a need of good quality seeds and disease-free planting material, including in-vitro cultured propagules, are essential for crop productivity and security for future. Hybrids are now becoming available for many crops. In the case of new varieties, foundation seeds would be provided to grass root level seed growers and their groups such as co-operative societies and SHGs. Mutually beneficial farmer-seed company partnerships should be encouraged. Agricultural and horticulture universities should be encouraged to organise courses on seed technology and business and

mainstream business principles in all applied courses. A national seed grid needs to be established to ensure supply of seeds across the State, as per the area specific requirement. There is a need to assess the risks and benefits associated with GM crops in a credible and transparent manner. Priority should be given for genetic modification to incorporate genes which can help impart resistance to drought, salinity and other stresses. Water-use efficiency as well as improvement of both nutritive and processing quality should also be accorded priority in the research agenda.

Training and awareness in agronomic management procedures in respect to GM crop/GM Seeds varieties should be introduced.

Low adoption of latest technology by farmers and deceleration in extension activities: Inadequacy of education and understanding of farmers has been instrumental in wrong and imbalanced applications of chemical fertilisers and usage of farm yard manure (FYM). The use of inferior quality or low dosage pesticides resulted in the evolution of new strains of crop insect- pests and diseases. The small and marginal farmers reveal that traditional varieties or crops could do better under adverse conditions than high yielding varieties or crops bred for better conditions. Besides this, the Department of Horticulture is also taking steps to introduce essential new technologies for the development of horticulture. Introduction of technologies like micro-irrigation, protected cover cultivation, use of bio- fertiliser in horticulture, improved horticulture tools, implements and machinery and field diagnostic facilities for diagnosing pathological and nutritional disorders are being promoted.

Generation of Waste due to spoilage/disposal of horticultural produce because of lack of Road & Transportation/storage facility: Hundreds of apple farmers are facing trouble

in Himachal Pradesh, as their produce is not able to reach markets on time due to bad road conditions. Due to delay in reaching the markets in Delhi and other cities, fruits get damaged. The storage of fruits and vegetables require special maintenance like temperature, relative humidity etc., without the maintenance of which the protection of produce during storage is difficult.

Freezing perishable commodities are generally high in water content and possess large, highly vacuolate cells. The freezing point of their tissues is relatively high (ranging from -3°C to -0.5°C) and disruption caused by freezing generally results in immediate collapse of their tissues and a total loss of cellular integrity. Freezing occurs in cold storage systems either due to inadequate refrigerator design or thermostat failure.

Chilling injury is manifested in a variety of symptoms including surface and internal discoloration, pitting, water soaking, failure to ripen, uneven ripening, development of off flavours and heightened susceptibility to pathogen attack.

Relative humidity (RH) RH can influence water loss, decay development, the incidence of some physiological disorders, and uniformity of fruit ripening. Condensation of moisture on the commodity (sweating) over long periods of time is probably more important in enhancing decay than is the RH of ambient air.

Drying: Inadequacy of moisture in apple, peach, plum, apricot and almond orchards because of inadequate snow and rain during this season is not good for the crops. The sudden rise in day temperature in March has further reduced the moisture content of the soil. About 81 percent of the total cultivated area in the State is rain fed.

Use of chemicals for enhancing the size, color and ripening of produce: Most farmers in

apple-growing areas are under pressure from middlemen to ensure regular supply of apple much before its due time as early arrival is highly remunerative. For this, they start ripening the fruit well in advance by using certain chemicals. For this, they are spraying an overdose of chemicals on the plants to enhance colour development (of the fruit) and to speed up its ripening process. Ethylene - a naturally occurring plant hormone - is a chemical commonly used by farmers to enhance colour development in apples. It is commonly available in the market under the brand names Ethephon and Ethereal. It is sprayed on the plant. Fruit colour starts developing nearly 15 to 20 days before attainment of maturity of fruits.

However, the Department of Horticulture is raising awareness among farmers about the need for adopting organic farming instead of chemical farming in apple orchards. Though use of chemicals stimulates or regulates various plant processes, including the flowering and shedding of leaves, its overuse at this stage (when the fruit is naturally attaining colour and ripening) has a negative impact both on the fruit and the plant.

Inadequate use of hi-tech Horticulture: Hi-tech horticulture is the deployment of modern technology, which is capital intensive, less environment dependent, having capacity to improve the productivity and quality of produce. Hi-tech interventions in horticulture are not new. The sector, by itself is highly technology driven, needs deployment of modern technologies like micro-propagation, micro-irrigation, protected cultivation, organic farming etc. which require skilled manpower as well as instruments. While the Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs) have been addressing the research and training aspects of hi-tech applications, some of them are introduced at the farmers' fields by the Department of Agriculture and Cooperation (DAC) since VIII Plan. Prominent among

these include micro-propagation, drip irrigation, green-house cultivation, plastic mulching, low tunnels, shading nets etc. The areas of hi-tech horticulture having scope for adoption are fertigation, use of bio-fertiliser, vermiculture, organic farming, hi tech mechanisation, soil-less culture, biological control. The Department of Horticulture is also promoting hi-tech-horticulture technologies like micro-propagation, micro-irrigation, protected cultivation, organic farming etc in the State.

Dwelling of Soil Health: - The soil Health State not only show deficiency of NPK (low to medium) but also of secondary nutrients (sulphur, calcium and magnesium) and micro nutrients (boron, zinc, copper, iron etc.). Besides, the three primary nutrients (N, P, K), deficiency of Sulphur and micro nutrients like zinc and boron is observed in many district areas like Shimla, and Bilaspur (Block-Jukhala). Intensive farming practices leave little time between harvesting of one crop and sowing of the next crop. As a result soils do not get adequate time to replenish its nutrient naturally, has caused second generation problems in respect of nutrient imbalance. Some such problems include:

- Emerging deficiencies of secondary and micro-nutrients,
- Decline of water table and its quality of water,
- Decreasing organic carbon content, and
- Overall deterioration in soil health

For the benefits of farmers, the Department of Agriculture has established 12 soil-testing labs and has also deployed 3 mobile soil-testing Vans. During the 11th Five Year Plan, the Department of Agriculture proposed to provide all the farmers in the State with soil health cards and it was proposed to distribute 125,000 number of soil health cards during Rabi and Kharif season 2010-11.

Suffering of farmers due to loss of crops on account of weather risk: Himachal Pradesh is a mountainous State comprising large Himalayan ranges with complex geological structures. The topography and climatic conditions make it particularly prone to natural disasters caused by drought avalanches, floods, cloud bursts/flash floods and glacial lake bursts etc. The extent of the damage caused by drought is given in Table 6.

Table 6: Damage Due to Drought Conditions in Himachal Pradesh

2000-01 (Rabi Season)	
Main Affected Crops	Qty. in (MT)
Damage of Horticulture Crops	226.34
During the year 2002-03 (Kharif Season)	
Damage of Horticulture Crops	225382
During the year 2002-03 (Kharif Season)	
Damage of Horticulture Crops	2.25

Source: State Environmental Report-HP

Poor post harvest management: Lack of sorting facilities, inappropriate packaging, slow transport systems and inadequate storage facilities add to the deterioration of these perishables. There are 11 grading and packing centres in Himachal Pradesh with an installed capacity of 37,500 tonnes. Grading is generally not followed at the producer's level. As a whole, grading facilities of the desired level have not been created. High post-harvest losses are due to:

- Lack of modern post harvest management system.
- Very high temperature differentials in the produce in areas and the consuming markets, especially for temperate fruits, during the marketing period.
- Highly perishable nature of most temperate fruits causing severe post-harvest losses during transport.

- Orchards located away from the main roads necessitating manual/ animal transportation of the produce.

It is difficult to maintain the quality and safety of horticulture crops during packaging. Packaging protects the produce from mechanical injury and contamination during marketing. Packaging accessories such as trays, cups, wraps, liners and pads used to help immobilise the produce within the packaging container while serving the purpose of facilitating moisture retention, chemical treatment and ethylene absorption.

Inadequate marketing and post harvest infrastructure: The agro- climatic conditions of North-western Hilly Region of India are conducive for cultivation of various fruits and vegetables and give very high returns to farmers as compared with traditional crops. But all these fruits and vegetables are highly perishable and require immediate disposal especially in absence of cold storages. This calls for elaborate arrangements for marketing of these perishables. Due to the increasing volume of production the marketing problems are aggravating. As regards to the post harvest facilities such as packing and grading houses and cold storage facilities, these appear to be not only awfully short but highly skewed as well. For example, total packing and grading (combined) houses capacity in the State stood at 25,000 metric tonnes. Of this, 80 percent of its packing & grading houses are found in Shimla District only, while remaining 20 per cent in Kullu District (Table). Here it is worth mentioning that though Shimla is the major apple producing district, but the same is grown in eight other districts of the State. In addition to this, grading houses with capacity of 6,000 metric tonnes with more equitable spread across apple producing areas also existed in the State. Another crucial component of infrastructural support for the production of fruits and vegetables is the existence of cold

storage facilities. Of the total cold storage capacity of 16,250 metric tonnes, fifty per cent lies outside the State in distant places such as Delhi, Chennai and Mumbai. If one excludes the exit point cold storage facility (18.46 percent) at Parwanoo in Solan District, then only about thirty percent of the total cold storage is within the State. Further, whatever is within the State, 80 percent set up in Shimla District only while nearly one-fifth

is found remaining 20% cold storage facilities are setup in

Kullu District. Thus, the fact that cold storage facilities are not only short to a large extent but also none existing in areas other than Shimla & Kullu Distt. points towards lack of adequate infrastructure. The distribution of post harvest facilities is given Table 7.

Table 7: Distribution of Post Harvest Facilities in Himachal Pradesh, 2005-06

Particulars	Total capacity (metric tonnes)	Capacity distribution (percent)					
		Shimla	Kullu	Sirmaur	Mandi	Kinnaur	Exit points
Packing and grading houses	25,000	80.00	20.00	-	-	-	-
Grading houses	6,000	16.67	16.67	16.67	33.33	16.67	-
Cold storages	16,250	24.62	6.15	-	-	-	18.46

Source:- State Agriculture Plan- HP

Impact of Climate change on horticultural crop: Studies by the Himachal Pradesh Agricultural University give some indications of higher than average impacts of climate change in the Himachal Pradesh uplands than on the lowlands. From the studies covering over 30 years of records, average air temperatures were found to be 0.7 to 2.4°C higher than that in the 1980s, as against the global average of 0.5°C; the Himachal Pradesh trend indicates an increase of 0.06°C per year. An analysis of rainfall data over the period 1976 to 2006 show increasing trends of rainfall in Lahaul, Spiti, Chamba and Kangra but decreasing trends in Solan and Kinnaur. Other districts showed no significant trends. Crops are showing shorter periods of flowering and maturity. The changes in climate are now affecting farmers. Low rainfall and reduced snowfall are affecting crops. Planting of winter crops is frequently delayed and affected by erratic rainfall. Higher temperature in cold-season

may lead to earlier ripening of annual crops, diminishing yields per crop but would allow locally for the growth of more crops per year due to lengthening of growing season. Winter chilling period helpful to exterminating the pests is likely to be reduced at high latitudes, resulting in greater crop losses and higher need for pest control. Higher temperature will allow for more plants growth at latitudes and altitudes. Soil, as a medium for plant growth, would be affected in several ways. Increased temperatures could lead to denitrification and more decomposition of soil organic matter.

Horticulture sector and cross sector policy and regulatory framework at State level shows the intent of the State Government to address inadequate service delivery in order to reduce the burden in the State. A mapping of the issues and policy and programme framework is described in Box 4.

Box 4: Policies mapped with the issues in health sector

Issues	Policy/Plan/Programme
1. Predominant rainfed horticultural crops	National Agriculture Policy, 2000 National Policy for Farmers, 2007 National Seed Policy, 2002

Issues	Policy/Plan/Programme
	The Seeds Act, 1966 The Seeds Rules, 1968 The Seeds (Control), Order, 1983 National Oilseeds and Vegetable Oils Development Board Act, 1983 (29 of 1983) The National Oilseeds and Vegetable Oils Development Board Rules, 1984 Pandit Deen Dayal Kisan Bagwan Samridhi Yojna Diversification of Crops Programme (Government of India and JICA) Quality Seed Multiplication and Distribution (Cereals, Pulses, and Vegetables)
2. Shift in cropping pattern by market driven forces	National Agriculture Policy, 2000 National Policy for Farmers, 2007
3. Threats of wildlife to horticultural crops	Wildlife Protection Act, 1972 National Afforestation Programme
4. Inadequate soil and water conservation measures	The Forest (Conservation) Act, 1980 The Water (Prevention & Control) of Pollution Act, 1974 Soil and Water Conservation Programme Integrated Waste Land Development Programme (National Wasteland Development Board), 1989 Grassland eco-system and grazing policy Grazing policy National Watershed Development Project for Rain Fed Areas (NWDPA) Land reforms
5. Use of Agro Chemicals in horticultural crops	IPM Act & Regulation 2004 Insecticides Act, 1968 The HP Agricultural Pests, diseases & Noxious Weeds Act, 1969 Fertiliser Control Order, 1985 Destructive Insects and Pests Act, 1914 Promotion of integrated pest management Establishment of plant health clinics Establishment of tissue/leaf analysis laboratories The Environment (Protection) Act, 1986 National Environment Policy, 2006 The Water (Prevention & control) of Pollution Act, 1974 Fruit Protection Act, 1935 The Air (Prevention & Control) of Pollution Act, 1981
6. Threat from obnoxious weeds	The Himachal Pradesh Agricultural, Pests, Diseases and Noxious Weeds Act,
7. Genetically modified seeds	National Agriculture Policy, 2000 National Policy for Farmers, 2007 National Horticulture Mission
8. Low adoption of latest technology/ hitech horticulture by farmers and deceleration in extension activities	National Policy on Education, 1986. Promotion And Strengthening of Agricultural Mechanisation through Training, Testing and Demonstration Educational Technology Programme District Institutes of Education and Training (DIETs) Sarva Shiksha Abhiyan Pradhan Mantri Gramodya Yojana (PMGY) Technical Education Quality Improvement Project Sectoral Perspectives and Development Strategy for Education Training of Farmers through short term training camps and training courses Exposure visits of farmers within and outside the State. National Agriculture Policy, 2000 Organisation of seminars and workshops National Policy for Farmers, 2007

Issues	Policy/Plan/Programme
9. Generation of Waste due to spoilage/disposal of horticultural produce because of lack of Road & Transportation/ storage facility	Fruit Protection Act, 1935 Fruit Product Order (FPO), 1955 The Essential Commodities Act, 1955 Fruit Nurseries Registration Act, 1973 The Himachal Pradesh Warehouses Rules, 1987 The Himachal Pradesh Warehouses Act, 1976 The Himachal Pradesh Holdings (Consolidation & Prevention of Fragmentation) Act, 1971 Fruit Processing Programme Area expansion Programme Horticulture Development Scheme Post harvest handling and cold chain management and procession
10. Use of chemicals for enhancing the size, color and ripening of produce	IPM Act & Regulation, 2004 Insecticides Act, 1968 The HP Agricultural Pests, Diseases & Noxious Weeds Act, 1969 Fertiliser Control Order, 1985 Destructive Insects and Pests Act, 1914 Promotion of Integrated Pest Management Establishment of plant health clinics Establishment of tissue/ leaf analysis laboratories The Environment (Protection) Act, 1986 National Environment Policy, 2006 The Water (Prevention & control) of pollution Act, 1974 Fruit Protection Act, 1935 The Air (Prevention & Control) of pollution Act, 1981
11. Inadequate use of hi- tech Horticulture	National Agriculture Policy, 2000 National Policy for Farmers, 2007
12. Dwindling soil health	The Forest (Conservation) Act, 1980 The Water (Prevention & Control) of Pollution Act, 1974 Soil and Water Conservation Programme Integrated Waste Land Development Programme (National Wasteland Development Board), 1989 Grassland Eco-system and Grazing policy Grazing policy National Watershed Development Project for Rain Fed Areas (NWDPR)
13. Suffering of farmers due to loss of crops on account of weather risk	National Agriculture Policy, 2000 National Policy for Farmers, 2007
14. Poor post harvest management	National Horticultural Mission (NHM) was launched in 2005. The mission adopts a cluster approach and promotes specific commodities in specific regions Subsidy is extended to farmers for adopting the crop and for greenhouses, organic certification and training. Subsidies are also offered to other private agents for creating nurseries, seed production, seed infrastructure, and post-harvest infrastructure Financial assistance is also given to research institutions for horticulture related research The Himachal Pradesh Agricultural and Horticultural Produce Marketing (Development and Regulation) Act, 2005
15. Inadequate marketing and post harvest infrastructure	The Himachal Pradesh Agricultural and Horticultural Produce Marketing (Development and Regulation) Act, 2005 Himachal Pradesh Agricultural Produce Markets Act, 1969 Agricultural Produce (Grading & Marking) Act, 1937 Agriculture Produce Marketing Committee (APMC) Model Act, 2003 The Agricultural and Processed Food Products Export Development

Issues	Policy/Plan/Programme
	Authority Act, 1985 Agricultural Produce (Grading and Marking) Act, 1937 (Act No. 1 of 1937) as amended up to 1986 Improving markets and incentives Survey of Markets under market intelligence scheme
16. Impact of Climate change on horticultural crop	The Ozone Depleting Substances (Regulation And Control) Rules, 2000 The Environment (Protection) Act, 1986 National Environment Policy, 2006

Pressure on account of increasing gaps and slow implementation of policy, programmes, plans and projects is leading to emergence of sector specific issues and risks/impacts. An analysis of the issues, causes and impacts has been carried out and summarised in Table 8.

Table 8: Issues, Causes and Impacts

Issues	Causes	Impacts/Risks
1. Predominant rainfed horticultural crops	Irrigated area is 19% 81% area is rainfed Abnormal pattern of rainfall Hilly Terrain Limited Water Resources Improper Management of resources	Low productivity Increased incidences of disease and pest infestation Excessive dependency on Rainfall for irrigation Frequent crop failure
2. Shift in cropping pattern by market driven forces	Diversification to vegetable and floriculture Instatncash/monetary gain based agriculture Higher production	Dwindling soil health due to intensive cultivation. Nutritional value decreased. Prone to Pest/Insect attack
3. Threats of wildlife to horticultural crops	Enhancement in fight for food Destruction of natural habitat Disturbance due to increased anthropogenic activities	Impact to crop production Destruction of crops by wild animals Degradation of water and soil Risk to human and domestic animals Human Animal Confrontation
4. Inadequate soil and water conservation measures	Soil and water erosion due to sloppy land and less depth Lack of vegetation cover in catchment area Growing flood menace due to high intensity of rainfall	Sheet, rill and gully erosion Loss of soil fertility Low productivity Desertification
5. Use of Agro Chemicals in horticultural crops	Inadequate awareness High Production Requirement Higher Monetary gains Higher pest/ insect infestation	Loss of useful microbial flora & fauna. Application of agrochemicals may result in ground water contamination. Risk to human and animal health. Bio accumulation
6. Threat from obnoxious weeds	Outflow of weeds through rain, wind irrigation water, animals, birds etc. High resistant species	Adversely affecting yields of horticultural crops & soil fertility Reduction in cropped Area Increased disease and pest infestation by acting as alternate host crops Encroachment into field
7. Genetically modified	Inadequate information.	May affect existing

Issues	Causes	Impacts/Risks
seeds	Large scale testing is not being carried out/ conducted before recommending GM seeds	germplasms May destroy ext.. varieties of crops
8. Low adoption of latest technology/ Hitech by farmers and deceleration in extension activities	Low purchasing power Small land holding Incompatibility of technology developed at research station vis- a-vis farmer's field Low awareness & confidence on the newer technologies developed	Low productivity of fruit and vegetable crops Increased pressure on production to meet the growing demand Increased use of pesticides
9. Generation of waste due to spoilage/ disposal of horticultural produce because of lack of road & transportation/ storage facility	Lack of infrastructure facility particularly primary processing Delay in access to the market due to lack of post harvest storage/ transportation facility Improper packaging Losses in processing and handling Freezing/ chilling injury Lack of cold storage facility locally	Reduced income due to loss of produce Pollution due to disposal on land/ water. Increased public/ animal health risk. Spread of vector borne diseases
10. Use of chemicals for enhancing the size, color and ripening of produce	For high revenue generation Short term Economic benefits	Ground water contamination, to human and animal health
11. Inadequate use of hi tech Horticulture	Poor purchasing power of the farmers. Ignorance of the farmers about adoption of such need based technology for generation of higher income	Failure of the high value crops due to unforeseen circumstances
12. Dwindling soil health	Long duration fruit crops and continuous cropping of vegetable crops Low use of organic matter Excessive use of chemical fertilizer for higher production	Poor soil health leading to low productivity Increase in cost of cultivation Soil erosion Desertification
13. Suffering of farmers due to loss of crops on account of weather risk	Frequent occurrence of natural calamities like drought, cloud bursts, heavy rains, hailstorms and fluctuation in temperature Change in overall weather pattern due to anthropogenic/ development activities	Results in problems of soil erosion lesser and water retention Loss of fertile soil Impaired quality and quantity of production
14. Poor post harvest management	Lack of awareness about sanitary conditions to handle produce Lack of integrated handling system to manage produce Improper storage, drying, grading practices at farm level Lack of processing/storage facilities/ orchard management	Loss of produce/ loss of revenue Input Resource loss like fertilizer, soil nutrients and water Increased health risk
15. Inadequate marketing and post harvest infrastructure	Inadequate investment	Unremunerative price Low returns and losses Unorganised producers Slow rate of growth & greater losses
16. Impact of Climate Change on horticultural crop	Global Warming Aberration in weather Heavy Deforestation Industrialization	Introduction/ extinction of new flora and fauna More biotic and abiotic stresses on crops Uncertainty in yields of horticultural crops

3.5 Agriculture

Agriculture in the State of Himachal Pradesh, though it has made good headway, faces several challenges in the absence of scientifically sound policy guidelines since 1948 onwards when the State had its own Department of Agriculture. For instance, the workers of the agriculture department laid much stress on using high yielding varieties (HYVs) and use of fertilisers and pesticides resulting in loss of area under crops like gram, mash, bean, mung, horse gram (Kultha) etc. and highly drought resistant crop varieties such as Rohru dhan, Ridley wheat and there was significant reduction in diversity at crop and variety levels. The major issues in agriculture are discussed below.

Predominant rainfed agriculture: Rainfall plays a crucial role in the agricultural crop production in Himachal Pradesh as 81.3 % of the area is still not irrigated and is totally rain dependent. The abnormal pattern of rainfall over the past few years has caused great fluctuations in crop production. Crop yield is directly related to on time rainfall received during the crop season. The change in rainfall pattern has been observed weather in the districts in higher Himachal distt. like Kinnaur, Lahaul Spiti and Chamba has received lesser rain while distt. in the lower belt of Himachal has recived more rainfall during the period 2005-10.

Table 9: District-wise Rainfall (in mm)

District	2005	2006	2007	2008	2009	2010
Bilaspur	724.8	1069.4	786.6	867.9	811.1	1079.7
Chamba	1,952.7	1583.7	706.4	857.2	1019.0	1117.5
Hamirpur	1,162.4	1570.0	1448.2	1414.6	1179.2	1247.1
Kangra	1,765.1	1930.0	1756.3	1947.9	1386.0	1619.6
Kinnaur	1316.4	348.6	310.9	354.1	269.4	1107.8
Kullu	992.2	814.8	886.6	1215.3	825.1	1732.5
Lahaul & Spiti	795.4	490.8	336.0	411.6	706.3	847.1
Mandi	1309.0	1313.3	1169.7	1173.8	775.0	1495.4
Shimla	1133.8	1177.1	967.4	1211.4	825.6	1272.3
Sirmaur	1244.4	1299.1	1431.0	1432.6	905.9	1896.9
Solan	921.6	829.8	1076.4	1368.2	862.8	1377.1
Una	956.8	69.2	1131.0	1437.4	1329.8	1182.3
HP	1189.6	1102.5	1000.5	1141.0	907.9	1242.8

Source: Statistical Outline HP-2008-09

Shift in cropping pattern by market driven forces and climate change: Shift from traditional cereal crops to cash crops influenced by market driven forces and climate change. Though, soil productivity has declined, increase of 18% area under vegetables and fruits has been recorded. According to a report published in the year 2000, the field studies in districts of Bilaspur, Hamirpur, Kangra, Sirmaur, Shimla and Solan reported that, with the provision of irrigation, there are clear cut shift in the cropping pattern. The major shift is from cereal crops

to vegetable crops. Besides, multiple cropping has been introduced in irrigated areas. The crops which are replacing traditional crops are generally cash crops and have become a predominant factor in small farm management to earn cash in order to meet their input requirements and family monetary needs. However, in certain situations this trend may be detrimental to meet food demands. Challenges in practicing and maintaining traditional mixed cropping and mixed farming is due to growing trend of raising single crop (mono-cropping) which is

good for commercial perspectives but not for sustainable farming. Since traditional cropping practices and animal husbandry tradition is on decline, it is challenging to sustain farm income and achieving self sufficiency. This

will have an overall long term repercussion on farm income, employment and farm based livelihoods.

Table 10: Season-wise shift in cropping pattern

Sr. No.	Traditional crop	% area	Replacing crop	% area	Trends in shift
(a) Kharif Season					
1.	Maize	65	Vegetable	10	Area reduced to 55% in the mid hill zone.
2.	Paddy	20	Vegetable	5	Yield of paddy crop increased by about 75% to 100%.
3.	Pulses	5	-	5	No change.
4.	Vegetables	5	Vegetable	18	Considerable increase in area, crops grown include tomato, beans, capsicum, aubergine, ginger.
5.	Cereals	5	Green forage	7	The increase in area was due and soybean was a replacement to cereals again. The area under Soybean has increased.
(b) Rabi Season					
1.	Wheat	75	Vegetables	10	Potato, peas, aubergine are becoming popular.
2.	Barley	8	Pea	3	Barley cultivation in traditional areas may be considerably reduced.
3.	Rape seeds and mustard	2	Toria	3	Small increase in area may further rise as a cash crop.
4.	Vegetables	3	Vegetables	18	The replacing crops are mainly due to the rise in area under cabbage, cauliflower, peas and radish.
5.	Gram and Lentil	8	Gram and Lentil	2	Area decreasing.
6.	Fodder and Berseem	4	Fodder and Berseem	6	Area is increasing because pastures abandoned.

Source: State of Environment Report of HP (year not mentioned)

Inadequate soil and water conservation measures: Agriculture in the Himachal hills is practiced on 5% to over 30% slopes coupled with heavy rainfall resulting in severe soil erosion. Little effort has been made to conserve the water in streams, rivers or rivulets. Inundation of forest areas and inadequacy of vegetation cover in catchment areas is increasing the problems of low productivity of soils as well as observation of natural water sources. Almost all areas in the State are subject to sheet erosion but the foothills and valleys are subject to the

formation of severe gullies .The upper fertile soil is drained away and the under lying layers slowly become unfit for cultivation. The intensity of soil erosion ranges from 14.7% to 24% and occurs both in arable & non arable lands. Inadequacy of soil and water conservation measures is also manifested in loss of soil fertility and growing flood menace which is leading to deteriorating soil and water conditions. Impact of ineffective soil and water conservation impact is visible as silting of hydroelectric dam reservoir and reduced in cultivable area which are indicated

by reduction of projected dam life, decline in agricultural production and crop failures due to drought spells.

Source: - State of Environment Report-HP (Year not mentioned)

Use of agro chemicals in agriculture: Widely used chemicals in agriculture include agriculture fertilizers (N+P+K), chemical pesticides fungicides and herbicides or weedicides. These chemicals are playing havoc due to their indiscriminate use in excessive quantities and substandard quality due to substandard fungicides and pesticides are high on sale because of their cheap rates and are used in large by the unaware without knowing the impact on quality of crop production and health farmers. The use of fertilisers has increased production in the State to a great extent since the late fifties and early sixties when fertilizer use was introduced in HP. Then onwards the use of fertilizers has constantly increased. The consumption of fertilizers in the year 1986-87 was 23,664 tonnes which has increased to 57,363 MT by the year 2008-09. The consumption of fertilizer has doubled. The trend in the use of fertilisers is depicted in Table 11.

Table 11: Consumption of Fertiliser (in MT)

Year	Kharif (N+P+K)	Rabi (N+P+K)	Total
2004-05	18244	28009	46253
2005-06	19197	28776	47973
2006-07	18592	30389	48981
2007-08	20597	29361	49958
2008-09	23768	33595	57363
2009-10	20874	32364	53238
2010-11	19811	35322	55133

Source: Statistical Outline- HP, 2010-11

The use of pesticides has shown a sharp rise particularly in vegetable crops. There is also more use of herbicides or weedicides. The use of pesticides brings in two concerns (i) sub standard or outdated pesticides act as booster and not as killer and (ii) toxic residual effects remain unnoticed. Higher use of pesticides causes pollution both during manufacturing &

process of handling and application in the field. Average use of pesticides is low in Himachal Pradesh but their use is high in areas where cash crops are grown. The trend indicates that cropping area decreased from 8% to a mere 2% under gram and lentil and there was a rise of fertiliser and pesticides consumption.

Pesticides residues in food products/crops in Himachal Pradesh is increasing because use of pesticides is increasing at the rate of 10-15% per annum. In 1977-78, 50630 kgs. pesticides were used which went up to 2,60,000 kgs. in 1995-96. In 1990, fruits & vegetables were grown on 1,93,490 ha of land and 97,500 kgs. pesticides were sprayed of which 65,000 kgs. was Mancozeb. Residues of various pesticides have been recorded in milk, milk products & various fruits from the fields in Shimla, Solan, Sirmaur, Bilaspur, Hamirpur, Una, Kangra, Kullu, Lahaul, Kinnaur & Chamba Districts for organochlorine, organophosphorus, carbonate, dodine etc.

Besides, the chemicals are washed away by rainwater which percolates through the soil and contaminate water sources as well as fodder and feed sources. From all these sources, pesticide residues enter the body of animals and human beings when it gets accumulate. It has been found that 70% of the vegetables sold in the market are contaminated with pesticides and the toxic residues contained in them are higher than the safe limits. For instance onion contained toxic residues in over 92% samples, lady's finger contained in 78% samples, potato and tomato had residues in over 51% samples and 74% samples of aubergine (brinjal), 62% samples of cabbage, 58% samples of cauliflower and 48% samples of spinach contained toxic residues in the market which enter in human body every day. In one study, it was found that sixteen samples of flour from the branded companies contained toxic residues of DDT, Aldrin and Lindane beyond safe limits. The chemical load in fruits may also be

found, as fruits like apple receive a heavy schedule of pesticide/fungicide sprays in the orchards.

Threat from Obnoxious weeds and wild animals: In the recent year, crop growing has faced a serious threat from weed plants such as. *Lantana camara*, *Ageratum conyzoides*, *Parthenium hysterophorus* among plants and wild animals. Their population has increased tremendously but no data has been available on them.

Low adoption of latest technology by the farmers: Hi-tech agriculture is the deployment of modern technology, which is capital intensive, less environment dependent, to improve the productivity and quality of produce. Hi-tech interventions in agriculture are not new. The sector, by itself is highly technology driven, needs deployment of modern technologies like micro-propagation, micro irrigation, protected cultivation, organic farming etc. which require skilled manpower as well as instruments. While the Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs) have been addressing the research and training aspects of hi-tech applications, some of them are introduced at the farmers' fields by the Department of Agriculture and Cooperation (DAC) since VIII Plan. Prominent among these includes micro-propagation, drip irrigation, green- house cultivation, plastic mulching, low tunnels, shading nets etc. The areas of hi-tech agriculture having scope for adoption are fertigation, use of bio-fertiliser, vermiculture, organic farming, hi-tech mechanisation, soil-less culture, biological control. Besides this, The Department of Agriculture is also taking steps to introduce essential new technologies the development of agriculture. Introduction of technologies like micro- irrigation, protected cover cultivation, use of bio-fertiliser in agriculture, improved agriculture tools, implements and machinery and field diagnostic facilities for

diagnosing pathological and nutritional disorders are being promoted.

Dwindling soil health: The State soils not only show deficiency of NPK (low to medium) but also of secondary nutrients (sulphur, calcium and magnesium) and micro nutrients (boron, zinc, copper, iron etc.) in most parts of the State. Besides the three primary nutrients (N, P, K), deficiency of sulphur and micro nutrients like zinc and boron are found in many districts like Shimla, and Bilaspur (Block-Jukhala). Intensive farming practices leave little time between harvesting of one crop and sowing of the next. As a result soils do not get adequate time to replenish its nutrients in a naturally, and has caused second generation problems in respect to nutrient imbalance. Some such problems include:

- Emerging deficiencies of secondary and micro nutrients
- Decline of water table and its quality of water
- Decreasing organic carbon content, and
- Overall deterioration in soil health

For the benefits of farmers the Department of Agriculture has established 12 soil-testing labs and has also deployed 3 mobile soil-testing vans labs. During the 11th Five Year Plan, the Department of Agriculture proposed to cover all the farmers in the State with soil health cards and it is proposed to distribute 1, 25, 000 number of soil health cards during Rabi and Kharif Season (2010-11).

Suffering of farmers due to crops losses on account of weather risk: Himachal Pradesh is a mountainous State comprising large Himalayan ranges with complex geological structures. The topography and climatic conditions make it particularly prone to natural disasters caused by avalanches, floods, cloud bursts/flash floods, glacial lake bursts etc.

Table 12: Damage Due to Drought Conditions in Himachal Pradesh

2000-01 (Rabi Season)	
Main Affected Crops	Qty. in (MT)
Damage of Agriculture Crops	411.00
2002-03 (Kharif Season)	
Damage of Agriculture Crops	612393
2002-03 (Kharif Season)	
Damage of Agriculture Crops	356.02

Source: State of Environment Report-HP

Inadequate marketing and post harvest infrastructure: The agro- climatic conditions of North-western Hilly Region of India are conducive for cultivation of various fruits and vegetables which give very high returns to farmers as compared to traditional crops. But all these fruits and vegetables are highly perishable and require immediate disposal especially in absence of cold storages. This calls for elaborate arrangements for marketing of these perishables. Due to the increasing volume of production the marketing problems are aggravating. As regards to the post harvest facilities such as packing and grading house and cold storage facilities, these appear to be not only awfully short but highly skewed as well. For example, total packing and grading (combined) houses capacity in the State stood at 25,000 metric tonnes. Of this, while 80 per cent of its

packing and grading houses found in Shimla District, while, remaining 20 per cent table in Kullu District (Table). Here it is worth mentioning that though Shimla is the major apple producing district, but the same grown in eight other districts of the State. In addition to this, grading houses with capacity of 6,000 metric tonnes with more equitable presence across apple producing areas also existed in the State. Another crucial component of infrastructural support for the production of fruits and vegetables is the existence of cold storage facilities. Of the total cold storage capacity of 16,250 metric tonnes, fifty percent cold storage facilities are located outside the State in distant places such as Delhi, Chennai and Mumbai. If one excludes the exit point cold storage facility (18.46 per cent) at Parwanoo in Solan district, then only about thirty per cent of the total cold storage is within the State of which 80 per cent facilities are found in Shimla District only while remaining 20 per cent cold storage facilities are established in Kullu District. Thus, the fact that cold storage facilities are not only short to a large extent but also non existing in areas other than Shimla & Kullu distt. points towards lack adequate infrastructure.

Table 13: Distribution of Post Harvest Facilities in Himachal Pradesh, 2005-06

Particulars	Total capacity (metric tonnes)	Capacity distribution					
		Shimla	Kullu	Sirmaur	Mandi	Kinnaur	Exit points
Packing and grading houses	25,000	80.00	20.00	-	-	-	-
Grading houses	6,000	16.67	16.67	16.67	33.33	16.67	-
Cold storages	16,250	24.62	6.15	-	-	-	18.46

Source: State Agriculture Plan- HP

Increasingly small holdings may lead to non-cultivable land: Agriculture is the main occupation of the people of HP. It has an important place in the economy of the State. It provides direct employment to 69% of the

total workers of the State. About 16% of the total GSDP comes from the agriculture and its allied sectors. Out of the total geographical area of 55.67 lakhs ha the area of operational holdings is about 9.68 lakhs ha and is

operated by 9.33 lakhs farmers. The average holding size comes to 1.04 ha. Distribution of land holdings according to 2005-06 Agricultural Census shows that 87.03% of the total holdings are of small and marginal

farmers. 12.54% of holdings are owned by semi medium/medium farmers and only 0.43% by large farmers.

Table 14: Distribution of Land Holdings

Size of Holdings (ha)	Category (Farmers)	No of Holdings in (Lakh)	Area (lakh ha)	Av. Size of holding (ha)
Below 1.0	Marginal	6.36 (68.17%)	2.58(26.65%)	0.41
1.0-2.0	Small	1.76(18.86%)	2.45(25.31%)	1.39
2.0-4.0	Semi Medium	0.88(9.43%)	2.40(24.79%)	2.73
4.0-10.0	Medium	0.29(3.11%)	1.65(17.05%)	5.69
10.0-Above	Large	0.04(0.43%)	0.60(6.20%)	15.00
Total		9.33	9.68	1.04

Source: Economic Survey of HP-2008-09

The majority of people suffer from scarcity of resources and that too when about 81.5% of the total cultivated area is rainfed. Resource scarcity prevents them to invest in agriculture and taking full advantage of modern agriculture. The small holdings have become non-profitable due to high input costs in the present situation. Further, progressive fragmentation of agricultural lands is leading to non-subsistence farming and increase in unemployment. It has caused 5% rise in unemployment during 1999 to 2003 and 105% increase from 1990 taken as base year. This has resulted in migration of rural people to urban area in search for alternate occupations. Inheritance laws have promoted further fragmentation which is also responsible for migration of rural people to urban areas for livelihood.

Impact of Climate change on agriculture: Studies by the Himachal Pradesh Agricultural University give some indications of higher than average impacts of climate change in the Himachal Pradesh uplands than on the lowlands. From the studies covering over 30 years of records, average air temperatures in the State found to be 0.7 to 2.4°C higher than that in the 1980s, as against the global average of 0.5°C, Himachal Pradesh trend lines indicate an increase of 0.06°C per year. An

analysis of rainfall data over the period of 1976 to 2006 show increasing trends of rainfall in Lahaul, Spiti, Chamba and Kangra but decreasing trends in Solan and Kinnaur while other districts had no significant trends. Rise in temperature has lengthened the warmer period and short end the flowering and ripening period of crops due to which farmers opting for harvesting two crops during the period, however winter period have shortened and planning of winter crops have delayed. The climatic change with erratic rainfall/snowfall has affected crop production farmer community adversely.

Winter chilling period which is helpful in killing of pest naturally is likely to be reduced at high latitudes, resulting in greater pest infestation and higher need for pest control. Higher temperature will allow more plants growth and soil, as a medium for plant growth, would be affected in several ways. Increased temperatures could lead to denitrification and more decomposition of soil organic matter.

Agriculture sector and cross sector policy and regulatory framework at State level shows the intent of the State Government to address inadequate service delivery in order to reduce burden on the State resources. A mapping of

the issues and policy and programme framework is described in Box 5.

Box 5: Policies mapped with issues in Agriculture Sector

Issues	Policy/Plan/Programme
1. Predominant rainfed agriculture	National Agriculture Policy, 2000 National Policy for Farmers, 2007 National Seed Policy, 2002 The Seeds Act, 1966 The Seeds Rules, 1968 The Seeds (Control) Order, 1983 National Oilseeds and Vegetable Oils Development Board Act, 1983 (29 of 1983) The National Oilseeds and Vegetable Oils Development Board Rules, 1984 Pandit Deen Dayal Kisan Bagwan Samridhi Yojna Diversification of Crops Programme (Government of India and JICA) Quality Seed Multiplication and Distribution (Cereals, Pulses, and Vegetables)
2. Shift in cropping system by market driven forces and climate change	National Agriculture Policy, 2000 National Policy for Farmers, 2007
3. Inadequate soil and water conservation measures	National Agriculture Policy, 2000 National Environment Policy, 2006 Agriculture Produce Marketing Committee (APMC) Act The Agricultural and Processed Food Products Export Development Authority Act, 1985 Agricultural Produce (Grading and Marking) Act 937 (Act No. 1 of 1937) as amended up to 1986. The Himachal Pradesh Agricultural & Horticultural Produce Marketing (Development & Regulation Act) 2005 Agriculture marketing through APMC Integrated Watershed Management Programme (IWMP) Rashtriya Krishi Vikas Yojana, 2007
4. Use of Agro Chemicals in agriculture	National Agriculture Policy, 2000 Fertiliser Control Order, 1985 Insecticide Act, 1968 Organic Farming
5. Threat from Obnoxious weeds	National Agriculture Policy, 2000 National Water Policy, 2002 State Water Policy (undated) Rural Infrastructure Development Fund (Minor Irrigation and Water Harvesting Schemes)
6. Low adoption of latest technology by the farmers	National Agriculture Policy, 2000 National Policy for Farmers, 2007 Destructive Insects and Pests Act, 1914 The Himachal Pradesh Agricultural Pests, Diseases & Noxious Weeds Act, 1969 Plant Quarantine (Regulation of Import into India) Order 2003
7. Dwindling soil health	National Agriculture Policy, 2000 Integrated Watershed Development Programme (IWMP)
8. Suffering of farmers due to losses of crops on account of weather risk	National Agriculture Policy, 2000 National Policy for Farmers, 2007 National Mission for Sustainable Agriculture under NAPCC
9. Inadequate marketing and post harvest infrastructure	National Agriculture Policy, 2000 Kisan Mitra - a scheme under twenty points programme

Issues	Policy/Plan/Programme
10. Increasingly small holdings may lead to non- cultivable land	National Agriculture Policy, 2000 The Himachal Pradesh Holdings (Consolidation & Prevention of Fragmentation) Act, 1971
11. Impact of Climate change on agriculture	National Agriculture Policy, 2000 National Policy for Farmers, 2007 The Himachal Pradesh Agricultural & Horticultural Produce Marketing (Development & Regulation Act) 2005 National Mission for Agriculture Under NAPCC Integrated scheme for oil seeds, pulses, oil palm and maize

Pressure on account of increasing threats and slow pace and inadequate implementation of policy, programmes, plans and projects is leading to emergence of sector specific issues and risks/impacts. An analysis of the issues, causes and impacts has been carried out and summarised in Table 15.

Table 15: Issues, Causes and Impacts

Issues	Causes	Impacts/Risks
1. Predominant rainfed agriculture	Irrigated Area is 19 % only abnormal pattern of rainfall Non-availability of water sources due to hilly terrain Tough Hill Terrain Scattered habitation requiring high capital investment for irrigation projects	Frequent Crop failures Vegetable due to erratic rainfall and climate change Low productivity / crop yield
2. Shift in cropping system by market driven forces.	Cereal- legume cropping system to vegetable crop for increased income. Increased availability of irrigation water. Climate Change Low crop yield from traditional crops	Impact on soil health Reduction of area under Food Crops / Food insecurity Inflation In discriminate use of pesticides for higher crop production
3. Inadequate soil and water conservation	Excessive exploitation of resources Soil and water erosion due to sloppy land, poor texture and less soil depth Lack of vegetation cover in catchment area. Growing flood menace due to high intensity of rainfall.	Sheet, rill and gully erosion. Low productivity. Washing away of cultivable area. Cultivation of crops on high slope (> 30 %) Land degradation
4. Use of Agro Chemicals in agriculture	Less effective implementation of Environment- Management Programme of project Inadequate awareness. Higher crop production from cash crops	Loss of useful microbial flora in soil Adverse impact on environment. Ground water contamination and risk to human health due to residual effect and bio accumulation through food chain.
5. Threat from obnoxious weeds	Varied seed disposal & plant propagation medium Outflow of weeds through rain, wind, irrigation water, cattle, birds etc. Import of exotic weeds with	Adversely affecting crop yields, pasture lands & soil fertility Damage in crop area. Poisonous to human & animals. Environmental degradation.

Issues	Causes	Impacts/Risks
6. Low adoption of latest technology by the farmers	seeds, saplings imported More resistant to weedicides Incompatibility of technology developed at research station vis-a-vis farmer's field. Lack of awareness. Poor financial conditions. Lack of confidence on the technology provided	Low crop productivity and farm income. Higher input requirement Demand rise
7. Dwindling soil health	Continuous cropping, intensive No period for replenishment of nutrient Low use of organic matter. Excessive use of fertilizers & chemicals	Poor soil health leading to low productivity Increase in cost of production Food insecurity
8. Suffering of farmers due to crop losses on account of weather risk	Frequent occurrence of natural calamities like drought, cloud bursts, heavy rains, hailstorms, temperature fluctuations, frost	Result in lot of problems of soil and water erosion Productive soil is lost Loss to the crops and quality of produce is affected. Loss to productive soil
9. Inadequate marketing and post harvest infrastructure	Inadequate investment. Inaccessibility of production area. Difficult topography. Lack of knowledge about modern system of marketing.	Unremunerative price to farmers Low returns due to inefficient marketing Unorganised producers. Loss in quality of produce. Damage.
10. Increasingly small holdings may lead to non-cultivable land	Average size of land holding is 1.1 ha and may further go down in view of fragmentation of land holdings	Subsistence farming results in unemployment. Low crop yields Increase in current fallows food security issues
11. Impact of climate change on agriculture	Global warming Aberration in weather In dust realization Deforestation Population growth Air Pollution	Introduction/extension of new flora and fauna. Change in crop/cropping seasons. More biotic and abiotic stresses on crops.

3.6 Animal Husbandry & Livestock

In Himachal Pradesh, 17.6% of the geographical area is under permanent pasture or grazing lands. The livestock population of the State is three times the carrying capacity of grazing lands. Due to the excessive grazing of livestock and modification on the livestock population, this sector has various deleterious effect on the environment like degradation of vegetation resources due to overgrazing, increased soil erosion due to clearing of vegetation and trampling, increased siltation

of surface water and deterioration of soil fertility and physical characteristics through removal of vegetation, increased erosion and soil compaction. Increased rapid runoff due to vegetation cleaning and soil compaction leads to decreased infiltration capacity of land. Conversions of moist tropical lowland forest to pasture and grazing land for livestock results in long-term environmental degradation leading to unsustainability.

Degradation of all kind of land (Alpine pastures vegetation, forest area) and shrinkage

of private grasslands and village common lands due to over grazing by livestock:

Overgrazing by domestic animals has adverse effects on the vegetation like alpine grasslands and forests. Due to this, the forests and the grasslands become bare and subsequently prone to soil erosion. Selective grazing tends to alter the composition of the forest or grassland eco-system, causing an increase in the population of undesired species, which are not consumed by the animals. Seedlings of various species can get crushed and trampled under the hooves of cattle. In some cases, the roots of a tree species may be exposed by trampling. This results in the death of the desired plant species. The animals graze during spring, when the seedlings of various tree species, grasses and herbs are growing. This leads to the problems of regeneration as the future crop is adversely affected.

Overgrazing also occurs when plants are exposed to intensive grazing for extended periods of time, or without sufficient recovery periods. It can be caused by either livestock in poorly managed agricultural applications, or by overpopulation of native or non-native wild animals. It reduces the usefulness, productivity and biodiversity of the land and is one of the causes of desertification and erosion. Overgrazing is also seen as a cause of the spread of exotic plants and weeds.

Public and Animal Health Risk due to Inadequate Animal / Public health infrastructure: Inadequate health infrastructure / facilities including buildings & equipment for treatment of livestock is due to scattered and sparsely distributed habitations hilly terrains a reason for public and animal health risk. There is also a problem of inadequate mechanism for drugs availability and distribution of veterinary drugs in Himachal Pradesh. Inadequate mechanism for disposal of dead animal bodies also poses health risk.

Effect of Animal Diseases on Human & Animal Health

a. Transfer of diseases from animals to human & vice versa (Zoonotic diseases): Zoonotic diseases are infectious diseases transmittable from animals to human beings. Each outbreak of such zoonotic diseases lead to number of infections among humans which are well known and preventable for eg. rabies, brucellosis, leishmaniasis and echinococcosis. They cause a serious amount of deaths and affect millions of people every year.

b. Inadequate awareness on animal health issues/practices leads to higher public and animal health risk: Majority of the population in the state are farmers, therefore owning a huge number of livestock. The farming community living in the rural area are not aware of animal health issues and risks associated with them. Due to such reasons the population of some livestock during 1972-97 declined however. The livestock populations showed increasing trend during 1998-2007. Cattle percentage share declined from 46.3 to 41.6, while the percentage share of sheep went down from 21.1 to 20.7. The number of horses and ponies has come down by one-fifth.

c. Public health and animal health risk due to increase in animal disease: Due to improper/inadequate sanitary and habitat conditions, the various kinds of diseases are caused to the animals, which are generally due to parasites, protozoa, viruses etc. The most important protozoan diseases observed in common livestock (cattle, buffalo, sheep, goat, etc.) based on the studies conducted in Himachal Pradesh are Coccidiosis and Haemoprotista. In sheep and goats, which are less than 6 months of age are the main victims of coccidiosis. Four species of *E. arloengi*, *E. intricata*, *E. parva* and *E. ninakoyakimovae* are reported to occur in goats in Himachal Pradesh out of the 11 species of *Coccidia* known to harbour in

Indian goats. In poultry, Coccidiosis is a major cause of mortality and sub optimal growth and conversion efficiency in immature flocks. The diseases which are generally found in Himachal's livestock are Sarcocystosis, Toxoplasmosis, Encephalitozoonosis, Trypanosmosis, Anaplasmosis, etc.

Increasing pressure on forest area/other land use: The livestock population in Himachal Pradesh is 53 lakhs. About 43 lakhs tonnes (green) and 40 lakh tonnes (dry) fodder are required for the survival of these livestock but the availability of fodder is only 16 lakh tonnes (green) and 30 lakh tonnes (dry), which is very less as per the requirement. The 0.5 ha per livestock grazing/pasture land is required but 0.18 ha. is available to sustain one livestock unit.

Environmental pollution due to animal waste: Fodder production requires intensive use of water, fertiliser, pesticides and fossil fuels. Which cause water and soil pollution. Further, since only one third of the nutrients fed to animals gets absorbed by the animal body, the remaining nutrients become part of excreta and open disposal of which has been found to be leading factor in water and land pollution.

Impact of migrating animals on the environment: Migratory movements reflect an animal's need for feed, breed, avoid predators and find a tolerable physiological environment over crop term. These movements are also shaped by an animal's evolutionary history, during which natural selection has resulted in behaviors that maximise fitness in complex and changing environments. Because migration behavior is labile, it contains information about the integrated organism's response to recent changes in the environment. These properties make migration behavior an ideal metric for understanding organism's responses to changing environments over large spatial extents (e.g., climate change and land use change).

Threat from obnoxious weeds affecting fodder availability for animals: Trees felled by right holders or removal after they dry up or fall due to vagaries of weather has created gaps in the canopy, which has resulted in preponderance of invasive species like *Parthenium hysterophorus*, *Ageratum conyzoides*, *lantana camara* etc. and which has brought in the change in the composition of vegetation in all types of forests and grass land in the State. The resultant growth even though serves the purpose of soil and water conservation, but also effectively eliminates the emergence of tree seedlings and smothers the naturally occurring grasses and herbs in the affected areas.

Water, soil and air pollution due to lack of dead animal management : Inadequacy of dead animal management programmes in the State lead to release of harmful gases infected/ putrefied waste leading to soil, water and air pollution.

Increase in environment and public health (Effect on human/animal health) risk due to unscientific management of slaughter houses: Inadequacy of programmes, policy and ineffective implementation of existing rules for scientific management of waste from slaughter houses lead to environment and public health risk from issues such as disposal of slaughter waste, treatment and packaging of meat, preservation of meat, transportation of meat and other health safety & environment issues.

Menace of stray cattle/dogs and menace of wild animals like monkey, bear etc.: In the past, wild animals used to feed on wild fruits and other natural food resources and did not interfere with the agricultural crops. Due to increase in their population and shrinking of their natural food resources, wild animals have more doubt of tree natural habitats resulting in human animal confrontation. Monkey sterilisation centres have been setup in

the State to check monkey menace. About 30,000 monkeys have been sterilised and released so far.

Research on effect of climate change on animal health: The threat from climate change and global warming is now recognised world wide and some alarming manifestations of change have occurred. Animal health may be affected by climate change in four ways: heat-related diseases and stress, extreme weather events, adaptation of animal production systems to new environments, and emergence or re-emergence of infectious diseases, especially vector-borne diseases critically dependent on environmental and climatic conditions. To face these new challenge, the

need for strong & efficient Veterinary Services is irrefutable, combined with good co- ordination of public health services, as many emerging human diseases are zoonoses and research.

Animal Husbandry & Livestock sector and cross sector policy and regulatory framework at State level shows the intent of the State Government to address inadequate service delivery in order to reduce the population, grazing and disease burden in the State. A mapping of the issues and policy and programme framework is described in Table 16.

Table 16: Showing Issues, Policy/Plan/Programme

Issues	Policy/Plan/Programme
1. Degradation of all types of land (Alpine pastures vegetation, forest area)	Grassland eco-system and grazing policy
2. Shrinkage of private grasslands and village common lands due to over grazing by livestock	Grazing Policy Feed, Fodder, Animal Nutrition and Grazing Policy Forest (Conservation) Act, 1980 The Wild Life (Protection) Act, 1972 Himachal Pradesh Non-Biodegradable Garbage (Control) Act, 1995
3. Research on effect of climate change on animal health	National Action Plan On Climate Change
4. Public and animal health risk due to inadequate infrastructure.	Guidelines for Implementation of Livestock Insurance Scheme Centrally Sponsored Schemes under District Rural Development Agency (DRDA) Centrally Sponsored Schemes in Sheep Development Centrally Sponsored Schemes in Poultry Sector Prevention and Control of Infectious and Contagious Diseases In Animals Act, 2009 The Himachal Pradesh Livestock Improvement Act, 1968 Assistance to State for Control of Animal Diseases (ASCAD) Transport of Animals Rules, 1978 Livestock Importation Act, 1898 Livestock Importation Act, 2001
Effect of Animal Diseases on Human & Animal Health	
5. Transmission of infections/ diseases from animals to humans & vice versa (Zoonotic diseases)	Prevention and Control of Infectious and Contagious Diseases In Animals Act, 2009
6. Inadequate awareness about animal health issues leading to higher public and animal health risk	The Himachal Pradesh Livestock Improvement Act, 1968 Assistance to State for Control of Animal Diseases (ASCAD)
7. Public health and animal health risk due to increase in animal disease	Transport of Animals Rules, 1978 Livestock Importation Act, 1898

Issues	Policy/Plan/Programme
	The Livestock Importation (Amendment) Act, 2001
	State level animal awareness programmes.
8. Increasing pressure on forest area/other land use	Mukhyamantri Arogya Pashudhan Yojna Participatory Forest Management Rule 2000 Programmes for Fodder development through People's Participation in grazing land and livestock management Pet food Order 2008
9. Environmental pollution due to animal waste.	The Municipal Solid Wastes (Management & Handling) Rules, 2000 Renewable Energy (RE) programmes National Biogas and Manure Management Programme (NBMMP)
10. Impact of migrating animals on the environment	The Prevention of Cruelty to Animals Act, 1960 The Livestock Importation (Amendment) Act, 2001 Livestock Importation Act, 1898 Transport of Animals Rules, 1978
11. Threat from obnoxious weeds affecting fodder availability for animals	Grassland eco-system and grazing policy Feed, Fodder, Animal Nutrition and Grazing Policy
12. Water, soil and air pollution due to lack of dead animal management	The Forest (Conservation) Act, 1980 The Wild Life (Protection) Act, 1972 The Prevention of Cruelty to Animals Act, 1960 The Livestock Importation (Amendment) Act, 2001 Livestock Importation Act 1898 Animals (Registration) Rules, 2000 The Wild Life (Protection) Act, 1972
13. Increase in environment and public health (Effect on human/animal health) risk due to unscientific management of slaughter houses	The Prevention of Cruelty to Animals Act, 1960 The Livestock Importation (Amendment) Act, 2001 Livestock Importation Act, 1898 Transport of Animals Rules, 1978 Meat production (chicken)
14. Menace of stray cattle/dogs	H.P. Municipal Act, 1994 Animals (Registration) Rules, 2000
15. Menace of wild animals like monkeys, bears etc.	The Forest (Conservation) Act, 1980 The Wild Life (Protection) Act, 1972

Pressure on account of increasing gaps and slow implementation of policy, programmes, plans and projects is leading to emergence of sector specific issues and risks/impacts. An analysis of the issues, causes and impacts has been carried out and summarized in Table 17.

Table 17: Issues, Causes and Impacts

Issues	Causes	Impact/Risks
1. Degradation of all Types of land (Alpine pastures vegetation, forest area)	Overgrazing	• Increase in soil erosion due to overgrazing
2. Shrinkage of private grasslands and village common lands due to over grazing by livestock	Unscientific grazing practices/lack of proper grazing management practices.	Decrease in soil fertility. • Increase in soil compaction. • Desertification

Issues	Causes	Impact/Risks
3. Research on effect of climate change on animal health	Risk to animal health Climate change is being witnessed everywhere and so is the case in HP. Changing living condition	• May lead to many problems related to adaptability and occurrence of diseases.
4. Public and animal health risk due to inadequate infrastructure.	Inadequate drugs availability and distribution. Inadequate capacity of health infrastructure/ facilities including buildings & equipment. Shortage of qualified veterinary doctors and/ para- veterinary staff	• Increased burden of disease/mortality. • Consumption of milk, milk products and meat of infected livestock may effect on human health. • Spread of zoonotic diseases • Inappropriate animal waste management leading to pollution of resources.
Effect of Animal Diseases on Human & Animal Health		
5. Transmission of infections diseases from animals to humans & vice versa (Zoonotic diseases)	Low priority to animal health issues Inadequate awareness and dissemination of information pertaining Zoonotic diseases Inappropriate health infrastructure	• Human health can be at stake due to transfer of communicable diseases from animals and vice versa • Higher pressure on already depleted infrastructure is resources
6. Inadequate awareness about animal health issues leading to higher public and animal health risk	Inadequate awareness due to peculiar topographical conditions in hilly terrain. Use of banned drugs e.g. Oxytocin Lack of NGO/ CSO/COBs participation.	• Pandemic diseases • increased Mortality
7. Public health and animal health risk due to increase in animal disease	Unscientific livestock's management practices, inadequate veterinary services infrastructures	• Increase in morbidity and mortality of livestock. • Human health risk due to spread of diseases.
8. Increasing pressure on forest area/other land use	Due to peculiar geographical and hilly terrain transportation of fodder becomes difficult Due to shrinkage of common grasslands and asteland in the residing villages	• Depletion of vegetation in the forest area. • Soil Erosion • Loss of soil fertility

Issues	Causes	Impact/Risks
9. Environmental pollution due to animal waste.	Unscientific livestock waste disposal practices (Faeces, urine, carcasses etc.)	• Emission of green house gases (CO₂, CH₄, N₂O) • Water pollution. • Offensive odour • Water borne diseases
10. Impact of migrating animals on the environment	Availability of grazing area. Centuries old migrating system of rearing animals by communities like Gaddies and Gujjars	• Degradation of soil quality/fertility • Decrease in vegetative cover • Increased pressure on common land, wasteland and Forest
11. Threat from obnoxious weeds affecting fodder availability for animals	Rapid spreading of obnoxious weeds like Parthenium, Lantana, Ageratum etc in the grasslands/ wastelands/ forest area. Import of exotic species	• Fodder production adversely affected. • Encroachment of locals into crops fields • Low crop yield

Chapter 4: Good Practices

4.1 Forests & Wildlife

Natural Regeneration and Afforestation: Speedy regeneration of forests becomes essential as more and more forest areas become degraded due to social and economic factors. The balance between forest degradation and forest regeneration should be maintained, to ensure that the forest cover does not get depleted. Methods for regeneration can be both natural and artificial. Large-scale afforestation programmes undertaken by the State Forest Department in selected areas in Himachal Pradesh in the past, involving such institutions as Joint Forest Management, have yielded good results. These include community based interventions.

Source: State Development Report, 2002

Promotion of Diversification in Forest plantation: Trends show a continuous decline in the area planted each year, because of paucity of funds and abandon Silvicultural fellings and normal working plan operations in the State under an order of the Supreme Court dated 12 December 1996, except for the right-holders. However, dry and fallen trees (salvage) can be removed through the

HP State Forest Corporation. Chil is the single largest species with about 30% of the area planted by the department. Deodar forms only 12 % of the total area planted during this period. Recently, a large number of broad-leaved species, including walnut, poplar, shisham (*Dalbergia sissoo*), etc., were planted under different projects. Cultivation of bamboo has a great potential for the state as it is highly versatile, lending itself to distinct and unique furniture designs, to new generation building materials, and to a vast range of items, thereby generating countless jobs. Since the state has a lot of degraded sites, bamboo holds the promise for their regeneration. At present, two bamboo species namely, *Bambusa bamboos* and *Dendrocalamus strictus*, are widely found in the State, whereas new fast growing species suitable to specific agro-climatic regions could be introduced based on the requirement of end objectives such as, making paper pulp, furniture, building material etc. The National Mission on Bamboo Technology and Trade Development has elaborated upon the use of bamboo for cultivation in different regions of the country and has given suggestions for its commercial and environmental benefits.

Source: State Development Report: 2002

Case Study 1 : Learning from Indo-German Changer Eco- development Project (1993-1999, 1999-2006) which can be adopted as good practices in the State

Lessons learned from the implementation of this project include interventions at social and institutional level.

- i) **Social Interventions:** Consensus among community members is necessary prior to planting on a site. Good growth and survival of plantations is a reliable indicator of social acceptance and successful plantations increase local community's interest and cohesion.
- ii) **Institutional Interventions:** Local Institutions such as VDCs/User groups are ideal to prepare the ground for long-term management. However, their post project linkage to Forest Department and Panchayat is essential. Grassroot institutions (e.g. user groups) are important for generating local interest in forestry and community forest management can be facilitated by such grassroot institutions in socio- technical terms (local management rules, protection against fire).

Grass production increases substantially after the plantation enclosure and has good economic potential (e.g. through sale of grass) provided that technical management interventions are timely. Unhindered development of vegetation enhances bush growth for use as fuel wood especially by resource poor. In good older plantations (after 6/7 years) fuel wood sale up to Rs.1000/ ha is easily possible consisting of bushes and pruned/lopped tree material.

Community based forest conservation and livelihood improvement to reduce pressure on forest and wildlife: Recommended practices for income generation from protected areas include; allowing community access to such areas for collection of fallen wood/litter and controlled collection of forest products including economically important wild plants; use of forest produce for value addition, like use of pine needles for making of bio-briquettes; develop opportunities for employment of local communities for area conservation and nature interpretation through proper training; promote initiatives of value addition in traditional technology/knowledge such as handicraft, fermented food/beverages, apiculture and cattle breeding to upgrade their skill set and income of local inhabitants; provision of entry fees and its utilisation for local community development; promotion of such practices will reduce pressure on forest, reduce incidences of illegal felling and increased forest conservation.

Source: Governance for Sustaining Himalayan Eco system Guidelines & Best Practices (G-SHE)

NTFP conservation through local collective action for NTFP management: The challenge of protecting diminishing forest resources combined with the provision of income for communities by letting them access and harvest NTFP can be overcome by

promoting sound and regulated economic development and harvesting schemes. With adaptive practice involving all stakeholders, maintaining and even increasing production while simultaneously maintaining or improving ecological conditions is possible.

Local collective action can perform either as a self-governance or joint management practice and can adjust resource overuse. It enables not only more sustainable use of resource, but also inclusive of management of resources with its related protection. The local collective action overcomes the weakness of de jure forest tenure system, by setting up the local adaptive and situated institution. It decentralises usufruct rights to a resource to local communities and henceforth creates incentives for economic development and efficient resource extraction. In addition, the institution initiates an improved tenure system to prevent overuse of resource. Rules, regulations and institutions need to be locally derived (and are often based on traditions), adaptive, accountable, and amendable as well as dynamic and open to adjustment. Thus, strengthening local access to and control over forest is a critical approach within a collective action for achieving rural sustainable development and livelihood improvement.

Community based conservation

Case study 2: Kamla Village, Bhatiy at taluka in Chamba District of Himachal Pradesh

Located in the western Himalayan region, the topography is mountainous and of mixed Shiwalik -Himalayan formation. The area experiences a sub-tropical climate with an annual rainfall of 1500 mm. The forest eco-system has south-facing slopes of the Dhauladhar range. The forest is regenerating with a mixed species composition. Major species found here are beul, khirik or toon, mulberry or shahtoot, aam, amrud, aadu, naakha (a variety of pear), kachnar, sisso and tuni. Legally, the area under community conservation is a Demarcated Protected Forest.

The main communities residing in the village are Rajputs, Brahmins, Mehra, Julahas, Gaddis (migratory pastoralists) and Tarkhans, Chamars, Doornas, Kumhars, Jogis, Charjs and Mashkus are the main scheduled caste communities. The total human population is 900 living in 109 households. Agriculture and service are the main occupations. The livestock population is 450. The villagers depend on the forest for fodder, fuel wood and other biomass needs.

Towards community conservation: The conservation initiative began in 1983 when the forest department decided to grow pine on the degraded south-facing slopes in the region. The people opposed the move and wanted to demonstrate to the FD that a broad-leaved forest can be raised on these slopes. Inputs were taken from a local NGO, Himalaya Bachao Samiti, for this purpose. All the villagers, men and women of all castes, under the management of Gram Utthan Sabha of Kamla village took charge of 5 ha patch of forest and defined rules and regulations for its protection.

No grazing allowed in the forest.

Grass collection permitted only after a date decided by the committee (in October-November).

Fuel wood collection allowed only for household consumption and not for sale.

Land has been divided temporarily among the households for grass collection.

Earlier, there was a full-time guard to look after the forest, paid for by voluntary contributions by the villagers in cash and kind. This practice was subsequently discontinued as it was no longer required.

Most decisions in the village are taken in the general body meeting (consisting of both men and women), which takes place roughly four times a year. The executive committee consists of 9 people, elected in an open process. Women as well as lower castes can be a part of the executive committee. Conflicts are resolved within the village itself in the traditional system of conflict resolution. Some more active individuals in the village have subsequently registered an NGO for working on the issues of village development and forest management.

Impacts of community effort: There has been a remarkable regeneration and growth of planted species-all broad-leaved-without added pressure on the other adjacent forests. The protected forest is now dense and close-canopied. Besides an increase in vegetation cover, an increase in tree and shrub diversity and consequent increase in bird diversity has been noticed. Local species of grasses have regenerated and some which had disappeared have resurfaced.

The community has benefited by the increase in fodder production, prevention of soil erosion and now enjoys moral authority over forest department. According to the forest department the initiative has decreased the conflict between the farmers and rhesus macaque monkeys over crop damaged caused by these primates. Now there appears to be a much higher availability of food and fruits in the forest.

Source: Himachal Pradesh: Community Conserved Areas in India, Edited by Neema Pathak, Kalpavriksha, 2009

Community based watershed and forest resources management: Community participation through a joint forest management programme can regenerate forests, protect watershed, improve water resources/water availability, reduce livestock grazing in hills and improve livelihood e.g. the local initiative of Sukhomajri village in Haryana, India, where community has worked together in protecting watershed and forest resources.

Forest regeneration and re-growth: Forest regeneration and re-growth can be achieved through re-establishing diverse native forests on previously mined lands. The usage of this practice has led to re-vegetation of iron- ore, dolomite, bauxite, coal, copper mines etc. in many parts of India

Rapid Response using high end technology to control forest fire: Forest Survey of India has state-of-the-art remote sensing MODIS rapid response system technology to monitor and combat forest fires across the country. MODIS detects fires and collects the coordinates of fire spots which are then sent to the respective state forest departments

(SFDs) via SMSs and emails for control. The feedback from the SFDs shows that detected forest fires are correct on more than 95% points.

Forest Department of Madhya Pradesh has also introduced a modern technology for detection and control of forest fire which has received the attention of Government of India and many State Forest Departments. Himachal Pradesh Forest Department may also have access to this technology. The institution of JFM in H.P is also actively involved in forest fire management in the State.

Source: Forest Survey of India, M.P. Forest Department, Bhopal

Development of energy efficient technologies that reduce fuel wood consumption: Introduction of energy efficient technologies can reduce deforestation from tree cutting for fire wood e.g. the back boiler water heater, introduced by the King Mahendra Trust for nature conservation in Nepal, consists of a pipe and a galvanized iron drum. When turned on, the water stored in the drum runs through the pipe, which is buried in the traditional cooking hearth and becomes

heated. This hot water is used for domestic consumption. In India also many states including H.P. have many such innovations for optimising energy use.

Source: Convention on Biological Diversity, UNEP/CBD/STTA/11, 2005

Recycling of community waste materials to produce briquettes: Recycling of waste paper and sawdust into briquettes can reduce deforestation from tree cutting for fire wood. e.g. the Mukuru Recycling Centre of Dandora waste dump in Nairobi Kenya has several local groups for recycling of wastes to produce briquettes.

Source: Convention on Biological Diversity, UNEP/CBD/STTA/11, 2005

Forest conservation by facilitation of under-storey development beneath plantation monocultures: Plantation can be catalysts for the re-colonisation of very large number of plants, especially when there is natural forest nearby. This raises the possibility that older plantations can provide some significant regional biodiversity benefits as well as production benefits for e.g. in North-eastern Australia, where rotations for two native rainforest timber species are approximately 50 years; regeneration of under-storey species occurred naturally after a canopy was established.

Source: Issues in Forest Conservation, Rehabilitation and Restoration of Degraded Forests, David Lamb and Don Gilmour, IUCN, WWF, 2003

Restoration of degraded forest through natural regeneration: Restoration can often start with low technology and low-cost options, relying on natural ecological process to provide added biological diversity over time. Social controls over cutting and grazing are essential to obtain a diverse species mix. Many of the sites with the potential for restoration are heavily grazed eroding grasslands with shallow stony soils. Chir pine is one of the few species that can survive and grow on these sites. It is also easy to handle in

low-technology nurseries, making it well suited for small village nurseries.

If a plantation area is protected from grazing, arrange of tree and shrub species often invades soon after establishment, particularly on moisture northern aspects. The invading species dramatically increase the biodiversity of the site and add to its productive potential for the village forest users. Chir pine acts as a pioneer species, returning the site to forest. An example of this is found in a series of studies undertaken in a forest about 40 km northeast of Kathmandu (Gilmour et al. 1990), where three waves of regeneration followed planting with chir pine.

Source: Issues in Forest Conservation, Rehabilitation and Restoration of Degraded Forests, David Lamb and Don Gilmour, IUCN, WWF, 2003

Approaches to Managing Human-Wildlife Conflicts (HWC): There are two basic approaches to managing human wildlife conflicts: prevention and mitigation. Measures that can prevent or minimize the risk of conflicts arising between people and animals include the extreme one of completely removing either the people or the animals, physically separating the two by the use of barriers, managing by a variety of means, the numbers of animals to reduce the risk of conflict, and employing a variety of scaring and repelling tactics. In this regard the State of Himachal Pradesh has taken several positive steps to manage the human wildlife conflicts. Rationalisation of PA boundaries, sterilisation of monkeys, conservation breeding of pheasants, activating EDCs etc. are some of these interventions.

Exclusion of wild animals by use of physical barriers can, in many situations, be an effective method of settling human-wildlife conflicts. If they are properly designed, constructed and maintained, fences can be completely effective in preventing conflict between people and wild animals. e.g. Fences to exclude elephants and other wildlife from

human settlements, cultivated areas and livestock areas are in use in all heartlands in Africa. Stone walls have been used to exclude buffalo from invading cultivated areas in Virunga Heartland. Trenches and moats have been used to keep elephants from cultivated areas with considerable success. The fencing-in of the cultivated areas of Kimana and Namelok in Kilimanjaro Heartland has significantly reduced levels of crop damage. Some of these examples are worth emulation in this State also.

Improving fences with the addition of a roof would substantially reduce the economic losses. In fact, the simple act of improving defenses against predators can make a substantial difference in rural livelihood e.g. in India, for instance, in the State of Himachal Pradesh, farmers have covered their livestock pens with chain-link fences and reported that this chain-link ceiling is one of the anti-predator management techniques that is significantly reducing livestock kills inside rural villages.

A less commonly used approach is the use of diversionary tactics—providing an alternate source of food or water in an attempt to lessen competition with people for crops or water sources. Successful use of diversionary fields to reduce crop damage has been reported from USA. It may be worthwhile to experiment some of these in the State as well.

Source: Human Wildlife Conflict: Lessons Learned From AWF's African Heartlands, AWF Working Papers, Philip Muruthi, Ph.D. July 2005; Human Wildlife Conflict worldwide: collection of case studies, analysis of management strategies and good practices, Elisa Distefano.

Waste management systems that restrict wildlife access to refuse: Good standards of waste management are important to avoid attracting wild animals to human settlements and to prevent wild population being augmented and artificially sustained by human induced food availability. Each stage of waste

handling should be addressed, from collection to transportation to disposal. Himachal Pradesh has already started garbage disposal system on experimental basis in some towns. This needs to be up scaled.

Source: Human Wildlife Conflict worldwide: collection of case studies, analysis of management strategies and good practices, Elisa Distefano.

Land use & Land use planning to avoid HWC: One of the most successful methods, however, has been introduced under the community based natural resources management (CBNRM) programmes in the form of land use planning and land use change. Land use planning and land use change are larger scale methods aimed at creating space for people and wildlife to live together. Land use change refers specifically to the management options that change farmers' attitudes to wildlife. Land use planning might achieve, limiting the encroachment of human settlements in wildlife areas; relocation of agricultural activities out of wildlife areas; consolidation of human settlement patterns that are near wildlife areas; creation of secure key areas of habitat, such as routes or corridors, that will permit wildlife to move freely; the distribution of wildlife population can be manipulated by changing the location of water points and providing salt licks at strategic sites; repositioning the boundaries of protected areas; reduction in the size of crop fields; changes in location of crop fields, e.g. dwellings and fields in proximity and changing cropping regimes, e.g. growing crops not palatable to elephants; diversify into other types of crops; using inter-cropping layouts for crops; changing timing of harvests. Himachal Pradesh has pioneering efforts in successful implementation of conflict free boundary rationalisation. The steps like sterilisation and release of monkeys in the wild has been well acknowledged by people and wildlife lovers.

Source: Human wildlife conflict manual, Wildlife management series Chapter-4, Lessons on Reducing Human wildlife conflict.

Introduction of Education and Awareness Programmes to reduce conflict with leopard: Awareness campaigns to be organised in leopard areas even in the absence of conflict. Points for awareness programmes with do's & don'ts are given below:

Do's / Do Nots	Reason
Children must be supervised.	Small children are especially vulnerable
Take a companion when answering the call of nature	A crouching person might be mistaken for prey
Announce one's presence in leopard areas by talking, singing, shouting, taking a transistor if moving alone in leopard areas.	It is likely that a quiet movement could be mistaken for a dog or a livestock by the leopard, especially in human dominated areas.
Do not chase or surround a leopard	High chances are that leopard will be stressed and attack in its attempt to escape
Reduce feral animals in areas adjacent to forests with leopard population	Feral animals especially domestic dogs could be "attractors" for leopards
Strengthen existing cattle shed and do not tether livestock outside	Better protection of livestock is seen to reduce livestock predation by carnivores
Educate local groups/village level communities	The public will be more co-operative in case of leopard situations in the area.

Source: Vidya Athbrey & Aniruddha Belsare, Human-Leopard Conflict Management Guidelines, 2007 Maharashtra State Forest Department.

Introduction of Insurance programmes: Livestock and crop insurance is often proposed as an innovative solution to mitigating the impact of human & wildlife

conflict (HWC). It covers crops and livestock from the risk of wildlife attacks and involves the villagers and local governing bodies paying a premium share of the insurance and allows rural inhabitants to make a minimum annual cost and to be refunded in the event of crop or livestock losses. In addition, the local governing bodies or the forest department are relieved of significant financial expenses, from not having to administer compensation schemes.

Source: Human Wildlife Conflict worldwide: collection of case studies, analysis of management strategies and good practices, Elisa Distefano.

Introduction of incentive programmes: Incentive programmes are based on subsidies. They offset the cost of conservation and demand the adoption of conservation-friendly practices, creating tolerance towards wildlife through the exchange of benefits. e.g. in India, in the State of Himachal Pradesh, the programme succeeded in reducing the forage overlap among wild herbivores and livestock through the clearance of an area of 500 ha from livestock grazing and other human use. The villagers received financial benefits for their loss of herding land and the money was used for collective work. As a consequence, wild herbivore densities increased, resulting in more naturally available prey for predators and thus reducing the pressure of carnivores on livestock.

Source: Human Wildlife Conflict worldwide: collection of case studies, analysis of management strategies and good practices, Elisa Distefano.

Case Study 5: Women stewardship in conservation in Nanj village, Mandi, HP

Background: Nanj village is situated 100 km from Shimla, in the Karsog Taluka of Mandi District, Himachal Pradesh. Since 1992, the villagers of Nanj have succeeded in protecting about 70 ha of adjoining forest. This village lies in the Middle Himalayan region where the forest includes species like daru haridra, deodar, khirik or toon, pine, simbal, amla, kambal and sisoo. The fauna includes leopard, barking deer, jungle fowl and rhesus macaque. The legal status of the land is Demarcated Protected Forest. The main communities residing in Nanj are Rajputs, Brahmins and Gujjars (Muslim). The scheduled caste comprise kolis and chamars. The total population of the village is 700. Agriculture and service are the primary occupations. The villagers depend on the forest to fulfill their fodder and biomass needs. Although the village owns significant livestock with 500 cattle, 60 buffaloes, 50 sheep and 40 goats, grazing is restricted in the forest.

Towards community conservation: The mahila mandal of the village took the initiative for conservation in this village in 1992. One of the reasons was that the women had to walk about 15 km for fodder and in those areas they were harassed by local villagers because of competition for fodder. Nanj has traditionally been known for a fertile and irrigated plateau of land. However forest degradation, resulting in excessive soil loss, has rendered this land infertile over a period of time. The women decided to take steps to alleviate the fodder scarcity and closed the forest for free grazing. Some of the rules laid down by them were 1. complete ban on free grazing in the protected forest, fodder collection to be done on days decided in the village general meeting, 2. collection to be done by all families together, 3. no individual collection of fodder and 4. only one bundle of grass allowed per family per day. All castes participate in the protection under the management of the mahila mandal. The mahila mandal has a 11- member elected committee which meets once a month.

Impacts of community effort: Very successful regeneration has taken place with many of the native species returning. The community has benefited by overcoming fodder scarcity in the village.

Source: Himachal Pradesh: Community Conserved Areas in India, Edited by Neema Pathak, Kalpavriksha, 2009

Preservation of ecological system by acknowledging contribution through payment for ecological services (PES): Proper acknowledgment of the contribution of indigenous communities in the maintenance of goods and services emanating from the Himalayan eco-system is an essential requirement. The stewardship role played by mountain farmers in maintaining the regional agro biodiversity and local genetic heritage deserves priority recognition in the form of adequate incentives so as to ensure their long-term involvement, which include value of eco-system services and appropriate mechanisms for support. g. In recognition of forests as national wealth, the 12th Finance Commission GoI has recommended an incremental grant of Rs 1000 Crores spread over the award period of 2005 – 10 for the maintenance of forests. This amount is to be distributed among the states based on their forest area for the preservation of forest wealth. Another form of recognition could be payments for the eco-system services (PES) of the standing forests of Himalayan region involving local communities in the conservation and adaptation efforts.

Reforestation for carbon sequestration through payment for eco- system services: Direct payment to individual producers for carbon sequestration can achieve reforestation. Farmers/land owners in environmentally sensitive lands are encouraged to plant long-term, resource conserving covers to sequester carbon and

address other issues like improvement of water quality, control soil erosion, enhance habitats & wildlife. e.g. Scolel Te project in Chiapas, Mexico, where Carbon payments are made to farmers. These payments vary depending on the size and land use system. Farmers receive \$8 US per tonne of carbon sequestered other examples include; PES programme involving multiple objectives, that deliver substantial conservation & rural poverty alleviation improvements in Bolivia, Guatemala, Colombia, Hungary, Romania and Serbia.

Similar approach can be applied in India. India's forests and tree cover accounts for about 23.4 % of the total geographical area of the country. The carbon stocks stored in the forests of the country have increased from 6244.78 to 6621.55 million tonnes (mt) in the last decade (1995- 2005) registering an annual increment of 138. 15MT of CO₂ equivalent. Afforestation and reforestation of 6 million ha of degraded forest land covered under the National Mission for Green India with participation of Joint Forest Management (JFM) would be able to add another 18 MT of carbon by 2020. The annual addition of 6 MT of biomass will increase the annual emission removal capability of forests from 4.87 % to 5.18 % of the corresponding projected emissions by 2020. In this context, there is a need for a wide ranging campaign to promote 'Tree Farming' across the region in order to cover the hill slopes with such species of trees and shrubs which are of value to the hill

people in the form of food fodder, fuel, fiber and leaf manure, etc.

Source: Convention on Biological Diversity, UNEP/CBD/SBT TA/11, 2005; ICFRE 2009

Control/Eradication/Use of Invasive Alien Species (IAS): Many eco- systems, especially when sparsely invaded or even densely invaded for a short time, can recover after clearing without further management intervention, but others cannot. Prevention, early-detection and rapid response are the

best means of tackling invasive species. Mitigation can include eradication; containment (keeping the IAS within regional barriers) or suppression (reducing population levels of the IAS to an acceptable threshold).

Source: David M. Richardson and Brian W. van Wilgen. Invasive alien plants in South Africa : How well do we understand the ecological impacts? South African Journal of Science 100, January/ February 2004; Science for Environment Policy, DG Environment News Alert Service, Special Issue, Invasive Alien Species: Issue 6, June 2006

Case Study 6: Developing strategies for the control of Parthenium weed in India using fungal pathogens

Parthenium hysterophorus has achieved major weed status in both Australia and India within a relatively short period. In India, the weed P. hysterophorus is of alien origin and very difficult to control as it has occupied most of the area in both cropped and non cropped eco-systems. Managing weeds using classical biological means is less expensive, permanent and pollution free. Considerable work on mycoherbicides for control of Parthenium weed has been carried out in India. Rajak et al. (1990) undertook a survey around Jabalpur (Madhya Pradesh), collecting diseased specimens of P. hysterophorus and isolating suspected pathogens. A total of 25 fungal species were identified, the majority being opportunistic necrotrophs. Myrothecium roridum Tode ex. Fr. Appeared, from the field survey and subsequent pathogenicity tests, to show most potential for mycoherbicide development. From further pathogenicity screening of the other fungi, it was concluded that most of them had the ability to suppress seed germination of P. hysterophorus and cause high seedling mortality, while a few could effectively kill mature plants, including: Collectotrichum gloeosporioides (Penz.) Sacc; Fusarium oxysporum Schlecht; Fusarium moniliforme Sheld, in addition to Myrothecium roridum. It is against this background that at least four Indian research centres have initiated IPM programmes against this weed.

Source : Project Final Technical Report, Crop Protection Programme, Prepared by : CABI Bioscience, UK, In collaboration with : Kurukshetra University, India, Tamil Nadu Agricultural University, India, Project Directorate of Biological Control, India, National Research Central for Weed Science (ICAR), India

Mechanical, chemical & biological control are some of the strategies to control IAS. Mechanical control involves directly removing the species by hand or with appropriate machines such as harvesting vehicles (e.g. for water hyacinth) or traps (for animals). Habitat management involves measures such as prescribed burning, grazing and other activities.

Source: Global Strategy on Invasive Alien Species, Edited by : Jeffrey A. McNeely, Harold A. Mooney, Laurie E. Naville, Peter Johan Schei and Jeffrey K. Waage.

Hand clearing: Selective clearing of woody species by organised community groups removes unwanted encroaching bushes/trees and minimises the competition between these and herbaceous plants for light, nutrients and water. However, this method has been found

to be only effective for selected small areas in Ethiopia.

Source: Technical Bulletin No.25, Management for proper range use, Ethiopia Sheep and Goat Productivity Improvement Programme, June, 2009 Website: <http://www.esgpi.org>.

The invasion of exotic species of *Lantana camara*, *Eupatorium adenophorum*, *Ageratum haustonianum* have caused serious problems in the Himalayan States. Traditional farmers have recently started converting these plants into bio-composts. At first it is removed by hand and then mixed with dung to form bio-compost.

Source: Improving and Scaling up of the Traditionally Managed/ Agricultural Systems of Global Significance, Department of Agriculture, Government of Sikkim, India.

4.2 Wetlands

Buffering Wetlands from human pressure and rejuvenation of natural process for wetland restoration: Conservation and restoration of wetlands involves not only buffering wetlands from direct human pressures, but also maintaining all other important natural process which are directly linked to supporting wetlands in maintaining fragile eco-system. The measures like controlling soil erosion, reducing pressure on wetlands resources and most importantly changing the attitude of people in using wetlands are important for conservation and restoration. Long term measures include creating buffer zones for wetlands protection, limiting anthropogenic activities around the wetland and help in reviving their natural functioning. The restoration programmes with an eco-system approach through Good Management Practices (GMPs) helps in correcting Point & Non-point sources of pollution. This along with regulations & planning for wildlife habitat and fish helps in arresting the declining water quality & the reduction of loss of wetlands.

An integrated approach to manage the wetlands is required where a conservation of the following measures can be used to restore wetlands.

- Pollution abatement practices to reduce the non-point source of pollution through source reduction and waste minimisation.
- Afforestation with native species in areas around the wetland to control the entry of silt from runoff.
- The shorelines of the lakes should be lined with bricks or stones in an attempt to control shoreline erosion.
- Creation of constructed wetlands for the purpose of storm water management & pollutant removal from surface water flows.
- Infiltration trenches for reducing the storm water sediment loads to downstream areas by temporarily storing the runoff.
- Rotation of crops rather than monocultures to reduce the need for Nitrogen fertilizers & assist with pest control & help in aeration of soil.
- Promoting public education programmes regarding proper use & disposal of agricultural hazardous waste materials & regular monitoring of wetlands.
- Promoting recreational facilities and creating public conscious is an essential part in prompting people in general to take initiative in protecting wetlands.
- Rainwater Harvesting is one of the key steps to be adopted in urban communities where most of the area has been metalled either by the roads or by the concrete buildings to improve the ground water recharge, and thereby reduce the pressure on wetlands to meet the urban water resources demands.
- Alongwith the rain water harvesting, storm water management helps in reducing the pressure on wetlands. In urban areas rainwater is diverted to sewerage drain which is expensive to treat and use it for many utilities. Investment can be made to have a separate drain for storm water to which the rainwater harvested in each and every individual unit is connected. It will be then cost effective to treat and use for non-potable utilities of water in industries, gardening and for other non-potable purpose.
- Prevention of silt is better than desilting or dredging which involves huge economic costs.
- Waste water, solid and semi solid waste entering into the lake from external sources must be stopped before any restoration work is implemented.
- To conserve the particular wetland conservation measures can be based on morphological, bathymetric and

physiographic features of the wetland ecosystem.

*Source: Nanda Kumar, Wetland Conservation in India; need for effective legal framework.
<http://www.nlsenlv.org/environmental-protection/articles/wetland-conservation-in-india-need-effective-legal-framework/sendto=form>*

Good practices in Stakeholder involvement for wetland management: Formulation of locally acceptable natural resource management plan prepared through participation of local communities which can fit local customs and traditional management structure can assist in the restoration of wetlands. The specific tools, which can be assets in formulation of such plans are “Stakeholder Analysis”, “Participatory Rural Appraisal”, “Local Convention” and other high end techniques like remote sensing. An

example of successful usage of this practice has been demonstrated in Niger Delta. In India, while outlining the lake water use in developing wetland management proposal, the details regarding stakeholders involved and impact of lake degradation on each of these are to be provided. The lake rejuvenation proposal may consider the stakeholder demands through a public hearing at site and their involvement in operation & maintenance.

Good practice in Solid Waste Management in buffer zone for conservation of lakes/ Wetlands: Door to door collection of solid waste from households in buffer zone and direct disposal using composting can assist in conservation of lakes and wetlands. e.g. conservation of Naini lake in Nainital.

Case Study 2: Naini Lake, Nainital

The Naini lake is the sole source of drinking water for Nainital town, an important tourist destination in Uttarakhand State, and is connected to 62 drains out of which 23 directly fall into it. Increasing inflow of tourists, urban waste making its way into the lake is adversely affecting water quality. To conserve this important water body, the residents have switched on to a scientific garbage disposal system – under the project name ‘Mission Butterfly’ by Nainital Lake Conservation Project. The sweepers, on a small monthly charge, collect waste from each household and directly transfer it to the compost pits. Apart from the residents, schools and hotel owners have extended full co-operation to the authorities, to save its precious eco-system. In addition to helping the authorities, in preventing the waste entering the lake, they are able to generate income and employment by converting it to manure, and the schools are educating their students about waste management.

Source: <http://www.mycleanindia.com/states/Uttarakhand/missionbutterfly.html>

Case study 3: Community conservation in Mcleodganj and nearby villages, Dharamshala

Dharamshala District in Himachal Pradesh has been a bird-watchers delight since a long time now. The bird enthusiasts travel to nearby villages like Haripur, Dehra Gopipur and Nagarota Surivan near Pathankot. The Pong dam, one of the biggest wetlands of Asia, attracts avian visitors by the thousands every year from as far as Russia, Siberia, Central Asia, Tibet and Ladakh. Rare terns like the gull-bellied tern and little tern breed here. The Pong also attracts waders like lapwings and plovers. Twenty per cent of the bar-headed geese breed on the Tibetan plateau winter at Pong. The Pong is also a refuge for threatened species like the Sarus crane, woolly-necked stork, painted stork, red-necked falcon, black-bellied tern, white-tailed eagle, red-headed vulture and white-rumped vulture. Kangra Bird Club, formed by a few bird enthusiasts, has recorded about 480 species of birds in Kangra District and 370 species at Pong wetland itself.

According to one of the members of Kangra Bird Club, these birds have been a way of life in Kangra. The villagers of the Kangra valley live in perfect amity with the birds and normally do not disturb the birds whilst going along with their daily work. The villagers do not mind even if the birds feed on their maize fields. According to Lajja Devi of Haripur village, even when sometimes flocks they accept the losses considering that the birds have come to their village after travelling long distances (incorrect sentence). Besides plentiful food and shelter on little islands on the lake, the winged visitors also get ample peace and quiet.

However, pressures of livelihood have increased, which has been causing a conflict between the fishermen and the birds. Birds feed on prawns, mahseer and shrimps, all of which are also commercially very important for the local fishermen.

Source: Himachal Pradesh: Community Conserved Areas in India, Edited by Neema Pathak, Kalpavriksha, 2009

Development of legal Instrument to prevent land use change for wetlands: Rapid unplanned growth of hill towns, construction activities without a proper plan, general non-compliance with prescribed norms and guidelines and indiscriminate use of land for commercial outfits/tourist resorts has severely and adversely affected the fragile ecosystem of the Himalaya. Therefore, regulations for control on land use change (e.g., diversion of agricultural land for other purposes) and sale/purchase of land are urgently needed across the Indian Himalayan Region (IHR). Legal/ policy initiatives taken by some State Governments could serve as a model to be promoted across the IHR after proper evaluation. e.g. Assam Hill Land and Ecological Sites Bill, 2006. The Assam Hill Land and Ecological Sites (Protection and Management) Bill, 2006 has been passed by the Assam Legislative Assembly to prevent indiscriminate cutting of hills and filling up of water bodies in urban areas, which had led to serious ecological problems in places like Guwahati. Prior to this, many assembly members had expressed apprehension that the Bill would take away traditional settlers' rights over the hills. However, the State Government assured them that it is committed to granting land rights to those who have been living on the hills for the past 15 years or more. It also promised a new land use policy for such settlers. Under the Bill, the State Government can bring any hill under its purview for protection.

Source: Governance for Sustaining Himalayan Ecosystem (G-SHE), Guidelines & Best Practices, Ministry of Environment & Forests, Government of India

Good practice on desilting/dredging: Unscientific desilting/dredging needs to be carefully carried out as turbidity caused by such activities adversely impacts aquatic flora and fauna. Dredging (need for dredging may be considered, on merit on case to case basis, only in cases of wetlands impacted by siltation), for example in India, NLCP

recommends Increasing the lake depth through desiltation which does have an impact on its flora and fauna and may lead to destruction of habitat for migratory birds. Desiltation must be supported by bathymetry of the lake as per the standard methodology and its planning and execution to be carried out scientifically under expert guidance.

Source: Guidelines for National Lake Conservation Plan, National River Conservation Directorate, MoEF, Government of India, 2008.

Legal intervention in Identification of Lake Boundary & prevention of encroachments
Legal instruments at local level like Government Order and zonation assists in identification of lake boundaries and prevention of encroachment. For ex. NLCP prescribes a list of DO's:

- a. The State Government/local Administration is to take necessary steps for declaring the lake boundary through a Government Order. The lake boundary is to be decided in relation to the lake submergence area at its full tank level.
- b. The local administration/local body is to take all necessary steps to ensure removal of encroachments if any in the lake submergence area/ lake boundary.

The project proponents to consider for notifying the 'Establishment of a Bio- conservation 'Zone' around the water body for better safeguard of the lake surroundings from the growing pollution potential and the encroachment.

Source: Guidelines for National Lake Conservation Plan, National River Conservation Directorate, MoEF, Government of India, 2008.

Good practice for bank stabilisation and re-vegetation of embankments to control erosion and siltation: Stabilisation of banks is needed to arrest the movement of fine silt towards deep and open water areas. Plantation of shallow wetland with emergent macrophytes will provide habitat for nesting

and to stabilise newly accumulated silt. Use of vegetated barrier towards periphery will control further movement of silt in the lake. Many geo textile products and agro-forestry technologies are available for stabilisation and revegetation of embankments to control erosion and siltation. Construction of check dam, check wall, toe walls, contour bunding and vegetative spurs and plantation are some of the demonstrated best practices to improve the continuous flow of clear water to the wetland. Creation of embankment where surface runoff is high and catchment is highly degraded to stem siltation problem.

Source: Wetland management Planning: A Guide for Site Managers, WWF, IUCN, Wetlands International and Ramsar Bureau, 2008, Guidelines for National lake Conservation Plan, National River Conservation Directorate, MoEF, Government of India, 2008

Usage of Soft engineering techniques v/s conventional concrete and steel techniques in soil stabilisation: Historically, concrete and steel was used as erosion control material. Use of concrete and steel in the form of concrete structures and steel piling etc. is called hard engineering. It is imperative that any development effort should go hand in hand with ecological equilibrium so as to sustain it and a return to natural living has been accepted as a safe way to solve many environmental problems. This method is called soft engineering. The ultimate objective of natural erosion control measures is to establish a dense network of root system and vegetative cover to the desired degree of growth in the shortest possible time. Slowing the flow of water down the slope accomplishes two things. The transport capacity of the thin sheet flow is reduced, thereby minimising the displacement of dislodged soil particles, and more rainfall infiltrates to the soil, providing desirable moisture to newly planted seedlings. The materials used in soft engineering are woven and non-woven geotextiles, geogrids, geomembranes and geocomposites. The

majority of geosynthetics, covering a wide range of woven and non-woven geotextiles, geogrids, geomembranes and geocomposites used in civil engineering applications are polymeric. These products generally have a long life and do not undergo biological degradation, but are liable to create environmental problems in the long run. Throughout the world growing awareness of the sustainable development to preserve the environment has led to the rehabilitation of areas damaged either by natural or industrial causes. In effecting this, the use of biodegradable natural materials are gaining popularity. However in absence of availability of natural material these should be used as the control offered by these is much beneficial than other hard engineering methods. In recent years, coconut coir fiber due to its characteristics of degradability, moisture retention, tensile strength and adaptability has been found to be eminently suitable internationally for manufacturing products used in soft engineering for soil and water erosion control, stream bank stabilisation, wet land regeneration, river bank stabilisation, wasteland restoration, hill side slopes, road embankments, re-vegetation applications etc.

Source: Wetland management Planning: A Guide for Site Managers, WWF, IUCN, Wetlands International and Ramsar Bureau, 2008, Guidelines for National lake Conservation Plan, National River Conservation Directorate, MoEF, Government of India, 2008

Engineering works in respect of bund may be minimised with naturalisation of bund as a preferred option. The cost towards shaping/strengthening including slope revetment, provision for construction of retaining wall, if any etc. should not exceed 10-15% of the total project cost. Stone revetment along the inner slope of the earthen bund, to be resorted to in cases where strengthening of bund is required. As far as possible naturalisation of slopes by providing suitable vegetation with proper selection of species, should be resorted to.

The lake shores to be naturalised as far as possible by planting macrophytes on the lake slope rather than providing hard stone pitching.

Source: Wetland management Planning: A Guide for Site Managers, WWF, IUCN, Wetlands International and Ramsar Bureau, 2008, Guidelines for National lake Conservation Plan, National River Conservation Directorate, MoEF, Government of India, 2008

Good practice to control invasive species in Wetlands: Management of invasive species should be based on three main strategies, which are prevention, elimination and control.

Once an invasive species is established in a wetland system it may be impossible to eliminate or control it. The most effective invasive species management is to prevent initial introduction. This needs to occur at different levels ranging from effective national quarantine programmes, to activities at the national, provincial, river basin and site level. Prevention should involve some prediction of exotic species that may become a problem and activities to ensure that they can be identified and turned away. Many Governments have criteria to assess whether plants proposed for import are likely to be dangerous. For example, the Australian Quarantine Inspection Services' 'weed risk assessment' guidelines are available.

Source: <http://www.daffa.gov.au/ba/reviews/weeds>.

Managers should focus on the 'vectors' that may transport invasive species into the country, river basin or their site. They must work with the people and businesses concerned to gain their help and vigilance. Some of the most dangerous vectors that bring invasive species into wetlands are: aquaculture using exotic species; aquariums and ornamental ponds; agriculture, including research stations; ornamental gardens, including botanic gardens and plant nurseries; zoos and aviaries; boats/ships that introduce species via unclean hulls and discharge of

ballast water; unclean farm and construction equipment coming from areas infested with problem species and transport of unclean agricultural produce.

Once an invasive species is present at the national, provincial, river basin or site scale there may be a window of opportunity to eliminate it depending on the biology of the species concerned. Incursion management requires wetland managers to identify potentially invasive species as soon as possible after their arrival, then plan and implement an eradication strategy. In some cases, invasive species that have overrun adjacent habitats can be kept out of protected areas through programmes designed to identify and eliminate new infestations.

Once an invasive species has become established in a wetland area then eradication may not be feasible. A control programme may then be required to reduce the impact of such species. Control should be a last resort since most control programmes that are ongoing are expensive, and only partially successful in restoring environmental health. Some control methods for invasive species are physical methods. These methods are pulling by hand or cutting; bottom barrier application/ sediment covers; water-level drawdown; watershed controls and water column dyes. Biological methods include grass carp (irrigation and drainage canals only) milfoil weevil, mechanical methods include harvesting and cutting, bottom tillage (rotovation), diver-operated dredging and weed rolling. Chemical methods include Fluridone, Glyphosate Diquat, Endothall, Copper compounds 2,4-D

Source: Wetland Management Planning. A Guide for Site Managers, WWF, IUCN, Wetlands International and Ramsar Bureau, 2008

Good practices for Species management: Management strategies need to focus on maintaining hydrology, removing barriers to migration, maintaining riparian habitats,

reducing water pollution and sedimentation, preventing invasion of exotic species and harvest regulation.

Water birds and fish are two important groups of animals for a wetland manager and usually find a prominent place in the management plan. Management strategies for water birds focus on maintaining a wide variety of habitats, ensuring adequate food supply and safety from disturbances, especially from anthropogenic factors (for example, pollution by agrochemicals). Particular attention is needed for migratory bird species which require not only conservation of the wetland that is their final destination, but also other sites (key staging points, moulting sites) along the migratory flyway. Fish are the most abundant vertebrates associated with wetlands, many being resident for all or part of their life cycles in wetlands. Wetlands provide important food sources for fish or spawning grounds, nursery areas or their migration path. Many fish (including shellfish) have complex life histories, with spawning, nursery and feeding grounds widely separated and long migrations necessary between them. It becomes important therefore to conserve all those areas essential for the completion of a fish's life cycle if species or stock is to be maintained.

Wetland species management strategies typically concern the need to conserve healthy population of species by focusing on habitat conservation, since single species management is expensive and can have unintended consequences on other environmental attributes. Nevertheless, there are two cases for focusing on single species: maintaining viable population of top predators, such as river dolphins and crocodiles, since if these species that are long-lived and often small in number have healthy populations then most other species in that eco-system are also likely to be conserved; and conserving threatened and rare species

that require special management interventions e.g. Murray Darling Basin Commission's Native Fish Strategy as a good example of how to plan good fish conservation.

Source: <http://www.mdbc.gov.au/NFS>

Bioremediation for weed eradication: Bioremediation is the cheapest and most sustainable control method for weed eradication as chemical and mechanical control measures are expensive and hampered by reinfestation from its long-lived seeds. Bioremediation serves as the best method for locations where water hyacinth continues to grow at greater than acceptable levels. It has proved to be an adequate control method in several instances in developing countries such as Sudan, Papua New Guinea, and Benin. *Neochetina bruchi*; *Neochetina eichhorniae*; *Niphograpta albiguttalis*; *Xubida infusellus*; *Orthogalumna terebrantis*; *Eccritotarsus catarinensis*; *Cornops aquaticum*; *Chiromonus larvae*; *Alternaria eichhorniae*; *Cercospora piaropi*; *Acermonium zonatum*; *Brachinus* sp.; *Eccitotarsus catarinensis*; *Thrypticus* sp.; *Megamelus* sp. are natural enemies of water hyacinth reported from different parts of world. Using currently available agents, it usually reduces extent of the infestation, climate, water quality and other control options. In conjugation with other available tools like herbicides application, physical removal, manipulation of flows, and reductions of nutrient input is expected to increase the pace of eradication of the weed from the aquatic eco-system.

Source:
http://www.wetlandsofindia.org/publication/EN_VOL3_4.pdf

Application of Geo-spatial tools in Weed Management: The major limitations of traditional methods of water hyacinth eradication programmes are inaccessibility of the areas for field sampling due to the dense mats of water hyacinth, the large geographic areas of infestation which require extensive

travel for adequate sampling, the exceptional high growth rate of this weed brings rapid changes in their extent and density, the movement of vegetation mats and effects of weather on plant growth rates. Modern spatial approaches are cost effective and an efficient tool to assess and monitor the relatively homogeneous species patches distributed over large geographical areas. Remotely sensed multi-spectral data with ground measurements of cover, density, biomass or leaf area, vegetation condition measured at sample points could be extrapolated across a large geographic region. This information is valuable in determining trends, confirming field reports, assessing the efficacy of control measures, providing early warning before a developing problem reaches a critical state and general strategic planning. Remote sensing provides a critical tool for monitoring the status of infestations as well as detecting impediments to waterborne transportation caused by aquatic plant infestations. Sensors especially like ASTER, IKONOS, QUICKBIRD and LISS IV MX can be employed in the mapping of Eichhornia.

Source:

http://www.wetlandsofindia.org/publication/EN_VOL3_4.pdf

Utility of Water Hyacinth as a resource: Despite the detrimental effects of the water hyacinth infestation, the weed has several economic uses, which can be part of its management. The capacity of water hyacinth for accumulating heavy metals and organic contaminants, together with its wide tolerance to environmental conditions is well recognised. Its rapid growth and multiplication has led, among other things, to various applications as an animal food, paper and other products, or as compost. Anaerobic digestion of water hyacinth produces biogas–methane. Water hyacinth is being used to cleanup metal-contaminated aquatic ecosystems. In Hong Kong, water hyacinth has been used for freshwater treatment. Many studies reported the ability of water hyacinth

for the accumulation of heavy metals such as lead (Pb), chromium (Cr), zinc (Zn), manganese (Mn) and copper (Cu).

Source:

http://www.wetlandsofindia.org/publication/EN_VOL3_4.pdf

Aquatic Weed's Utilisation: Water hyacinth, *Eichhornia crassipes*, was recommended for use as a fertiliser, *Ipomoea aquatic* a young shoots are used as vegetables, leaves of *Typha* spp are used for making mats, ropes, baskets and thatching roofs.

Source: Brij Gopal and K. P. Sharma, Economic Botany, Vol. 33, No. 3 (Jul. - Sep., 1979), pp. 340-346 Published by: Springer on behalf of New York Botanical Garden Press, <http://www.jstor.org/stable/4254084>

Good practice of biological control of the aquatic weed, *Salvinia molesta*: Infestations of the aquatic weed, *salvinia*, disrupted waterways in tropical countries but biological control using a tiny weevil brought it under control in many places.

First recorded in Australia in 1952 and originating in south-eastern Brazil, the aquatic fern *Salvinia molesta* became a serious aquatic weed in Australia, South-East Asia, the Pacific and south, central and eastern Africa. *Salvinia* has a phenomenal growth rate, doubling its dry weight in two and a half days under optimum conditions. *Salvinia* grows quickly to form thick mats covering lakes, slow-moving rivers and other waterways. These mats severely interfere with the use of water bodies for boating, irrigation, flood mitigation and conservation of wildlife. Once vital waterways become stagnant ponds supporting only *salvinia*. In some countries village life is disrupted because waterways are no longer navigable.

In 1978, CSIRO scientists began the search for biological control agents in southeast Brazil which they had identified as the native range of *salvinia*. They found three promising potential agents namely aweevil (*Cyrtobagous salviniae*), a moth (*Samea multiplicalis*) and a

grasshopper (*Paulinia acuminata*). *C. salviniae* was the first to go through the formalities required before an agent can be released in Australia. In 1980, the first releases were made on Lake Moondarra, an artificial lake providing water and recreation for Mt Isa in north Queensland, which was heavily infested with *Salvinia*. By mid-1981, the beetle had reduced the *Salvinia* to a few small patches. Weevil went on to clear massive infestations of *Salvinia* in areas like the Sepik River (Papua, New Guinea), Sri Lanka, Wappa Damand Lake Moondara (Queensland, Australia) and lagoons in the Northern Territory, Australia, including in Kakadu National Park. In all, *Salvinia* has been controlled by *C. salviniae* in at least 13 tropical countries.

Source: <http://www.csiro.au/resources/salvinia-control.html>

Biological control of *Typha* spp: *T. angustata* and *T. elephantina* are invading irrigation channels and arable lands; they form clumps in waterlogged soils and are spread both by rhizomes and airborne seeds. Herbicides were applied as foliar sprays to run-off at the flowering or post-flowering stages of *Typha* spp. in early autumn or early spring. Amitrole [aminotriazole] at 12 kgs. + 2,4-D amine 1.5 kgs + Tenac (surfactant) 10 ml/ha gave the best control; rootstocks disintegrated in 8 weeks. Foliar application of these non-persistent herbicides allows the growing of sensitive crops within a few weeks after application.

Source: Dutta, T. R. *A method for the control of Typha angustata in arable land. Indian Journal of Agricultural Sciences.* <http://www.cababstractsplus.org/Abstracts/Abstract.aspx?AcNo=19722300384>

Good practices of Creating Zones as part of wetland management plan of the wetland should be one as a part of wetland management plan: Zonation of the area of influence when dealing with large or complex sites, it is often helpful to divide it into units and to treat these separately within the plan.

Units or zones are usually subdivisions of a site, based on different criteria. These are ecological units, functional units, management zones and buffer zones. Ecological units is a large site which may contain an inter-tidal unit, a coastal unit with dunes and salt marsh, a woodland unit and a river and its valley. Each will need different management approaches. Functional units are devised based on the predominant functions of the site. For example, the wetland could be divided into recreational, cultural, hunting, archaeological, historical, infrastructural, residential and commercial units. A separate subsidiary plan, which nests within the whole site plan, could be produced for each unit, in which part or all of the management plan format could be repeated.

The process of unitisation should not be confused with the splitting of a site into management 'zones' which is, in most cases, the division of a site into sections for similar management purposes. Zonation is optional. The division of a nature conservation site and neighbouring lands into a number of sectors is done for better management. For each management zone there are certain prescriptions which are short descriptions of the location of the zone (or zones, if there is more than one sector requiring similar management); the relevant strategy (ies) and time taken to implement.

It is important to keep the zoning system as simple as possible. Not all zones of a zonation system need to be present on all sites and some sites are so homogeneous that they do not require zoning at all. Managers should only have zones at sites where they find that it reduces the complexity of management and makes the task of managing easier. A system of zones can also be used to inform all involved parties about management aims. Often there is a need to protect the site from damaging factors originating outside the site. This can lead to the setting up of buffer zones around the most vulnerable parts of the

site. In buffer zones, control of activities is usually exercised indirectly, by management agreements or framing laws. If a buffer zone around a site is not possible, part of the site itself may be used as a buffer for the most

fragile parts of the site. The advantages of zonation has been described in the case study given below.

Case study 4: Biosphere Reserve zonation concept

The concept of zoning Biosphere Reserves, adopted by UNESCO's Man and the Biosphere (MAB) Programme, in which the site may include up to three zones, core zone, buffer zone (for research and training) and transition zone (for sustainable use) is potentially applicable to all Ramsar sites and other wetlands, and should be applied whenever feasible and appropriate.

The core area which needs to be legally established for giving long-term protection to the landscape, eco-system and species it contains, should be sufficiently large to meet these conservation objectives. There may be several core areas in a single Biosphere Reserve to ensure a representative coverage of the mosaic of ecological systems. Normally, the core area is not subject to human activity, except research and monitoring and, in some cases, for traditional uses by local communities.

A buffer zone (or zones) which is clearly delineated and which surrounds, or is contiguous to, the core area. Activities are organised here so that they do not hinder the conservation objectives of the core area but rather help to protect it. It can be an area for experimental research, for example to discover ways to manage natural vegetation, croplands, forests, fisheries and to enhance high quality production while conserving natural processes and biodiversity, including soil resources, to the maximum extent possible. In a similar manner, experiments can be carried out in the buffer zone to explore how to rehabilitate degraded areas.

An outer transition zone, or area of co-operation extending outwards, which may contain a variety of agricultural activities, other human activities and human settlements. It is here that the local communities, conservation agencies, scientists, civil associations, cultural groups, private enterprises and other stakeholders must agree to work together to manage and sustainably develop the area's resources for the benefit of the people who live there. The transition area is of great economic and social significance for regional development. Although presented schematically as a series of concentric rings, the three zones are usually implemented in many different ways to accommodate local geographic conditions and constraints. This flexibility allows for creativity and adaptability, and is one of the greatest strengths of the concept.

The experience of the Man and the Biosphere Programme (MAB), under which zonation is recognised as an important part of the delimitation and management of Biosphere Reserves as multiple use sites, is that zonation plays an important role in minimising user conflicts by separating potentially conflicting activities, while ensuring that legitimate land uses can continue with minimal conflict.

A Ramsar/MAB joint Web site (http://www.unesco.org/mab/BRs/brs_ramsar.shtml) was launched in February 2001, providing information on the 85 Ramsar Sites and 74 Biosphere Reserves in 43 countries. A joint work programme established in 2001 recognises the mutual interest in the activities of the Ramsar Convention and MAB particularly in the areas of identification and designation of sites, site management planning, assessment and monitoring, and communication, education and public awareness.

Source: Managing wetlands. Ramsar Handbook No. 16, 3rd edition, 2007.

4.3 Fisheries

Good practices for Aquatic Species management: Management strategies need to focus on maintaining hydrology, removing barriers to migration, maintain in riparian habitats, reducing water pollution and sedimentation, preventing invasion of exotic species and harvest regulation.

Fish is one of the important animals for a wetland/water body/reservoirs manager and usually find a prominent place in the management plan. Fish are the most abundant vertebrates associated with Wetlands/water body/reservoir, many being resident for all or part of their life cycles in wetlands/water body/reservoir. Wetlands/water body/reservoir provide important food

sources for fish, or spawning grounds, nursery areas or their migration path. Many fish (including shellfish) have complex life histories, with spawning, nursery and feeding grounds widely separated and long migrations necessary between them. It becomes important therefore to conserve all those areas essential for the completion of a fish's life cycle if species or stock is to be maintained.

Wetland/water body/reservoir species management strategies typically concern the need to conserve healthy populations of species by focusing on habitat conservation, since single species management is expensive and can have unintended consequences on other environmental attributes. Never the less, there are two cases for focusing on single

species: maintaining viable population of top predators, such as river dolphins and crocodiles, since if these species that are long lived and often small in number have healthy population then most other species in that eco-system are also likely to be conserved; and conserving threatened and rare species that require special management interventions e.g. Murray Darling Basin Commission's at Australia Native Fish Strategy is a good example of how to plan good fish conservation

Source: <http://www.mdbc.gov.au/NFS>

Offsetting the loss of indigenous species due to hydroelectric project through mass seed production in hatchery: An interesting initiative on cross-sectoral work has been demonstrated in Nepal at the Hydroelectric Project in Kali Gandaki by Nepal Electricity Authority (NEA). Here a 144 MW dam has been built to produce electricity. In recognising that dam structures have potential negative impacts especially on some of the traditional migratory fish species living in the rivers, a hatchery for mass seed production of indigenous species was built to offset the loss of the economically and ecologically important indigenous riverine fish species. Restocking with a number of indigenous species both up and down stream of the reservoir and sustaining the income and employment opportunities of fisher community by fishing and conserving for the local people in these localities are main benefits from this hatchery and its activities. The hatchery has been running jointly between NEA and Nepal Agricultural Research Council (NARC) since 2002. The Kali Gandaki River is important because it has 56 indigenous fish species available in the River system. Among the successful breeding of fish species, sahar Tor spp has shown one of the potential for breeding and there are ambitions and potential for the hatchery to be a regional centre of excellence for Tor spp breeding.

Source: *Potential Development Interventions for Fisheries and Aquaculture in Nepal*; Asia Pacific Fishery Commission; Food and Agriculture Organisation of the United Nations.

Stock enhancement of flood plains and beels (ponds) to enhance fish production in Bangladesh: Stocking of the floodplains and beels was initiated in 1989 as donor-supported development programmes. The objective of these stock enhancement programmes was to increase fish production, provide employment opportunities and enhance the food fish supplies to the large population living in the floodplains. In the very early stages, floodplains were stocked with 5-8 cm carp fingerlings, which led to increased fish production.

The size of fingerlings at stocking ranged from 7 to 16 cm for the major carps and from 5 to 11 cm for Java barb (a fish species in Thailand). These sizes were determined as optimal and were also relatively easily to procure. Finger lings required for stock enhancement of floodplains were procured in two ways. The most effective way was to use the beels in the floodplains as nurseries, which then automatically disperses the fingerlings when the beels connect with the flood plains during monsoonal flooding. It is believed that such fingerlings will survive better than those brought from else where because they will be acclimated to the environment. An alternative source is hatchery-nursed fingerlings. Survival during the nursery stage in the beel is low, and overall, it is estimated that 10 percent of beel-reared stocks versus 25 percent of introduced seed stock are recoverable. The cost of seed stock is quite different, with beel-nursed fingerlings costing 0.78Tk as compared to hatchery-nursed fingerlings costing 4.10 Tk.

\The financial analysis indicates that the rates of return were estimated for each beel for the duration of the trial and then projected over a 20-year period assuming there would not be any further stocking after 1996 ranged from

16 to 23 percent and 28 to 122 percent, respectively. The economic internal rate of return for the 20-year projected period was estimated to average 38 percent and that for the duration of the trial as 29.7 percent. A total of 85 000 fisher households benefited from the stock enhancement programme. This total comprised 22 percent full-time, 28 percent part-time and 50 percent subsistence fishers.

Source: A Review of Stock Enhancement Practices in the Inland Water Fisheries of Asia: Sena S. De Silva and Simon Funge-Smith; Food and Agriculture Organisation of the United Nations.

Stock enhancement of rivers to increase production in Thailand: Thailand is one of the few countries that practice stock enhancement of a crustacean species, the giant river prawn, *Macrobrachium rosenbergii*. This species is regularly stocked in some Thai reservoirs, for example in Pak Mun Reservoir (4 910 ha), which has a run-of-river type dam. It has been reported that this reservoir has been regularly stocked with giant river prawn since 1995, totalling 22 million fry up to 2000. The giant river prawn catches (16646 kgs/yr) contributed 53.8 percent to the total fish catch by weight, but 97 percent to the economic value of the landings. It was demonstrated that despite the low return from stocking (only 1 percent), the high price of the captured prawns (US\$ 5.4/kgs.) resulted in an economic rate of return of 43 percent, making the practice economically viable.

Source: A Review of Stock Enhancement Practices in the Inland Water Fisheries of Asia: Sena S. De Silva and Simon Funge-Smith; Food and Agriculture Organisation of the United Nations.

Use of net cages for developing and sustaining stock enhancement strategies for large water bodies: The nursing of fingerlings for release to the fishery by fisher groups or individuals is one method to make fishers more accountable for the costs of stocking. In this case, the nursed fingerlings are paid for by the fisher groups. This, therefore, requires

that the fishers using a water body are sufficiently organised to be able to levy fees on members to pay for the stocking. The land required for nursing in ponds is considerable, and therefore, the nursing of fingerlings in net cages has been suggested as a viable strategy in large inland water bodies in Sri Lanka and Vietnam. Local nursing takes advantage of locally available labour and relies on locally sourced materials. Nursing activities also provide opportunities for womenfolk of fisher households to be involved in the management of husbandry-related activities, for example, in the preparation of feeds, ingredients for which are sourced, at least partially, by fishers from the water body itself. There are probably more examples of this type of activity where the fish are not actually released, but are retained and fed in cages until harvested for sale.

Source: A Review of Stock Enhancement Practices in the Inland Water Fisheries of Asia: Sena S. De Silva and Simon Funge-Smith; Food and Agriculture Organisation of the United Nations.

Stock enhancement using reservoir design & operation strategy: In most of Asia, large water bodies are typically under the purview of several different administrative bodies such as irrigation and agriculture authorities, hydroelectric generation bodies and occasionally, forestry or national park authorities. They are rarely, if ever, under the management of fisheries' authorities. The stocking of fingerlings in large water bodies is neither coordinated with water release schedules nor are suitable structures installed near sluices to prevent the loss of stocked seed. Lack of co-ordination between stocking events and water release, especially in the immediate post-stocking period before the seed finds its most suitable location within a water body, can often result in loss of stocked seed. In smaller water bodies, there are conflicts between water use for irrigation and retaining the minimum amount of water necessary to support fish or a fishery. In very small irrigation reservoirs, it is not unusual for

almost complete drainage to occur. This can lead to conflicts between fisheries groups and groups that rely on water for dry-season irrigation. Unfortunately, except the study of Jhingran, this issue has not been studied in detail anywhere in the world, and it essentially remains an unknown entity that affects the returns from all stock enhancement programmes. Jhingran reported a nearly 300 percent increase in fish production in three reservoirs in India as a result of co-ordination between water release and stocking, and provision of devices to prevent fingerling escape from the spillway.

Source: A Review of Stock Enhancement Practices in the Inland Water Fisheries of Asia: Sena S. De Silva and Simon Funge-Smith; Food and Agriculture Organisation of the United Nations.

Culture based fisheries and water body planning/design for fisheries stock enhancement in China: The culture-based fishery practices in PR China, where over a number of years of trial and error, general guidelines for maximizing production from culture-based fisheries have been empirically determined. Fore most among these is the stocking size and preparation of the water body prior to stocking. In China, the average stocking size is 27 g (12-14 cm seed), and in small and medium-sized water bodies, predators are removed prior to stocking. The Chinese culture-based fishery is based on using standard species combinations and stocking densities that are calculated from the productivity of each reservoir. Another notable factor contributing to the relatively high yields is that fishery activities were taken into account during the planning stages of Chinese reservoir construction. This included designs that minimise the number of escapees and facilitate harvesting.

Source: A Review of Stock Enhancement Practices in the Inland Water Fisheries of Asia: Sena S. De Silva and Simon Funge-Smith; Food and Agriculture Organisation of the United Nations.

Optimum determination of species combinations and stocking ratios to

enhance fish production in culture based fisheries: One of the main constraints in optimizing yields from culture-based fisheries in most countries is the lack of knowledge on the most appropriate species combinations that should be used. Use of ad hoc species combinations and stocking densities can lead to reduction in yield, as well as the production of under-sized fish, resulting in low economic return. The water bodies suitable for culture-based fishery activities differ widely in their morphology, catchment features and hydrological regimes and consequently, in their biological productivity. The final yield from a water body will depend not only on the species stocked and their size at stocking, but also on the biological productivity of the water body, which determines the food availability to the stocked seed, and hence their growth and well being. A comparable method based on Secchi depth has been developed for oxbow lake fisheries in Bangladesh. The empirical models used in Bangladesh and PRC hina provide an opportunity for the improved planning of enhancement activities that would not only lead to a cost saving on seed stock, but also to increases in fish yield.

Source: A Review of Stock Enhancement Practices in the Inland Water Fisheries of Asia: Sena S. De Silva and Simon Funge-Smith; Food and Agriculture Organisation of the United Nations.

Aquaculture-based fisheries stock enhancement in Iran: Aquaculture- based fisheries stock enhancement can be seen to have a positive impact on capture fisheries yield. It has been extended to other inland water bodies, in which production of carp (14,733 tonnes) and trout plus other naturally produced native species (5,449 tonnes), totalling 20,182 tonnes has been achieved in 1992. This excludes sturgeon and kutum roach production. Fisheries enhancement has therefore become an important method of fish production in Iran. Several large hatcheries, some of them among the world's largest, (totaling 301 ha in 1991) are operated

by the Iranian Government. At present there are 12 Government-run hatcheries and 11 private hatcheries, and with the presently improved method of hatchery operation through the adaptation of the Chinese system.

Source: Report on Regional Study on the Environmental Assessment and Management of Aquaculture Development; <http://www.fao.org/docrep/field/003/ac279e/AC279E09.html>

Preserving Surface water quality for managing fishing eco-system: Wastes from livestock, birds and humans can contaminate dams, rivers and other water resource. These wastes can contain disease-causing micro-organisms. The following practices (do/don't) to be adopted for avoid or minimise water quality problems of surface water:

- Make sure that surface water sources are fenced against livestock and protected from septic tank overflows and spills of domestic, agricultural or industrial chemicals.
- Check up-stream for contamination sources. Upstream activities in the stream's catchment might affect the quality of its water.
- Manage Your Waste water properly: To conserve and protect water quality.
 - (i) Never dump harmful contaminants into toilets, sinks or sewers and if you have a septic system at your home or cottage, keep it maintained and properly working.
 - (ii) Use non-toxic cleaners and biodegradable soaps and detergents. Reduce or eliminate your use of fertilisers and other chemicals on lawns and gardens. Use de-icing salts conservatively during winter months. Direct roof downspouts to broad grassy areas.
- Control Erosion and Sediment: To reduce the negative effects sediment can have on water quality.
 - (i) Trees can be planted along hillsides and steep slopes.
 - (ii) Livestock can be kept away from river banks.
 - (iii) Grassed waterways, vegetated buffers and seepage areas are also good methods of reducing runoff as well as removing sediments.
- Protect Wetlands: To protect and preserve an existing wetland, grow vegetation around its boundary, keep livestock away and eliminate harmful activities like dredging, filling, large-scale logging, dumping garbage and harvesting peat.
- Manage Storm Water: Municipalities can clean streets and store and filter runoff to prevent pollutants from reaching waterways.
- Prevent Spills: Be cautious when handling and storing gas, oil, pesticides, herbicides, fertilisers and other chemicals. Similarly, farmers should adopt conservation tillage and cropping practices and ensure the proper disposal of dead stock and farm wastes.
- Boat Responsibly: Boating can disturb sediment settled on the bottom of lakes and rivers. The following practices to be adopted to avoid or minimise water quality problems of surface water.
 - (i) Reducing speeds in shallow waters and in areas with soft bottoms can help prevent this problem.
 - (ii) Reducing speeds near shore will also decrease shore line erosion from wave wash. Always use a pumping station to dispose off black water from toilets and grey water from showers, baths, washing machines and dishwashers.

- (iii) Never discharge black or grey water overboard. Be cautious when refueling and remember to fill portable tanks on shore, away from the water.

Source:

http://www.livonline.com/Extension_Notes_English/pdf/wtr_qlty.pdf

Buffering Wetlands/water body/reservoir from human pressure and rejuvenation of natural process for wetland/water body/reservoir restoration: Conservation and restoration of wetlands/water body/ reservoir involves not only buffering wetlands/water body/reservoir from direct human pressures, but also maintaining all other important natural processes which are directly linked to supporting wetlands/water body/ reservoir in maintaining a fragile eco-system. The measures like controlling soil erosion, reducing pressure on wetlands/waterbody/reservoir resources and most importantly changing the attitude of people in using wetlands are important for conservation and restoration. Long term measures include creating buffer zones for wetlands/water body/reservoir protection, limiting anthropogenic activities around the wetland/water body/reservoir and help in reviving their natural functioning. The restoration programmes with an eco-system approach helps in correcting point & non-point sources of pollution. This along with regulations & planning for wildlife habitat and fish helps in arresting the declining water quality & the reduction of loss of wetlands/water body/reservoir.

An integrated approach to manage the wetlands is required where a conservation of following measures can be used to restore wetlands/water body/reservoir.

- Pollution abatement practices to reduce the non-point source of pollution through source reduction and waste minimisation.

- Afforestation with native species in areas around the wetland/water body/reservoir to control the entry of silt from runoff.
- The shorelines of the lakes should be lined with bricks or stones in an attempt to control shoreline erosion.
- Creation of constructed wetlands/water body/reservoir for the purposes of storm water management & pollutant removal from surface water flows.
- Infiltration trenches for reducing the storm water sediment loads to downstream areas by temporarily storing the runoff.
- Rotation of crops rather than monocultures to reduce the need for Nitrogen & assist with pest control & help in aeration of soil.
- Promoting public education programmes regarding proper use & disposal of agricultural hazardous waste materials & regular monitoring of wetlands/water body/reservoir.
- Promoting recreation facilities and creating public consciousness an essential part in prompting people in general to take initiative in protecting wetlands.
- Rainwater Harvesting is one of the key steps to be adopted in urban communities where most of the area has been metalled either by the roads or by the concrete buildings to improve the ground water recharge, and thereby reduce the pressure on wetlands/waterbody/ reservoir to meet the urban water resources demands.
- Along with the rain water harvesting, storm water management helps in reducing the pressure on wetlands/water body/reservoir. In urban areas rainwater is diverted to sewerage drain which is expensive to treat and used for many utilities. Investment can be made to have a separate drain for storm water to which the rainwater harvested in each and every individual unit is connected. It will be then cost effective to treat and use for

non-potable utilities of water in industries, gardening and for other non-potable purpose.

- Prevention of silt is better than desilting or dredging which involves huge economic costs.
- Waste water, solid and semi solid waste entering into the lake from external sources must be stopped before any restoration work is implemented.

Source: Nanda Kumar, Wetland Conservation in India; need for effective legal framework. <http://www.nlsenuh.org/environmental-protection/articles/wetland-conservation-in-India-need-effective-legal-framework/sendto=form>

Good practice on desilting/dredging: Unscientific desilting/dredging needs to be carefully carried out as turbidity caused by such activities adversely impacts aquatic flora and fauna. Dredging (need for dredging may be considered, on merit on case to case basis, only in cases of wetlands impacted by siltation). For example in India, NLCP recommends increasing the lake depth through de-siltation. It does have an impact on its flora and fauna and may lead to destruction of habitat. De-siltation must be supported by bathymetry of the lake as per the standard methodology and its planning and execution to be carried out scientifically under expert guidance.

Source: Guidelines for National Lake Conservation Plan, National River Conservation Directorate, MoEF, Government of India, 2008.

Good practice for bank stabilisation and revegetation of embankments to control erosion and siltation: Stabilisation of banks is needed to arrest the movement of fine silt towards deep and open water areas. Plantation of shallow wetland/water body/reservoir with emergent macrophytes will provide habitat for nesting and to stabilise newly accumulated silt. Use of vegetated barrier towards periphery will control further movement of silt in the lake. Many geo textile products and agro-forestry technologies are

available for stabilisation and revegetation of embankments to control erosion and siltation. Construction of check dam, check wall, toe walls, contour bunding and vegetative spurs and plantation are some of the demonstrated best practices to improve the continuous flow of clear water to the wetland/water body/reservoir. Creation of embankment where surface runoff is high and catchment is highly degraded to stem siltation problem.

Source: Wetland management Planning: A Guide for Site Managers, WWF, IUCN, Wetlands International and Ramsar Bureau, 2008, Guidelines for National Lake Conservation Plan, National River Conservation Directorate, MoEF, Government of India, 2008

Usage of Soft engineering techniques v/s conventional concrete and steel techniques in soil stabilisation: Historically, concrete and steel was used as erosion control material. Use of concrete and steel in the form of concrete structures and steel piling etc. is called hard engineering. It is imperative that any development effort should go hand in hand with ecological equilibrium so as to sustain it and a return to natural living has been accepted as a safe way to solve many environmental problems. This method is called soft engineering. The ultimate objective of natural erosion control measures is to establish a dense network of root system and vegetative cover to the desired degree of growth in the shortest possible time. Slowing the flow of water down the slope accomplishes two things. The transport capacity of the thin sheet flow is reduced, thereby minimising the displacement of dislodged soil particles and more rainfall infiltrates to the soil, providing desirable moisture to newly planted seedlings.

The material used in soft engineering are woven and non-woven geotextiles, geogrids, geomembranes and geocomposites. The majority of geosynthetics, covering a wide range of woven and non-woven geotextiles, geogrids, geomembranes and geocomposites

used in civil engineering applications are polymeric. These products generally have a long life and do not undergo biological degradation, but are liable to create environmental problems in the long run.

Throughout the world growing awareness of the sustainable development to preserve the environment has led to the rehabilitation of areas damaged either by natural or industrial causes. In effecting this, the use of biodegradable natural materials are gaining popularity. However in absence of availability of natural material these should be used as the control offered by these is much beneficial than other hard engineering methods. In recent years, coconut coir fiber due to its characteristics of degradability, moisture retention, tensile strength and adaptability has been found to be eminently suitable internationally for manufacturing products used in soft engineering for soil and water erosion control, stream bank stabilisation, wetland/water body/reservoir regeneration, river bank stabilisation, wasteland/water body/reservoir restoration, hill side slopes, road embankments, re-vegetation applications etc.

Source: Wetland management Planning: A Guide for Site Managers, WWF, IUCN, Wetlands International and Ramsar Bureau, 2008, Guidelines for National lake Conservation Plan, National River Conservation Directorate, MoEF, Government of India, 2008

Engineering works in respect of bund may be minimised with naturalisation of bund as a preferred option. The cost towards shaping/strengthening including slope revetment, provision for construction of retaining wall, if any etc. should not exceed 10-15% of the total project cost. Stone revetment along the inner slope of the earthen bund, to be resorted to in cases where strengthening of bund is required. As far as possible, naturalisation of slopes by providing suitable vegetation with proper selection of species, should be resorted to.

The lake shores to be naturalised as far as possible by planting macrophytes on the lake slope rather than providing hard stone pitching.

Source: Wetland management Planning: A Guide for Site Managers, WWF, IUCN, Wetlands International and Ramsar Bureau, 2008, Guidelines for National lake Conservation Plan, National River Conservation Directorate, MoEF, Government of India, 2008

Good practice to control invasive species in Wetlands/water body/reservoir: Management of invasive species should be based on three main strategies, which are prevention, elimination and control.

Once an invasive species is established in a wetland/water body/reservoir system it may be impossible to eliminate or control. The most effective invasive species management is to prevent initial introduction. This needs to occur at different levels ranging from effective national quarantine programmes, to activities at the national, provincial, river basin and site level. Prevention should involve some prediction of exotic species that may become a problem and activities to ensure that they can be identified and turned away. Managers should focus on the 'vectors' that may transport invasive species into the country, river basin or their site. They must work with the people and businesses concerned to gain their help and vigilance. Some of the most dangerous vectors that bring invasive species into wetlands/water body/reservoirs are: aquaculture using exotic species; aquariums and ornamental ponds; zoos and aviaries; boats/ships that introduce species via unclean hulls and discharge of ballast water.

Once an invasive species is present at the national, provincial, river basin or site scale there may be a window of opportunity to eliminate it depending on the biology of the species concerned. Incursion management requires managers to identify potentially invasive species as soon as possible after their

arrival, then plan and implement an eradication strategy. In some cases, invasive species that have overrun adjacent habitats can be kept out of protected areas through programmes designed to identify and eliminate new infestations.

Once an invasive species has become established in a wetland/water body/reservoirs area then eradication may not be feasible. A control programme may then be required to reduce the impact of such species. Control should be a last resort since most control programmes that are ongoing are expensive and only partially successful in restoring environmental health. Some control methods for invasive species are physical methods. These methods are: Bottom barrier application/sediment covers; water-level drawdown; watershed controls and water column dyes. Chemical methods include Fluridone, Glyphosate Diquat, Endothall, Copper compounds 2, 4-D.

Source: Wetland Management Planning. A Guide for Site Managers, WWF, IUCN, Wetlands International and Ramsar Bureau, 2008

Bioremediation for weed eradication: Bioremediation is the cheapest and most sustainable control method for weed eradication as chemical and mechanical control measures are expensive and hampered by reinfestation from its long-lived seeds. Bioremediation serves as the best method for locations where water hyacinth continues to grow at greater than acceptable levels. It has proved to be an adequate control method in several instances in developing countries such as Sudan, Papua New Guinea and Benin. *Neochetina bruchi*; *Neochetina eichhorniae*; *Niphograpta albiguttalis*; *Xubida infusellus*; *Orthogalumna terebrantis*; *Eccritotarsus catarinensis*; *Cornops aquaticum*; *Chiromonus larvae*; *Alternaria eichhorniae*; *Cercospora piaropi*; *Acermonium zonatum*; *Brachinus* sp.; *Eccitotarsus catarinensis*; *Thrypticus* sp.; *Megamelus* sp. are natural enemies of water hyacinth reported from

different parts of world. Using currently available agents, it usually reduces extent of the infestation, climate, water quality and other control options. In conjugation with other available tools like herbicides application, physical removal, manipulation of flows and reductions of nutrient input is expected to increase the pace of eradication of the weed from the aquatic eco-system.

Source:

http://www.wetlandsofindia.org/publication/EN_VOL3_4.pdf

Application of Geo-spatial tools in Weed Management: The major limitations of traditional methods of water hyacinth eradication programmes are inaccessibility of the areas for field sampling due to the dense mats of water hyacinth, the large geographic areas of infestation which require extensive travel for adequate sampling, the exceptional high growth rate of this weed brings rapid changes in their extent and density, the movement of vegetation mats and effects of weather on plant growth rates. Modern spatial approaches are cost effective and an efficient tool to assess and monitor the relatively homogeneous species patches distributed over large geographical areas. Remotely sensed multi spectral data with ground measurements of cover, density, biomass or leaf area, vegetation condition measured at sample points could be extrapolated across a large geographic region. This information is valuable in determining trends, confirming field reports, assessing the efficacy of control measures, providing early warning before a developing problem reaches a critical state and general strategic planning. Remote sensing provides a critical tool for monitoring the status of infestations as well as detecting impediments to waterborne transportation caused by aquatic plant infestations. Sensors especially like ASTER, IKONOS, QUICKBIRD and LISS IV MX can be employed in the mapping of *Eichhornia*.

Source:

http://www.wetlandsofindia.org/publication/EN_VOL3_4.pdf

Development of legal Instrument to prevent land use change for wetlands/water body/reservoir: Rapid unplanned growth of hill towns, construction activities without a proper plan, general non-compliance with prescribed norms and guidelines and indiscriminate use of land for commercial outfits/tourist resorts has severely and adversely affected the fragile eco-system of the Himalaya. Therefore, regulations for control on land use change (e.g., diversion of agricultural land for other purposes) and sale/purchase of land are urgently needed across the Indian Himalayan Region (IHR). Legal/policy initiatives taken by some State Governments could serve as a model to be promoted across the IHR after proper evaluation. e.g. Assam Hill Land and Ecological Sites Bill, 2006. The Assam Hill Land and Ecological Sites (Protection and Management) Bill, 2006 has been passed by the Assam Legislative Assembly to prevent indiscriminate cutting of hills and filling up of water bodies in urban areas, which had led to serious ecological problems in places like Guwahati. Prior to this, many assembly members had expressed apprehension that the Bill would take away traditional settlers' rights over the hills. However, the State Government assured them that it is committed to granting land rights to those who have been living on the hills for the past 15 years or more. It also promised a new land use policy for such settlers. Under the Bill, the State Government can bring any hill under its purview for protection.

Source: Governance for Sustaining Himalayan Ecosystem (G-SHE), Guidelines & Best Practices, Ministry of Environment & Forests, Government of India

Legal intervention in Identification of Lake Boundary & prevention of encroachments
Legal instruments at local level like

Government: Order and zonation assist in identification of lake boundaries and prevention of encroachment. For ex. NLCP prescribes a list of DO's:

- a. The State Government/local Administration is to take necessary steps for declaring the lake boundary through a Government Order. The lake boundary is to be decided in relation to the lake submergence area at its full tank level.
- b. The local administration/local body is to take all necessary steps to ensure removal of encroachments if any in the lake submergence area/lake boundary.
- c. The project proponents to consider for notifying the 'Establishment of a Bio-conservation Zone' a round the water body for better safeguard of the lake surroundings from the growing pollution potential and the encroachment.

Source: Guidelines for National Lake Conservation Plan, National River Conservation Directorate, MoEF, Government of India, 2008.

Regulation mechanism for identification and protection from pollution of protected zones and its monitoring can protect ecological environment for fisheries. An optimum regulatory mechanism and its enforcement can assist in identifying and protecting protected zones for fisheries e.g. in People's Republic of China: The Water Pollution, Prevention and Control Law Decree No. 12 provides that competent Central and Local Governments may define protected zones and take measures to ensure that the water quality in those protected zones complies with the standards for their designated uses with regard to important fishery water bodies (art. 12 Decree No. 12); ("Fishery water bodies" = "those parts of water bodies designated for the spawning, feeding, wintering or migration passage of fish, or shrimps, and for breeding fish, shrimp, or

shellfish, or growing algae” art. 43). Article 13 of the Regulations for Implementation of the Fishery Law also states that the “natural spawning, breeding and feeding grounds of fish, shrimp, shellfish and algae as well as their major migration routes shall not be used as aquaculture grounds”.

The fishery environment monitoring network was established in 1985, and has come to consist of 25 monitoring stations: The central station, oceanic province and basin stations, and provincial stations. The main function of the network is to monitor the resources and environment in important fishing waters under its jurisdiction, conduct studies on environmental pollution, submit reports about the condition of the fisheries environment, present reports about the loss in fishery resources to the local fishery administration as an evidence for verdicts concerning pollution incidents. At present, because of the unpunctuality of investigations and evidence- finding, the complicated task of identifying pollutants and the difficulty in calculating economic loss to fishery resources, the compensations for fishery resource loss remains very low. Between 1990 and 1991, the average compensation for pollution incidents amounted to between 5.9% and 13% of the total economic loss. However, most of the compensation given was for aquaculture.

Source: Report on Regional Study on the Environmental Assessment and Management of Aquaculture Development; <http://www.fao.org/docrep/field/003/ac279e/AC279E09.htm#annII>

Promoting micro-finance in fisheries communities: The micro-finance scheme is to develop their skills and help vulnerable and disadvantaged fishing communities can lead to fisheries and aquaculture management and conservation. This will reduce illegal poaching and extraction. A general micro-finance strategy involves the promotion of sustainable rural livelihoods and more equitable access to resources, particularly for vulnerable and

disadvantaged groups, such as small-scale fishing and fish farming households. Micro-finance programmes are seen as a means for such communities to gain access to much-needed and appropriate credit services. The development objectives of micro-finance for poor fishing communities are to enable fishing households to increase income, smoothen consumption, develop micro-enterprises, manage risks better and enhance earning capacities, thus reducing economic and social vulnerability for example Report of the National Workshop on Best Practices in micro- finance Programmes for Women in Coastal Fishing Communities in India. Panjabi, Goa, India highlighted the positive aspects of micro-finance projects in relation to Government policies and initiatives, research, technology development, appropriate support services and other financial support and interventions for the fisheries sector.

Source:

http://www.fao.org/bestpractices/content/06/06_05_en.htm

Alternate livelihood for fisheries to reduce of fisheries pressure on fishing: The Pearl Culture project in the Maldives was established to diversify livelihoods. It has provided an increased and more reliable supply of raw material to the cottage craft industry and helped to reduce stress on the wild stock. Positive outcomes have been the establishment of pearl culture technology (suited to local conditions) and links with tourist resorts for marketing products. They are now in the process of forming a co-operative to take over ownership of the pearl farm. The lessons learned relate to the expectations of immediate returns and the need to demonstrate success in aquaculture to engage more people.

Source: Best practices to support and improve the livelihoods of small-scale fisheries and aquaculture households; APFIC Regional Consultative workshop; a case study of aquaculture development in the Maldives; Shafiya Naeem, Research Officer, Marine Research Centre, Maldives

In 2009, three grey natural pearls were found at the Pong Dam in Kangra District in Himachal Pradesh. The first ever finding of precious gemstones in freshwater is being seen as a boon for the State and has the potential to boost the economy of the hill State. The size of one pearl was 3 mm and two were 2 mm. The shells of freshwater mussels embedded with grey natural pearls were lying along with millions of shells spread over the reservoir bed.

The department of fisheries had already introduced freshwater pearl culture in lower Shiwalik hills, especially in Una District. More than 16 fish farmers were engaged in culturing the freshwater mussels (*Lamellaeden marginellis*) in their fish-ponds. A progressive fish farmer of the district, Dinanath of Bangana, has been successfully producing design pearls for the past one year.

Source: <http://www.tribuneindia.com/2009/20090808/himachal.htm>

Micro-finance for fishery sector assist in fish workers in the small-scale fisheries sector in India, Bangladesh and Sri Lanka: Fish workers in these countries have always been very poor and among the most marginalised communities. Their low social status is a result of poverty as well as exploitation by middlemen and merchants. Middlemen have control over credit and fish marketing, which drains away the surplus generated by the fish workers and often makes them indebted. A combination of variability in catch, technology upgrades, over-capitalisation, rising costs, aggressive fishing, overcrowding, etc. have made the economics of fishing and fishing related occupations uncertain. The overall output remains almost the same but the investment and operational costs have gone up considerably. This has resulted in fishers getting increasingly dependent on loans to finance their expenditures and also using loans as a coping mechanism. It is against this background that the micro-finance services extended by the Bangladesh

Grameen Bank and the integrated micro-finance programme extended by SIFFS in India to the sector are noteworthy. The integrated micro-finance model of SIFFS incorporating technology development and dissemination, support services for production and repair of marine fishing units, information services including location of fish stock, post-harvest infrastructure, alternative livelihoods and policy and advocacy might be a good model for possible replication.

Vietnam Bank for Agriculture and Rural Development (VBARD) employs a unique and effective group lending model that relies on close collaboration between VBARD and the Farmers' Union. The objective is for VBARD to reach more poor households in more remote areas of Vietnam at a much lower cost for the bank. The Farmers' Union takes care of the formation of a borrower-savings group of five to seven members as well as the assessment of loan applications of members and loan collection. In turn, VBARD disburses the loans, organises and conducts regular training on borrowing procedures and taps service providers to give lectures on cultivation, aquaculture, animal husbandry and other business activities. VBARD also reimburses the operating fees of the Farmers' Union. As a result of this approach, the repayment rate has increased to and has been maintained at 95 percent to 98 percent and has provided financing to 85425 groups consisting of 1 500 000 clients and close to 700 000 women.

Source: Best practices to support and improve the livelihoods of small-scale fisheries and aquaculture households; APFIC Regional Consultative workshop; Review of the best practices for the development of micro-finance services for coastal small-scale fisheries and aquaculture for the APFIC member countries; K.G. Karmakar, G.S. Mehta, Dr S.K.Ghosh and Dr P. Selvaraj (NABARD Consultancy Services)

Multi stakeholder participation in the fisheries management to arrest decline of fisheries: Introduction of best practices like seasonal closure of fishing, introduction of resource friendly areas and strict enforcement of

regulations has helped to arrest the decline of fisheries in Lake Victoria in Kenya. This is

described in the case study given below.

Case Study: Kenya and Lake Victoria

Despite attempts to control fishing pressure through setting and implementing fisheries regulations, the Kenyan Government continued to observe declining fish stocks in Lake Victoria. A new approach was introduced by the Fisheries Department (the Department)—stakeholder participation in the fisheries management as a way to assure sustainable resource use was applied to various fisheries eco-systems. In 2000, the Department began consultations with communities at a grass-root level in order to increase awareness of both the fish stock trends, and of the role communities could play in reversing this trend.

A stakeholder meeting for the Kenyan section of Lake Victoria was organised by the Department in 2001, which was attended by all stakeholders and key players in the industry, including Lake Victoria Fisheries Organisation (LVFO) Secretariat and the research co-ordinators for the Lake Victoria (regional) research and environmental management projects. The main outcomes of this meeting were various fisheries management measures which could possibly reverse the decline.

One suggested measure consisted of closed seasons and areas. At the end of the first closed season, there was an abundance of good quality target fish and a recovery of non-target fish such as tilapia. During the closed period, the fishers participated in the surveillance and law enforcement, for example by reporting those who violated the new regulation with respect to closed seasons. The second closed season, in 2003, was therefore less resisted and through general consensus, it was also decided to ban any trade in the target fish (omona) during the closed season to discourage illegal fishing activity due to available market.

Another outcome of the meeting was an expressed willingness of fishers to actively participate in the management of the Lake Victoria fisheries. This resulted in the formation of Beach Management Units (BMUs), which are being developed to assist communities in taking the lead in fisheries management. The results of this approach were:

A decline in destructive fishing gears.

An increase in resource friendly gears.

The apparent decline in Nile perch landings which could be attributed to the integrated concerted law enforcement effort that reduced the harvesting of large volumes of immature fish, whose market has been significantly reduced.

Facilitation of development of strategies for conflict resolution and sustainable fish stocks utilization in several Kenyan fisheries waters, which could be attributed to the ongoing fisheries stakeholders' meetings.

Higher compliance, achieved due to involvement of stakeholders in the policy-making process from the outset. Resource users ended up policing them selves, encouraged by the sense of ownership stemming from the participatory approach.

This lightens the Government's burden in regard to law enforcement.

It should be noted that there are still prevailing surveillance weaknesses to be addressed, resulting from lack of surveillance facilities such as patrol boats and engines for both the Department of Fisheries and the fishing community.

Source: Human Dimensions of The Ecosystem Approach to Fisheries: An Overview of Context, Concepts, Tools and methods; Cassandra De Young, Anthony Charles, Antonia Hjort; Food and Agriculture Organisation of the United Nations.

Institutional management structure and stakeholders involvement can enhance fish production in culture based fisheries: Successful culture-based fisheries are dependent upon functional management structures and these require a supporting institutional environment. In Bangladesh, for example, the culture-based fisheries in oxbow lakes that are under the purview of the Department of Fisheries and are managed by the stakeholders, a system that is referred to as a common property regime (CPR). It has been reported that such a CPR can be sustained only through fostering co-operation

among stakeholders (fishers), by providing incentives, maintaining equity and ensuring democratic rotation of leadership and the monitoring of all operations by the fishers themselves.

It has been observed that long-term security of tenure of the fishing rights for the CPR, as well as the long-term tenure of individual fishers in the CPR, were important determinants of sustainability.

Source: A Review of Stock Enhancement Practices in the Inland Water Fisheries of Asia: Sena S. De Silva and Simon Funge-

Smith; Food and Agriculture Organisation of the United Nations.

Community based fingerling production in backyard hatcheries for fish stock enhancement: In most Asian countries, backyard hatcheries are common, particularly for the propagation of Chinese and Indian major carps. These backyard hatcheries generally produce only fry, which are not suited for stock enhancement purposes, unless grown to advanced fingerling stages. Backyard hatcheries are generally effective, not capital intensive and are managed by at most, two persons. In Orissa, India, for example, community-based carp hatcheries are successfully run by village women. These community-based hatcheries enable poor women who do not have pond resources to be engaged in fish-related activities, providing them with additional household income. Such hatcheries tend to contribute significantly to rural aquaculture development and indirectly, to poverty alleviation in rural communities.

Source: A Review of Stock Enhancement Practices in the Inland Water Fisheries of Asia: Sena S. De Silva and Simon Funge-Smith; Food and Agriculture Organisation of the United Nations.

4.4 Horticulture

Best Management practices related to vegetables, compost and storm water management: Some of the tried and tested management practices in increasing productivity and reducing pollution load are given below. An indicative list of these practices is given below.

Vegetables

- Rotate crops to avoid the build up of pathogens and pests in the garden
- Test the soil to learn the pH and nutrients already present
- Determine soil drainage capacity before planting

- Utilize companion planting/inter-cropping to attract beneficial insects and to take advantage of symbiotic biochemical and cultural benefits
- Use cover crops/green manures to improve soil nutrients and structure
- Practice right plant, right place, in order to take advantage of garden micro-climates- hot areas, light angles and moisture sinks, when planning your garden layout.
- Identify insects (friend or foe), diseases or weeds and susceptible life cycles and evaluate the extent of the problem before taking remedial action (using the least toxic alternative).
- Improve compacted soil by aerating, double digging
- Select cultivars of plants and seeds that are bred for resistance and tolerate local conditions.

Compost

- Top-dress existing lawn with ¼” of compost to improve the soil structure of clay soils.
- A simple formula to calculate how much compost is needed is: Area to cover (square feet) X depth of compost (inches) X 0.0031= compost needed (cubic yards).
- In late spring, add about 1 inch of compost around the trees and shrubs. Cover with a mulch of shredded pine needles, straw, bark chips, or leaves 2 to 3 inches deep.
- In the fall, spread about 2 inches of compost over your entire garden and work it 6 to 8 inches into the soil.

Storm water management

- Remove debris from storm drains regularly, and clear snow from drains
- Clean parking lots and paved areas of leaves, trash and sediment

- Reduce the amount of road salt used in parking lots and walkways, or use ice melt, sand, kitty litter, cinders, ashes or other alternatives, but not fertiliser
- Clear snow to the lower end of the paved areas
- Educate employees/residents on proper storage, handling and disposal of potentially hazardous wastes
- Collect and recycle hazardous waste, waste oils, solvents, etc.
- Store potential pollutants inside or cover
- Minimize the amount of material stored by implementing “just enough” and “just in time” purchasing
- Practice preventive maintenance to reduce leaks, spills

Source: <http://www.co.prince-william.va.us/docLibrary/PDF/007663.pdf>

Management Practices for Control/Preventions of Premature fruit fall/dropping: Thin fruit to reduce competition and encourage the plant to put more energy into producing fewer numbers of larger, higher quality fruit. The removal of fruit beyond what is lost during the early season drop may even be necessary. Some of the practices are: Avoid unfavourable environmental conditions that might cause a plant to drop its fruit. This involves effective water management and a balanced fertiliser programme, according to individual plant specifications.

Soil testing may be required in order to confirm nutrient deficiency/toxicity. Supplement with fertiliser where necessary. Avoid herbicide drift. Never apply herbicides in windy or dead calm conditions.

Contrary to popular belief, dead calm conditions are often associated with a phenomenon known as temperature inversions. Spraying under such conditions

can actually increase drift distance. If additional symptoms are observed on fruit, leaves or stems, proceed to identify the causal agent and administer appropriate control measures.

Source: http://www.umanitoba.ca/afs/bort_inquiries/fruit_and_fruit_plants/premature_fruit_drop.html

Tillage and residue management to protect top soil: This practice involves leaving some crop residues to protect the soil. Residue acts in two ways: It protects the soil from the impact of raindrops and the resulting movement of soil particles and crusting; it acts as small dams or windbreaks slowing the movement of wind and water across a field and reducing their ability to carry soil. To protect soils, at least 20% residue cover should be left-but any amount will help. A rye cover after processing tomatoes add organic matter, holds some excess nutrients and protects the soil over winter. Cover crops are planted to protect the soil surface and to maintain soil structure. They also help tie up excess nutrients, add organic matter to soil and control pests. There is a variety of cover crops available.

Source: <http://www.omafr.gov.on.ca/english/environment/bort/bort.htm>, Ministry of Agriculture Food & Rural Affairs.

Good use of nutrient management will improve both production and the environment: Cost-effective application will produce the best yield potential while minimizing costs. In turn, this helps reduce nutrients lost to the soil through leaching and water erosion. Soil testing is an important first step. Soil test results will give a base on which to analyze soil needs. Also do tissue tests, if available for your crop. This shows what plant nutrient levels are at that point in time, as opposed to what is available in the soil. This is particularly important for perennial crops. Record keeping of soil and tissue tests will help track trends. Include observations on crop growth, yield, quality and weather conditions during the growing season.

Application of nutrients varies from crop to crop. A few general best management practices include: If possible, use split applications of nitrogen to reduce the possibility of loss by leaching; keep soil healthy so that root systems will be most effective in using nutrients and if nutrients are left after a crop harvest, use cover crops to hold them for the next crop.

Source:

<http://www.omafra.gov.on.ca/english/environment/hort/hort.htm>, Ministry of Agriculture Food & Rural Affairs.

Integrated Pest Management (IPM) : IPM is a broad ecological pest control approach aiming at best mix of all known pest control measures to keep the pest population below economic threshold level (ETL). It is an economically justified and sustainable system of crop protection that leads to maximum productivity with the least possible adverse impact on the total environment. In crop production technology, IPM is a schedule of practices which starts from field selection till harvest of a crop. The major components in this approach are cultural, mechanical, biological and chemical methods of insect pests, diseases, weeds and rodent control in a compatible manner.

Salient Features:

- Popularising IPM approach among farming community.
- Organising regular pest surveillance and monitoring to assess pest/ disease situation and study agro-eco-system to advise timely IPM control measures.
- Rearing biological control agents for their field use and conservation of naturally occurring biological control agents for control of crop pests.
- Promoting use of biopesticides, neem based pesticides, bacillus based biopesticides, insect pathogen as alternative to chemical pesticides.

- To play a catalytic role in transfer of innovative IPM skills/methods/ techniques to extension workers and farmers in all States including the rich.
- To preserve eco-system and environment.
- Human Resource Development in IPM by imparting training to master trainers, extension workers and farmers by conduct of trainings and establishment of Farmers' Field Schools (FFSs).
- Field releases of laboratory reared bio-control agents for the control of pests. Issuing insect-pest and disease situation bulletins for the benefit of State functionaries and farmers.

Monitoring: Monitoring allows forecasting and evaluating potential pest problems. It identifies the pests present, estimates numbers and examines conditions favorable to pests. Monitoring allows accurate timing of pesticide applications which may reduce pesticide use. Each field should be watched separately because conditions vary. Monitor at least once per week and preferably twice per week when the pest is usually most active. Scouts may be hired to monitor the crop. Good record keeping is essential. Complete written records help decision-making by supplying information on previous problems and applications. It is useful to record:

- Crop health
- Pest species present
- Weather and other environmental conditions
- Population level of pests and beneficials
- Sprays and other controls applied

Control Guidelines: Control guidelines, or thresholds, indicate when pesticides need to be applied to prevent economic losses. Timing of control measures is critical. Guidelines for diseases, weeds, nematodes

and vertebrates may be based on weather, history of the field or region, stage of the crop and other field observations.

Control Methods: There are three types of controls used in IPM systems: cultural, biological and chemical (pesticides). Cultural and biological controls are used wherever possible. When these are inadequate, pesticides are usually used. The most economical and reliable way to deal with pest problems is to avoid them when possible.

Cultural Control: Many cultural practices reduce pest damage. They prevent problems and are effective and economical. Examples are:

- Site selection - choose sites that are less favourable to pests.
- Cultivar selection - choose varieties that are resistant, when possible.
- Crop rotation - rotate away from crops of the same family (e.g. turnip, cole crops and canola) to prevent some pests and help control weeds.
- Inter-cropping - planting a mixture of crops may reduce insect damage (e.g. under seeding brussels sprouts with clover). However, competition may reduce yields in some cases.
- Cover crops - can provide shelter for beneficials.
- Trap crops - plant crops to attract the pest away from the main crop. Pests can be killed with a localized spray. For example, in tomatoes, trap crops of potatoes and eggplant can be used for Colorado Potato Beetle (CPB).
- Tillage - provides weed control and may kill some insects and pathogens.
- Time and method of planting - may help to avoid a generation of the pest.
- Sanitation - remove pest habitat such as cull piles, dropped fruit or other plants. For example, potato cull piles

provide a place for potato blight to overwinter.

- Pruning - removes a food source or a point for infection. For example, removal of pear suckers helps to keep psylla numbers down.
- Clean seed and transplants - avoid introducing pests. Use seed that has been certified disease-free.
- Plant health - healthy plants are less prone to infection.
- Irrigation - use good timing/scheduling to prevent disease.

Biological Control: Biological control uses a pest's natural enemies to control the population of the pest. Natural enemies include predators, parasites and diseases. The term, "beneficials", refers to predators and parasites of insect pests. IPM systems take maximum advantage of control by natural enemies. There are two ways in which biological control is managed:

Encouraging natural enemies provide shelters or food sources for natural enemies. For example, a sod or weedy cover in an apple orchard provides an overwintering site for predatory mites. These mites control European red mite and two-spotted spider mite.

- Select pesticides that have minimal effect on beneficials. For example, *Bacillus thuringiensis* (Bt) is specific to certain types of caterpillars.
- Time or schedule pesticide applications to have least effect on beneficials.
- Apply pesticides only when needed.

Adding natural enemies to provide control adding natural enemies is not usually economical in the field. However, in greenhouse operations, it is often possible. For example, whitefly can be controlled with *Encarsia formosa* (a parasitic wasp). At

present, work to develop pest diseases is continuing. In the future, more of these products may come on the market.

Resistance: It refers to the developed ability of a pest to survive applications of pesticides at rates that once killed most of that species. This ability is passed from generation to generation making the pesticide useless. Colorado Potato Beetle resistance, for example, is a major problem. With fewer new pesticides coming onto the market, resistance could become a more widespread problem. Resistance is most likely when pesticides are applied at lower-than-recommended rates and when either the same pesticide or pesticides with the same mode of action are repeatedly used.

Resistance Management do's and don'ts

- Use pesticides only when needed.
- Avoid pesticide residues.
- Alternate pesticides with different modes of action.
- Use recommended rates of pesticide.
- Use other controls where possible (e.g. rotary hoe for weeds).
- Time pesticide sprays for the most vulnerable stage. For example, spray for the larvae of Colorado Potato Beetle rather than the adult

Weed Control: Weed control should be integrated, combining the use of mechanical, cultural and as necessary, chemical controls. The following methods control weeds in either a nursery field or container crop:

- Plant new crops in a weed-free field or media.
- Control weeds in perimeter areas (i.e. fence rows and windbreaks).
- To reduce weed seeds, properly store and compost manure before applying to the soil.

- Mow buffer strips to reduce seeds blown into irrigation ponds.
- Minimise run-off from weedy fields to ponds.
- Pump irrigation water from deep in the pond to avoid seeds on the water surface.
- Ensure weed-free material is planted.
- Do not move weeds between fields on equipment.
- Cultivate fields when seedlings are small.
- Use shallow tillage (2.5-5.0 cm) if herbicide has been applied.

A mowed grass strip between nursery rows with a weed-free strip at the base of the plants 0.5 to 1.0 metre wide can be maintained by: hand hoeing, mechanical cultivation, mulching with various organic materials, or herbicide application. Weed control with container stock is more difficult than in the field because there are few effective registered herbicides. In container stock, the following measures will help:

- Weed by hand.
- Install a weed barrier of old polyethylene or geotextile fabric under pots. This prevents weed germination under the pots. Water ponding may occur if polyethylene is used.
- Keep media components weed-free. Components stored outdoors should be covered.
- If planning to use field soil, ensure that it comes from a source known to have few weeds and no herbicide residues.
- Use weed discs in pots; these reusable barriers are made of materials that allow water and air movement while reducing seed germination.

Source:

<http://www.omafr.gov.on.ca/english/environment/hort/hort.htm>, Ministry of Agriculture Food & Rural Affairs.

Note: A list of do's and don't including monthly time tables for application of various control measures to various crops in Himachal Pradesh is available on [Http://www.hpagrisnet.gov.in/default.aspx](http://www.hpagrisnet.gov.in/default.aspx)

Best Practices for fumigation of fields: Applying fumigants is usually done with a three-point hitch cultivator which places fumigants in a shallow band 1.75 metres wide and 15 centimetre deep. The entire field can be fumigated or just the strips where trees will be planted. Before applying fumigants, prepare a good seedbed. A new method uses a twin-shank subsoiler to deliver fumigant in a narrow band at 15, 30 and 45-centimetre depths. Establishing the sod cover in the summer before fumigation is recommended. Fumigating row strips through the sod allows better weed and erosion control. This may give better nematode control and also subsoils the planting area. The reduced tillage also preserves organic matter and reduces erosion.

*Source: -
<http://www.omafra.gov.on.ca/english/environment/bort/bort.htm>, Ministry of Agriculture Food & Rural Affairs.*

Good soil management in orchards should promote tree growth and good health, productivity and overall fruit quality while preserving soil structure. Issues include ground covers, organic matter and erosion. Soil management systems include clean cultivation, cultivation plus cover crop, sod plus herbicide strip, sod plus mulch and inter-cropping between tree rows. In Ontario, growers usually use sod or cultivation plus cover crop. Clean cultivation decreases organic matter, degrades soil structure, increases erosion and increases the potential for winter injury.

*Source:-
<http://www.omafra.gov.on.ca/english/environment/bort/bort.htm>, Ministry of Agriculture Food & Rural Affairs.*

Growth of permanent sod systems to increase life of orchard: Producers grow permanent sod between tree rows and mow sod for the

life of the orchard. Advantages are: Decreased erosion; moderate soil temperatures; increased organic matter; decreased mechanical injury of roots; water penetrates soil more easily; easier orchard operations and decreased soil compaction. Some growers are trying to establish sod the year before planting. In the fall, sod in the tree row is killed with a herbicide. The following spring, trees are planted into the dead grass without cultivation.

Sod farming has a relatively low environmental impact. Pesticide use is minimal and nutrients are carefully managed. The amount of soil removed during harvest operations is the issue most often raised. This is offset by the environmental benefits of sod use. Construction sites are highly prone to wind and water erosion. The eroded soil goes directly into lakes and streams through storm sewers and waterways. However, sod can stabilise these fragile areas quickly which reduces soil loss and leaching and filters storm water. The use of best management practices during sod production can help to ensure efficient production of nursery sod.

*Source:
<http://www.omafra.gov.on.ca/english/environment/bort/bort.htm>, Ministry of Agriculture Food & Rural Affairs.*

Usage of Herbicide Strips for weed suppression: The objective of a herbicide strip is weed suppression during the critical growth stage from early spring to mid summer. A strip of bare ground is left at the base of the trees to reduce competition for moisture between trees and grasses and to aid in the control of mice. The wider the strip, the better tree growth will be.

*Source: -
<http://www.omafra.gov.on.ca/english/environment/bort/bort.htm>, Ministry of Agriculture Food & Rural Affairs.*

Increasing organic matter levels in the soil will improve its ability to hold water and nutrients. If a soil test shows organic matter levels are low, consider using cover crops or adding

manure, straw or hay. Tillage, including cultivation between rows, breaks down organic matter. To reduce loss, reduce the depth and amount of tillage. In established raspberry and blueberry fields, permanent sod between rows will reduce soil compaction and erosion, improve soil organic matter levels, make harvesting easier and moderate soil temperatures.

Use of mulches reduces winter injury and infection: The use of wheat straw mulches controls winter injury to strawberries. Mulches are also useful during the growing season to control fruit rots, especially Leather Rot. Mulch keeps berries off soil which reduces the spread of fungi to fruit. When the mulch is worked into soil, it adds to the organic matter levels.

Timing of mulch application is important. If it is applied too early, plants don't harden; if applied too late, winter injury is possible.

Since the berry roots are shallow, the mulch will preserve soil moisture, decrease soil temperature during the summer, protect roots from winter injury, increase organic matter and provide weed control.

Mulches may be sawdust, wood chips and chipped brush or acidic peat moss. If finding mulch is difficult, produce your own by chipping brush and composting it for a year. Mulching can be used in raspberry production to control soil temperature and to conserve moisture.

Source: -
<http://www.omafra.gov.on.ca/english/environment/hort/hort.htm>, Ministry of Agriculture Food & Rural Affairs.

Water harvesting, Snow Water Harvesting in Cold Deserts of HP: Among other environmental stresses, severe water shortage in remote cold deserts of the Himalayan region in particular makes these areas most difficult. Snow water harvesting in this region has traditionally played a significant role in the

sustenance of farming communities. However, introduction of modern technologies in snow water harvesting have proved much beneficial for the region. Initiatives of Chewang Norphel, Ladakh's "glacier man", in making low cost artificial glaciers during winters has enabled the villagers to get irrigation water during sowing season (April-May), thereby, improving crop growth. The added advantage is that the areas under artificial glaciers turn into green pastures during summers.

Source: G-SHE guidelines

Creation of water sources for horticulture by creating pucca tank: Suitable water sources are to be created to ensure irrigation for the horticulture crops round the year. For creating community tank, assistance @ Rs. 1.00 lakh for providing irrigation to one ha of area with a maximum limit of Rs. 10.00 lakhs per tank for irrigating.

Disease/Weed growth restriction through Plastic Mulching: Covering of soil around the root zone of plant with a plastic film is called plastic mulching. It is an effective practice to restrict weed growth, conserve moisture and reduce the effect of soil borne diseases through soil solarisation.

The community tanks should be pucca (Concrete with RCC structure including all walls and bottom). With regard to size of the community tank, for providing three irrigations in 1 ha of land with 1 cm water per irrigation, the capacity of tank would be 300m³. The dimensions of such a tank from top, would be length (20m), width (15m) and depth (1.5m) and, at bottom, length (18m) width (13m).

In India plastic mulching is yet to gain momentum. As a result the quantity of film required per farmer is very small. Since it would be difficult for the supplier to supply the film to individual farmers, the implementing agency in the State may arrange

to procure the plastic film in bulk as per the estimated requirement for a quarter/six months/year.

The thickness of the walls of the tank should be 18 inches, brick and cement plastered all around and inside out. The bottom of the tank should be at least 9 inches thick concrete. The above dimensions can be further increased for creating higher capacities as per needs and availability of land for providing irrigation. The financial assistance would also go up proportionately.

On farm water management for water resource usage optimisation: Besides developing water sources to ensure round the year irrigation, the on-farm handling of water is also very important. The use of plastics for on farm management of water has gained significant importance in recent years.

The plasticulture applications include water distribution network through plastic pipes, plastic sprinklers, micro-irrigation, micro sprinkler, nursery bags, green houses, net structures, walk in and low tunnels, plastic mulching etc. Drip irrigation is useful from the point of view of judicious utilisation of scarce surface and ground water resources.

Plasticulture application has proved beneficial to promote the judicious utilisation of water sunlight and also reducing the vagaries of climate. In plasticulture, plastic material is used for efficient utilisation of natural resources through various applications resulting in enhanced productivity and sustainability. Different grade of plastic material like low Density Polyethylene (LPDE), High Density Polyethylene (HDPE) pipes for drip irrigation system, Ultra Violet Stabilised films for use as cladding material for green houses, plastic sheets of different thickness for plastic mulch are now available for use. These are light in weight, durable and cost effective.

One of the major sectors of plasticulture application is in the area of water management and conservation. Application of micro-irrigation has helped in increasing productivity by 30 to 100 per cent with 50 to 70 percent saving of water. Fertiliser use efficiency is also enhanced when it is applied through drip irrigation. Increased productivity with saving of 30 to 40 percent fertiliser is achieved through fertigation.

Usage of Low Tunnels Greenhouse Technology for input resource optimisation: Low tunnels are a miniature form of greenhouse to protect the plants from rain, winds, low temperature, frost and other vagaries of weather. However, under low tunnels, artificial control of conditions is not possible. The low tunnels are very simple structures requiring very limited skills to maintain, are easy to construct and offer multiple advantages. It has been proven that with low tunnels seedlings can be raised very quickly. Sometimes the advancement of the period is by more than one month giving the farmer extra one month for his main crop. It is therefore felt that the application needs to be supported as it will attract the small and marginal farmers who may not be in a position to take up green houses.

Development of information base through remote sensing for development implementation and upgradation of integrated development plan for horticulture: Remote Sensing (RS) and GIS together is able to provide many parameters required for planning and managing horticultural sector in India such as identification of crop, area estimation, condition assessment, separation of areas with diseased plants from areas with healthy ones. Therefore, remote sensing can be used for (i) upgradation of data; (ii) infrastructural planning, (iii) site suitability through training and strengthening of infrastructure. The methodology for developing it includes identification of sites for Horticultural Area Expansion,

Identification of Jhoom Areas, Identification of Other Waste Lands, Water Resources Development, Infrastructure Development of Post Harvest Management and Inventory/Database for Management of Existing Orchards.

Source: Operational guidelines for centrally sponsored scheme on technology mission for integrated development of horticulture in Himachal Pradesh; Department of Horticulture, Himachal Pradesh.

A planned farm layout can assist to protect environment and maximise agriculture production: Farm should be planned so as to: protect the environment; allow for maximum agriculture use and profitability of the site and ensure that farming practices have minimal impact both on and off the farm. By preparing a “Whole Farm Plan” you can consider all the natural resources available for your farm. You can plan the ideal farm layout for your situation.

Site selection is important. Slopes to the north-east are preferred for maximum sunlight, warmth and protection from wind. To help reduce soil erosion orchards planned on steep slopes should be planned on the contour (angled to the prevailing slope) to reduce water flow following heavy rainfall and help to divert water into dams and grassed areas. Permanent plantings like fruit trees, vines and nut crops are best planted in rows in a north to south aspect. To prevent erosion on steep slopes, planting are best positioned on a contour (contour is a line of similar elevation). It is recommended that plantings be across the slope and not down them so as to minimise any soil erosion.

When determining a maximum slope for orchards, consider soil erosion risk, ground cover and planting method. For example where trees are planned on the contour on soils of moderate erosion risk (e.g. loam soils) and permanent ground cover is above 90 percent then slopes up to 10 percent can be

planted provided the length of slope doesn't exceed 150 metres.

Buffer zones (areas of vegetated land) need to be established or left in place to protect sensitive environmental areas and provide a wildlife habitat. The zones should be located between the area of farm activity and any areas of possible water quality impairment. Water environs or features needing protection include: Riparian areas (the area of land, including flood plains, adjacent to rivers, streams and other watercourses); Wetland (land areas temporarily or permanently covered with shallow water and which play a crucial role in nutrient recycling). Wetlands have a high ecological productivity and should not be drained, filled or used as storages; Watercourses.

Wind protection and screening of whole farm and of individual large paddocks is recommended. Screening of the property, especially with trees, often prevents complaints about farm activity; windbreaks also prevent drift and movement of sprays, dust pests, and noise to adjoining areas. A windbreak will protect a crop for 10 times the height of the windbreak. Natural windbreaks using perennial grass or fast-growing local native trees such as casuarinas, will provide screening within three years.

Source: Horticulture in the Sydney; Drinking Water Catchment; Ministry for Agriculture, Australia.

Improving soil structure to reduce soil erosion, water loss and improve productivity: Improved soil structure allows greater infiltration of rainfall meaning higher crop yields and less need for costly irrigation. Greater infiltration means less run-off and less erosion. Improved drainage due to good soil structure means vehicle access will be easier, so that operations are more timely, which improves crop management. Better yields through improved seedling emergence and vigorous plant growth. Good structure

requires less tillage for crop establishment. This means less wear on equipment, reduced fuel consumption and fewer hours on the tractor.

There are non income producing crops grown to protect bare soil erosion prior to or between plantings of a commercial crop (usually vegetable or flower crops). They can also be green manure crops grown as a break from normal production to add organic matter to the soil or to act as a “brak crop” which helps reduce pest or disease levels.

To prevent erosion and loss of vulnerable topsoil you need to control movement of water through your block. Diverting run-on water around the cultivated block by construction of a permanent diversion bank or channel up-slope of the cultivation; reducing the length-of-run within the cultivated paddock through construction of diversion banks and ploughed drains; use of dedicated grassed waterways which are kept stock and traffic free. Use of sediment detention devices at the base of the grassed waterways to trap sediment at the bottom of the block. Installation of grassed filter strips at the outlet point of the dam and sediment fences or straw bales at the base of the dam spillway to filter out the remainder of the sediment before water leaves the property.

Source: Horticulture in the Sydney; Drinking Water Catchment; Ministry for Agriculture, Australia.

Use of recycled water to reduce water resources loss: Horticulture enterprises can use two sources of recycled water- water from outside sources, such as a sewerage treatment works, and drainage water from horticulture enterprise itself. Drainage water can also be reused for purposes other than irrigating production areas – for example on lawns, landscaped areas and windbreaks. For use of recycled water supply, there is a need to separate contaminating sources. Sample surface drainage water and get it tested by an accredited laboratory. The quality of drainage

water can change rapidly over time depending on the water source and what is happening during the production cycle. As a minimum, a sample could be taken four times per year at: The end of your driest month; during your wettest month; in the middle of winter; in the middle of summer. The results of these tests will help to decide whether to recycle the water back through production areas or reuse it at non-production areas like lawns.

Source: Horticulture in the Sydney; Drinking Water Catchment; Ministry for Agriculture, Australia.

Prepare and implement irrigation and drainage management plans to optimise water usage and reduced pollution: Irrigation and Drainage Management Plans (IDMP) can be prepared for any property that irrigates some or all of its production enterprises, it describes resources’ available management procedures needed to achieve best management practice and the direction for future development. IDMP can be integrated into a property management plan, showing how the irrigation enterprise fits in with other farm systems such as grazing management of animal production and into an environmental management system.

Source: Horticulture in the Sydney; Drinking Water Catchment; Ministry for Agriculture, Australia.

4.5 Agriculture

Conservation of genetic resources: Realising the need for maintaining the valuable gene pool of traditional varieties/land races of at least domesticated biodiversity and for the promotion of indigenous ‘best management practices’ in mountain farming (as an adaptation and coping option under changing climate scenario), appropriate incentive mechanisms need to be framed and implemented for the benefit of indigenous farming communities of the region. In this context, the facilitation of organic farming, which encompasses commodities, value added foods, woollens, health products, has emerged as an effective option. Certain State

Governments (e.g., Mizoram, Uttarakhand and Sikkim) in the region have already taken the lead in this regard.

Organic farming: The Legislative Assembly of Mizoram passed the Mizoram Organic Farming Act (2004) on 12.07.2004, to introduce, adopt areas to promote and regulate organic farming in consonance with the National Organic Programme. The aims, among others, include:

- To notify areas of organic farming and to undertake such farming in such areas;
- To encourage the development of organic farming in private land and organic processing through various measures as may be prescribed;
- To facilitate certification of organic products in the State in conformity to the National Standards for organic products;
- To facilitate marketing of organic products in the local, national and international markets;
- To make infrastructure for organic farming including permitted inputs or material easily available to the intending farmers.

Source: The Mizoram Organic Farming Act, 2004; Act No 6 of 2004, passed on 12.07.2004

Organic farming in Sikkim: Organic farming combines ecologically-sound modern technology with traditional agricultural practices including crop rotation, green manure and biological pest control to ensure reduction or total elimination of chemical inputs. Sikkim, an ecological hotspot of the eastern Himalayas has moved towards sustainable agriculture in a big way, covering almost 90% of its agricultural land. In several parts of Sikkim, farmers have succeeded in growing completely organic maize, paddy, ginger, cardamom and turmeric while expanding the practices to other horticultural crops.

Use of chemical pesticide, insecticide or chemical inputs was slowed down as early as 2003 but what was awaited was blanket certification of 70,000 ha of arable land in Sikkim, 6000 ha is already organic-certified. By 2015, Sikkim aims to be completely organic certified. The first step came in May 2003, when the State Government withdrew the subsidy on fertilisers. From 2006-07 onwards, the transport and handling subsidy and commission to the retailer was also withdrawn. Along side, the Government also adopted a seven-year plan to phase out use of chemical fertilisers, by gradually replacing these with organic sources.

“The Government had taken the decision because it had seen the adverse impact of chemical fertilisers on our soil, water and on human health, considering Sikkim as a biodiversity hotspot,” says S K Gautam, Secretary in the Department of Food Security and Agriculture. The spinoffs, however are encouraging. “Village tourism in Sikkim will obviously improve. Home stays will become more popular. We believe that the organic tag will boost the inflow of tourists, especially international tourists,” said Lukendra Rasailly, general secretary of Travel Agents Association of Sikkim. We understand that only organic farming can help us maintain our soil quality and prevent pollution of our water sources. It will also be the key to high end tourism, hopes Rasailly”

Source: Sikkim Makes an Organic Shift, Times of India, New Delhi, issue dated May 7, 2010.

Conservation through integration of traditional & cultural values: Realising the need for maintaining the valuable gene pool of traditional varieties/land races of at least domesticated biodiversity, and for the promotion of indigenous ‘best management practices’ in mountain farming (as an adaptation and coping option under changing climate scenario), appropriate incentive mechanisms need to be framed and

implemented for the benefit of indigenous farming communities of the region. In this context, the facilitation of organic farming, which encompasses commodities, value added foods, woollens, health products, has emerged as an effective option. Certain State Governments (e.g., Mizoram, Uttarakhand, Sikkim) in the region have already taken the lead in this regard.

Soil fertility

Case Study 1: Community Efforts – sustaining soil fertility by protecting the forests: The Apatani tribe of Arunachal Pradesh having sound traditional ecological knowledge (TEK) of forest, land and water management, has highly developed valley cultivation of rice over centuries. Wet rice land agro-eco-system is dependent upon nutrient flow from the hill slopes. With crop harvest, nutrients are lost. The farmers grow wet rice integrated with fish culture in terraces and finger millet on the risers. To maintain and regulate water supply and nutrients to the field, the surrounding hills are fully covered with forests and protected by the community. The Apatani is under the overall supervision of their village headman have optimised water use along with nutrient use in their rice fields.

Case Study 2: Traditional Wisdom – Maintaining Soil Fertility: The Nagaland State produces horticulture crops like passion fruit, banana, ginger, orange, cardamom, french beans, pepper, turmeric, pineapple, etc. Alder (*Alnus nepalensis*), a multipurpose, nitrogen fixing tree species is maintained along with the crops to enhance soil fertility. The value of alder tree was recognised by the tribal farmers long back and more than 200 years old trees can be seen. Agricultural crops, together with alder trees, form a very remunerative agro-forestry system. Knononome village in Kohima is proud of its alder plantations and alder tree based agriculture. Keeping in view their traditional approach, the State Government has launched a programme called Communitisation of Public Institutions and Services. Source: ENVIS Bulletin – Himalayan Ecology (2001); Vol 9 (1): 31-36).

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Traditional Wisdom – Maintaining Soil Fertility: The Nagaland State produces horticulture crops like passion fruit, banana, ginger, orange, cardamom, french beans, pepper, turmeric, pineapple, etc. Alder (*Alnus nepalensis*), a multipurpose, nitrogen fixing

Also, to harness community support to maintain and conserve the uniqueness of biodiversity (both wild and domesticated), there is a need for the integration of cultural values and indigenous knowledge practices with management as given in Box 2 & Box 3.

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Source: ENVIS Bulletin – Himalayan Ecology (2001); Vol 9 (1): 31-36)

Soil management practices:- In most of the agricultural fields in Meghalaya, soil against depletion by natural and anthropogenic erosion is minimised through traditional methods such as by using bamboo culms, stones and gunny bags filled with soil. Some non-cereal crops such as grass clover (*Trifolium repens*) and alfalfa (*Medicago*

sativa) conserve the organic matter in the soil. Thus, growing these crops tends to conserve soil even if some minerals are carried away in the removal of crops. Applying green leaf and farmyard manure is the traditional method of improving the condition of the soil, in which green leaves and farmyard manure are ploughed into the soil. It helps in improving soil fertility through fixation of nitrogen using micro-organisms.

Terrace or Bun cultivation:- Bun cultivation on hill slopes and valleys is a settled cultivation system being practiced for last three decades in Meghalaya, to provide improved production system, to conserve soil moisture and also to prevent land degradation and soil erosion. In this system, bench terraces are constructed on hill slopes running across the slopes. The space between two buns is leveled using cut and fill method. The vertical interval between the terraces is not usually more than one metre. Such measures help to prevent soil erosion and retaining maximum rainwater within the slopes and safely disposing off the excess runoff from the slopes to the foothills.

Traditional tree based farming practices:- Tree based farming practice has a long tradition among indigenous people of Meghalaya, where trees are integrated extensively in the crop production practice according to the agro-climatic conditions. A variety of indigenous and cultivated crops are grown with edible and timber value trees. Tree species are raised for food, fiber, medicine and other minor agricultural produce. The land is collectively used for vegetables, fruits, forest tree species, plantation crops and agricultural crops. Traditional tree based farming practice helps in conserving and improving the field, optimising the combined production of forest and agricultural crops. Priorities of multipurpose tree and shrubs in traditional farming practices are ascertained based on growth, uses and economic returns. In this system, mostly edible and timber

yielding plants are preferred and there is a symbiotic relationship among the species grown.

Traditional harvesting and post harvesting practices:- Harvesting of cereals in shifting cultivation is done by picking up the ear heads only, using a knife or sickle. There are about fifteen types of sickles used indigenously in the region. These vary in shape and size from tribe to tribe. After harvesting, proper drying of grains is essential before storage. The traditional storage structure in Meghalaya is ventilated out door structures constructed with locally available materials such as bamboo, timber and thatch grass. The storage structure is suitable under high humid conditions. Farmers use indigenous plant materials as insect pest repellent, but do not disclose the name of the plant species used for this purpose. The traditional knowledge largely remains with local tribal communities as a hidden treasure.

Farmers for storing of rice, use separate storehouse with raised wooden or bamboo floor. In the hilly areas, usually un-husked paddy after threshing is stored while in the plains rice is stored either as a bundle of straw without threshing or unhusked paddy after threshing. Bamboo containers of different sizes, woven tightly and thickly are plastered with mud on the inner side also used for storing paddy mainly for consumption and rarely for seed purpose is usually done in a specialised bamboo container commonly called Thiar in Khasi. The Thiar is a small container loosely woven with bamboo split into strips. The container is thickly padded inside using rice straw. Thiar containing the seeds covered by the thick layers of straw inside is usually kept in warm places.

The wooden bin indigenously made by the Khasi tribes is called Duli. It is a double-layered bamboo basket, plastered on both the sides with cow dung and mud, and placed in the inner side of the wooden bin. This bin has

been found to be the most effective storage structure for storing grains particularly for wheat. Most of the farmers store maize as cobs in un-husked condition. In the indigenous practices of storing maize, un-husked cobs are fastened on frame made out of bamboo poles and kept at a certain height to protect from damage by animals. A covering thatch grass is placed on the top to protect the cobs from rain. Sometimes a conical bamboo box is fixed upside down in the poles to keep the rats away from cobs.

Storage of rice for seed purpose has been found to be easier than the storage of wheat and other seeds. This is due to the fact that rice grain with the husk is less susceptible to the high humidity prevailing in the region than the other seeds.

Source: Traditional agricultural practices in Meghalaya, North East India, Solomon Retna Dhas Nadar Jeeva, Roytre bristopher Laloo & Bhanu Prakash Mishra Ecology Research Laboratory, Department of Botany, Northeastern Hill University, NEHU Permanent Campus, Umshing, Mawkyntrob, Mawlai, Shillong Indian Journal of Traditional Knowledge Vol.-5(1), January 2006, pp. 7-18

Hill Agriculture and communication to farmers: Geographical situation of hill region of Uttaranchal demands for special extension approaches and methods. Reasons for low awareness in farmers to improved agricultural technologies and technology transfer devices suggested by State agricultural personnel has been enumerated. Sharing of the experiences on some of the extension methods are being used to communicate to farmers like telephone, field level demonstrations, non government organisations, farmers' fair and field days, trainings, agricultural exhibitions, mobile week, extension literature and e-mail service etc.

Demonstrations on wheat had positive impact on farmers' perception and attitude but unavailability of inputs, less relative advantage, women based agriculture etc were reasons for non adoption. The sizes of plots were very small and scattered thereby one ha

of land accommodated 20 to 30 farmers. The seed production on wheat under crop demonstration, initiated in collaboration of seed certification agency in two ha produced 50 quintals of certified seed but only 5 quintals sold by the farmers because of low price and inadequacy of surplus for sale. The platforms created by NGOs, are also being used as a means for conducting crop demonstrations. Krishi Gosthies and competitive exercises at farmers' fair and on field days help in greater involvement of farmers and farm women.

Training is an important link with State Agriculture Department. The State agricultural personnel are grouped in to agriculture, horticulture and soil and water conservation is responsible for agricultural activities. Some important training needs of these personnel have been identified. Systematic and planned trainings' can be more beneficial than routine one.

To make agricultural exhibition more attractive and effective, blow-ups on agricultural technology with 2-3 line caption helps conveying the message more effectively. Specially designed acrylic seed sample disks, small size of seed packets (pouch packaging of input) along with literature attracted the visitors' attention in exhibitions. Systematic planning for pre exhibition, exhibition and post exhibition phases are necessary.

Mobile week before rabi and kharif season initiated for timely seed availability in far flung areas. Three routes were covered for rabi season mobile week which covered 40 villages. Small packets of seed were supplied at reasonable prices. Radio is a very useful media for farmers in hills. Kheti and Gram Jagat are two important programme broadcasted for farmers from AIR Almora. These have 5-10 minutes broadcast every day. The aerial distance of radio station is only 10-kms which results in low coverage. Scientist and technical officers from institutes are

delivering the talks on radio since 1990. The important topics for their talk were on major crops of the region.

Krishi calendar sized 2x1.5 feet consist six pages elaborating every two months' major agricultural operations on each page has been designed and printed. The message of few leading organisation/companies advertised on each page of calendar helps in accommodating the printing cost of calendars. The folders on package of practices costing each about Rs 5/ get printed and distributed in masses. Technological Options for educated people is ready reckoner in form of handbook consisting photographs on each back-page and tips on package of practice at each of front page.

E- Mail service to progressive farmers and NGOs is initiated keeping in view for future advances in information technology. In this respect audio and video cassettes are some other proposed devices to be used in coming years.

Source: International Conference on Communication for Development in the Information Age: Extending the Benefits of Technology for All. 07-09 January 2003 Eds. Basavaprabhu Jirli Editor in Chief, Diapak De, K. Ghadei and Kendadmath, G.C., Department of Extension Education, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, (India).

Water harvesting: Snow Water Harvesting in Cold Deserts of J&K and HP, among other environmental stresses, severe water shortage in remote cold deserts of the Himalayan region in particular makes these areas most difficult. Snow water harvesting in this region has traditionally played a significant role in the sustenance of farming communities. However, introduction of modern technologies in snow water harvesting have proved much beneficial for the region. Initiatives of Chewang Norphel, Ladakh's "glacier man", in making low cost artificial glaciers during winters has enabled the villagers to get irrigation water during sowing season (April- May), thereby, improving crop

growth. The added advantage is that the areas under artificial glaciers turn into green pastures during summers.

Source: Governance for Sustaining Himalayan Eco system Guidelines & Best Practices (G-SHE).

Soil and water conservation: Soil and water conservation, integrating the rural women development in Motna village has been successfully demonstrated at Tehri Garhwal District, Uttarakhand. In the villages of Garhwal hills, the major problem faced by the farmers is soil erosion due to rain or natural streams. In several areas, it has been found that the soil of the land in villages, cut out due to the rain which needs permanent protection to save the soil. A proposal was made to stop the soil erosion of the land in Motna Village. 2. Activities relating to the employment of the local women by making various items from the Rambans were taken, so that they can utilise the major use of the Rambans. Proper training to the women of the Motna village was imparted to generate some money by extracting the Rambans as it is available in bulk at this area Women were imparted proper training for making this final item at the village level. Vacant space in the village area was planted to prevent the soil erosion. A full fledged nursery was developed where several types of sapling of various trees were planted and variety of seeds were distributed of the same in Motna and nearby villages. Mangal Dal, Group of women of the Motna village were involved in plantation of several saplings in the barren land of the village with the permission of the Gram Pradhan of the area.

It is evident that basically the women of the villages are more eager to learn the method of making rope from the Rambans. They have also made several other decorative items from the extract of Rambans. It is advisable to the all villagers to take this project as their employment so that they can earn some money for their basic needs at village level. Every village should have their own Nursery

so that they can plant the saplings of the various types of trees in the barren portion of their village land to stop or to prevent the soil erosion. People of the Village also come to know how they can stop the soil erosion of their land by planting maximum number of trees in the sloppy area of the village.

Source:

http://gbpibed.gov.in/envis/HTML/vol10_1/sum10_1.html
#Soil and water Conservation integrating the rural women development in Motna.

Control/Eradication/Use of Invasive Alien Species (IAS): Many eco- systems, especially when sparsely invaded or even densely invaded for a short time, can recover after clearing without further management intervention, but others cannot. Prevention, early-detection and rapid response are the best means of tackling invasive species. Mitigation can include eradication; containment (keeping the IAS within regional barriers); or suppression (reducing population levels of the IAS to an acceptable threshold).

Source: David M. Richardson and Brian W. van Wilgen. *Invasive alien plants in South Africa: How well do we understand the ecological impacts?* *South African Journal of Science* 100, January/ February 2004; *Science for Environment Policy*, DG Environment News Alert Service, Special Issue, *Invasive Alien Species: Issue 6*, June 2006.

Mechanical, Chemical & Biological control are some of the strategies to control IAS. Mechanical control involves directly removing the species by hand or with appropriate

machines such as harvesting vehicles (e.g. for water hyacinth) or traps (for animals). Habitat management involves measures such as prescribed burning, grazing and other activities.

Source: *Global Strategy on Invasive Alien Species*, Edited by : Jeffrey A. McNeely, Harold A. Mooney, Laurie E. Naville, Peter Johan Schei and Jeffrey K. Waage.

Hand clearing: Selective clearing of woody species by organised community groups removes unwanted encroaching bushes/trees and minimises the competition between these and herbaceous plants for light, nutrients and water. However, this method has been found to be only effective for selected small areas in Ethiopia.

Source: *Technical Bulletin No.25, Management for proper range use, Ethiopia Sheep and Goat Productivity Improvement Programme*, June, 2009 Website: <http://www.esgip.org>.

The invasion of exotic species of *Lantana camara*, *Eupatorium adenophorum*, *Ageratum haustoni* and *anum* has caused serious problems in Himalayan states. Traditional farmers have recently started converting these plants into bio- composts. At first it is removed by hand and then mixed with dung to form bio-compost (see Box 4 as well).

Source: *Improving and Scaling up of the Traditionally Managed/ Agricultural Systems of Global Significance*, Department of Agriculture, Government of Sikkim, India.

Case Study 3: Developing strategies for the control of *Parthenium* weed in India using fungal pathogens

Parthenium hysterophorus has achieved major weed status in both Australia and India within a relatively short period. In India, the weed *P. hysterophorus* is of alien origin and very difficult to control as it has occupied most of the area in both cropped and non cropped eco-systems. Managing weeds using classical biological means is less expensive, permanent and pollution free. Considerable work on mycoherbicides for control of *Parthenium* weed has been carried out in India. Rajak et al. (1990) undertook a survey around Jabalpur (Madhya Pradesh), collecting diseased specimens of *P. hysterophorus* and isolating suspected pathogens. A total of 25 fungal species were identified, the majority being opportunistic necrotrophs. *Myrothecium rostratum* Tode ex. Fr. Appeared, from the field survey and subsequent pathogenicity tests, to show most potential for mycoherbicide development. From further pathogenicity screening of the other fungi, it was concluded that most of them had the ability to suppress seed germination of *Physotherophorus* and cause high seedling mortality, while a few could effectively kill mature plants, including: *Collectorium gloeosporioides* (Penz.) Sacc; *Fusarium oxysporum* Schlecht; *Fusarium moniliforme* Sheld, in addition to *Myrothecium rostratum*. It is against this background that at least four Indian research centres have initiated IPM programmes against this weed.

Source : Project Final Technical Report, Crop Protection Programme, Prepared by : CABI Bioscience, UK, In collaboration with : Kurukshetra University, India, Tamil Nadu Agricultural University, India, Project Directorate of Biological Control, India, National Research Central for Weed Science (ICAR), India.

Best practices for environmental improvements in Agriculture:

- Upgrade existing pesticide and hazardous materials storage to allow for appropriate containment to mitigate accidental release;
- Provide secondary containment of tanks to prevent spills reaching natural ground and surface watercourses;
- Protect areas of high ecological value or areas protected by State/ local authorities;
- Dredge water courses on a regular basis to mitigate sedimentation of soil has occurred and reduce flood risk impact of operations;
- Avoid on site burning (e.g. crop stubble) that may give rise to odour or air quality nuisance complaints or could present fire risks;
- Avoid nuisance complaints for noise pollution from grain silos by closing windows, operating during the day only, maintaining equipment regularly and considering the use of sound proofing;
- Implement waste segregation and reclamation programmes;

Health and Safety Improvements

- Separate people from vehicles where practicable;
- Ensure drivers are properly trained to operate the machinery and equipment;
- Fit vehicles with rollover protective structures;
- Use mechanical lifting devices where possible;
- Enclose noisy machines to isolate people from the noise;
- Make improvements to general housekeeping.

- Reduce exposure times for people working near noisy machinery;
- Use and maintain effective filters in vehicle cabs to keep air free of dusts and fumes from spraying activities;
- Improve ventilation in buildings;
- Ensure that machinery is adequately guarded to reduce likelihood of entrapment;
- Introduce accident, fire and explosion precautions and emergency procedures;
- Ensure security of storage areas to prevent third parties misusing chemicals (or their containers).

Source: Agricultural Production – Crops Sub-sectoral Environmental and Social Guidelines, 8 August 2009, European Bank of Rural Construction and Development.

4.6 Animal Husbandry & Livestock

Development and implementation of controlled grazing programme can mitigate overgrazing: Controlled grazing programmes regulate livestock farmers' use of grazing areas to ensure that production practices are environmentally sustainable, thereby reducing the impact of negative externalities (e.g. soil erosion and water pollution) and expanding the positive externalities (e.g. improved pastures and conservation of wetlands and wildlife habitat) of livestock production systems. Controlled grazing programmes built on rules and regulations that govern access to and use of circumscribed grazing areas by livestock farmers, and are a typical command and control measure; the literature refers to land co-management when the rules and regulations governing access to and use of land and common resources are generated by the community itself. Effective controlled livestock grazing schemes call for the following:

- Reviewing the extent and magnitude of environmental externalities associated with livestock grazing (trends in the

availability of grazing areas and forage production, changes in soil characteristics, etc.) and of livestock production systems (number of producers, herd size and composition, production technologies, etc.).

- Identifying environmental objectives/standards to be achieved through controlled grazing, i.e. by reducing livestock pressure on the land. In general, the more ambitious the environmental objectives, the greater the costs – in terms of foregone income – for livestock farmers (at least in the short term) and the benefits for society as a whole. Therefore, adequate consideration should be given to trade-offs between environmental and socio-economic variables.
- Defining rules that limit/regulate livestock access to grazing areas, in line with established environmental targets. These rules/regulations should be consistent with the prevailing socio-economic and institutional framework: for instance, establishing maximum stocking densities or limiting manure emissions per ha are two options for reducing livestock pressure on land. The latter option, however, is more complex, and will be successfully implemented only when adequate human and financial resources are available.
- Providing adequate incentives and training for farmers to comply with the newly established grazing rules and regulations, including awareness and information campaigns, financial compensation, penalties, creation of alternative income opportunities, etc.
- Putting in place an effective mechanism for enforcing grazing

laws/ regulations, and measuring their impact both on the environment and on farmer livelihood. Designing and introducing effective grazing control programmes is challenging, for a variety of reasons:

- Each country/region is characterised by a variety of agro-ecological zones and livestock production systems. Controlled grazing mechanisms are typically enforced only in specific zones, because defining and implementing regional and sub regional grazing schemes is unworkable. This may limit both the attractiveness of such interventions for policy-makers and their overall impact on the environment.
- There is a tendency to overlook the important socio-economic impact of controlled grazing mechanisms and to focus only on mitigating the negative externalities associated with livestock grazing.
- Farmers are rarely, if ever, given sufficient (financial) incentives to reduce livestock pressure on the land. Such incentives are critical for resource-poor farmers with limited access to alternative sources of income, if they are to be able to comply with land-access and land-use rules.
- Unsecured and ambiguous access to agricultural land and grazing areas, which characterises many developing countries, might make controlled grazing mechanisms both ineffective and unsuccessful.

Source: FAO, Livestock sector policies and programmes in developing countries – a menu for practitioners, 2010.

Co-management of common pastures can reduce overgrazing and over exploitation of natural resources: Open access to pasture lands can lead to overgrazing and

overexploitation of natural resources. Whenever a farmer is in a position to decide freely on the number of animals to graze in an open-access pasture, his/her choice will depend on a comparison between his/her private costs and the benefits he/she can expect to accrue (e.g. between the time he/she needs to pasture one more animal and the additional milk the animal will produce). Each additional animal on the open-access land will impose a negative externality on other farmers, because it will reduce the amount of biomass available. However, even though the farmer might be aware of the negative externalities his/her behaviour generates, he/she will be reluctant to reduce the number of animals he/she pastures because the other farmers will continue to pasture all of theirs. The total number of animals grazing on the open-access areas, therefore, will surpass the carrying capacity of the land. Governments could facilitate the establishment of common rules and regulations regarding the use of common pastures. These may include the following:

- Identification of open-access pastures that are becoming degraded because of overgrazing, including an analysis of the land tenure system and of the rules and regulations governing access to, and use of, natural resources by different stakeholder groups.
- Promotion of a participatory process to quantify the contribution of overgrazing to natural resource degradation. This is critical, because farmers often misjudge

the causes and overlook their own contribution to environmental degradation.

- Definition of a comprehensive land co-management plan that, by taking account of existing common and private resources, and of potential sources of conflict among different stakeholders, sets out new rules for the common use of grazing land, including the rights and duties of different users.
- Provision of the necessary legal, financial and technical support for effective land co-management, including the securing of land tenure rights, helping farmers to create collective institutions, defining adhoc rules and regulations to facilitate the sustainable use of common pastures, etc. Supporting participatory land co-management is anything but straightforward, however.
- Returns on land co-management can be reaped only in the medium to long term, whereas farmers are obliged immediately to face costs caused by reduced livestock production. Community members, therefore, may feel inadequacy of incentives to support co-management schemes unless they are compensated for any foregone income, at least during the start-up phase of a programme.

Source: FAO, Livestock sector policies and programmes in developing countries – a menu for practitioners, 2010.

Case Study 1

Co-management of grazing land in Kenya: Approximately 75 percent of Marsa bit District in the Eastern Province of Kenya is classified as rangeland. Different ethnic groups populate the area and keep a variety of livestock – including camels, goats and sheep, and cattle (in higher-rainfall areas) – which exert significant pressure on grazing areas and contribute to desertification. In 1990, GTZ launched the Marsabit Integrated Development Programme (MIDP) aimed at supporting rangeland rehabilitation through the promotion of environment-friendly grazing practices. In particular, MIDP supported the establishment of so-called environmental management committees (EMCs), composed of elders, traditional leaders, women and young people, responsible for organising community workshops to identify sustainable land-use practices within their communities, from both a technical and a social perspective. Twenty-nine EMCs were established and jointly agreed upon a harmonised natural resources management protocol. Notable items in the protocol related to water resources management, access to grazing land by residents and non-residents, tree conservation measures and wildlife protection. After a promising start, however, the EMCs began to encounter problems: farmers had little incentive to be members of committees; the legal status of EMCs was unclear and there was poor integration and co-

ordination among EMCs in different neighbourhoods – to the extent that vast areas of rangeland remained unused owing to conflicts among different pastoral groups and communities. GTZ therefore grouped the 29 EMCs into four larger units corresponding to different major grazing areas, and facilitated a series of consultative meetings, bringing together district- and local- level government authorities, NGOs active in Marsabit, traditional authorities and EMC members, to help pastoral groups agree on measures to reduce banditry, theft and murder and on regulated access to range resources in neighbouring territories.

The participatory, broad-based process successfully promoted environment-friendly husbandry practices throughout Marsabit District. Vegetation has regenerated; wildlife poaching has declined; agree men has been reached with regard to dry-seas ongrazing-reserve rules and temporary restrictions have been agreed on with regard to areas that can be entered during the rainy season; and, ultimately, environmental degradation has been halted.

Source: Haro et al., 2005. And FAO, Livestock sector policies and programmes in developing countries – a menu for practitioners , 2010.

Design and implementation of discharge quotas system of manure can reduce soil and water contamination: Livestock manure is a source of nitrogen, phosphorus and many micro-nutrients that improve soil fertility. However, pathogens, excess nutrients and organic matter from livestock manure may contaminate soil and water. The establishment and implementation of discharge quota systems, which set ceilings on the quantity of livestock manure that can be released in the soil, may contribute to reducing the negative externalities on the environment generated by some livestock production systems. Designing and implementing a discharge quota system calls for the following:

- Identifying livestock production systems that contribute to environmental degradation through excessive manure discharge, depending on the numbers and species of farm animals, production technology, soil characteristics, etc.
- Defining a discharge-pollution equation and setting environmental targets necessary to identify the maximum acceptable quantity of manure discharge from livestock. When reviewing the manure- pollution interface, account should be taken of farm characteristics,

prevailing technologies and production practices in order to avoid setting overambitious environmental objectives.

- Setting discharge quotas and establishing a quota allocation mechanism. For instance, manure quotas: may be based on numbers of animals or farmsizes; can or cannot be sold/bought on a dedicated market; may be provided free of charge and shared equally among live stock farmers or may be sold, auction ed or allocated in accordance with predefined parametres (e.g. livestock per unit of land).
- Setting up an institutional mechanism to implement the quota system, which implies issuing and allocating manure quotas, providing adequate incentives for livestock farmers to respect the system – including financial support and technical assistance when necessary – as well as monitoring and evaluating its impact both on the environment and on farmer livelihood. Constraints on the design and effective implementation of discharge quota systems for livestock include the following:

Source: FAO, Livestock sector policies and programmes in developing countries – a menu for practitioners, 2010.

Case Study 2

Manure production rights in the Netherlands: Quotas for animal manure production were introduced in the Netherlands in the 1980s, as part of a mix of policy measures to deal with the excessive release of nutrients into the soil. Under the country's Manure Act of 1986, each farm was required to calculate an annual reference level of manure production in phosphate terms, obtained by multiplying the number of animals on the farm on 31st December 1986 by a given 'phosphate' parametre associated with each animal

species. Farms with a manure: land ratio of less than 125 kgs. of phosphate per ha, or 'deficit farms' and new farms were allowed to increase animal numbers until that level was reached. Farms with a ratio of more than 125 kgs. of phosphate per ha could expand their activities only by extending their land areas to reach the threshold of 125 kgs. of phosphate per ha. The manure reference level was not tradable and could be transferred only under specific circumstances (marriage, inheritance or transfer of the entire farm), which constrained both the land market and livestock sector growth. As of January 1994, therefore, manure quotas were allowed to be traded and denominated 'manure production rights'. A farm's manure production right was divided into two parts: a land-based quota, which amounted to 125 kgs. of phosphate per ha, and a non-land based quota, calculated with reference to specific animal categories (turkeys, pigs and chickens). The non land quota was made tradable within animal categories to prevent further increases in swine production, which was allegedly causing serious environmental problems. Trading in manure production rights/animals took place through brokers, but transactions had to be approved by relevant Government authorities to ensure that purchasing farmers had an appropriate manure disposal plan. The manure production right systems, however, were unable to create a balance between the production and disposal of animal manure. Therefore, in 1998, the Netherlands Government introduced the so-called Mineral Accounting System (MINAS), which is essentially a tradable permit approach for nitrogen and phosphorous applied as fertiliser. The system applies to pig, poultry, mixed livestock and cattle farms with stock rates above a set density (in all, about 50 percent of all Netherlands livestock farms) and to arable farms. MINAS farmers are required to declare the mineral surplus on their farms, whereby the surplus is estimated as the difference between the volume of nitrogen and phosphate supplied in the form of fertiliser and feed and disposed off in the form of products and manure. Farmers exceeding their surplus quotas can 'trade' by giving excess manure to farms that have not reached their quotas. Those exceeding the quotas are charged. As many as 90 percent of farms pay no charges because they supply manure to arable crop farms with unused manure capacity.

MINAS did succeed in reducing nutrient emissions but its implementation was extremely complex. It was therefore abolished in 2006, following an October 2003 decision by the EU Court of Justice stating that the Netherlands Government had failed to implement certain elements of the EU Nitrate Directive and that the application limits for animal manure were too high. In January 2006, the Netherlands adopted a manure policy based on application rather than mineral loss standards. Compared with MINAS, the new policy set stricter limits on the use of nitrogen and phosphorus.

Sources: Oenema and Berensten, 2005; Verburg, 2009; Wossink, 2003. And FAO, Livestock sector policies and programmes in developing countries – a menu for practitioners, 2010.

Preparation of Contingency plans to (i) mitigating the impact of natural shocks on fodder production systems and livelihoods; (ii) providing relief to people rendered destitute by shocks; and (iii) promoting rehabilitation of fodder production systems following shocks: Plans for specific mitigation, relief and rehabilitation measures that support/ complement household risk-coping strategies. These measures include, for example, storage of feed reserves, establishment and maintenance of fodder

shrubs; emergency movements of livestock to green pastures and water points; prevention and control of animal disease; establishment of ad hoc slaughtering and marketing facilities; provision of credit/heifers for herd reconstitution and safety-net supplies of food and medical aid. The following case study demonstrates its efficiency.

Source: FAO, Livestock sector policies and programmes in developing countries – a menu for practitioners, 2010.

Case Study 3

Drought contingency planning in Rajasthan, India: The Central and State Governments of India have drawn up a common strategy to mitigate the impact of drought, which affects about 28 percent of the country. This strategy is based on the Famine Codes drawn up by the British in the 1880s, and stipulates that: (i) the State Government declares a drought situation and drafts a so-called Memorandum of Scarcity; (ii) the Central Government sets up a committee to assess the situation on the ground; (iii) the committee, in consultation with the State Government, formulates recommendations for assistance, including a drought contingency plan that typically includes the supply of cereals and water; provision of health and nutrition services; wage employment programmes; fodder supply; provision of animal health and veterinary supplies; and post-drought rehabilitation interventions; (iv) the recommendations in the contingency plan are scrutinized by an inter-ministerial group that selects priority areas of intervention and determines the level of Central Government financial assistance, which may range between 10 and 80 percent of State drought relief expenditure; and (v) the State Government is responsible for implementing the approved interventions.

With an area of 342 239 km², Rajasthan is India's largest State. It has a human population of 56.5 million, of which 80 percent lives in rural areas, and a livestock population of 4.4 million. The State is particularly vulnerable to drought, having since 1901 experienced approximately 50 drought years of varied intensity. Given the prominence of livestock in the economy, the State's drought contingency plans also include mitigation and relief measures for farm animals, so much so that, in the last five drought years

expenditure on livestock fodder has come second only to wage employment (i.e. food-for-work programmes). The 2002 drought, which led to an estimated fodder deficit of 6 million tonnes, could have affected 42.5 million cattle in the State. But thanks to implementation of a well-designed contingency plan, cattle mortality rates were in the usual 12 to 14 percent bracket and the drought had no perceived impact on livestock. The contingency plan, which focused on ex ante mitigation activities rather than ex post relief interventions, included: (i) the distribution of 2 million tonnes of fodder, stored in more than 5 500 State fodder depots throughout the State, at a subsidised market price; (ii) loans totalling about US\$222.2 million to livestock farmers to purchase fodder; (iii) a 5-rupee subsidy per head/day for 0.7 million cattle; and (vi) provision of free veterinary services to all livestock farmers.

Sources: Rathore, 2005; Samra, 2004. And FAO, Livestock sector policies and programmes in developing countries – a menu for practitioners, 2010.

Promote membership-based organisations to gain access to animal health resources and veterinary supplies: Membership-based organizations (MOs) include producer associations, co-operatives, rotating savings and credit associations (ROSCAs) and other community-based organisations. MOs help their members gain access to animal health services and veterinary supplies because, by sharing the fixed costs among all members (e.g. a veterinarian's travel costs) and

gaining bargaining power based on bulk orders, they can pay for the services of a veterinarian/animal health assistant and/or buy animal drugs at favourable prices. Supporting livestock-focused MOs, therefore, could be a way of increasing the access of livestock farmers to animal health services and veterinary supplies to reduce diseases burden and animal health risk.

Source: FAO, Livestock sector policies and programmes in developing countries – a menu for practitioners, 2010.

Case Study 4

Membership organisations in Gujarat, India: Mehsana is one of the 19 districts of the State of Gujarat in India, and has a population of about 3 million, of which about 80 percent lives in rural areas. Marginal, small and landless farmers hold about 67 percent of all milk animals in the district. The State Department of Animal Husbandry provides livestock services to farmers but, because it spends about 95 percent of its annual budget on salaries, it can seldom provide sufficient animal vaccines and drugs to farmers. To address these constraints, the Mehsana District Cooperative Union, has been set up, the main objective of which is to help its members to market their surplus milk, has also started supplying veterinary services and drugs to its members. The union follows a three-pronged approach: (i) At the village level, veterinary first aid is provided by the dairy co-operative societies (DCSs), to which villagers have always handed over their surplus milk. The union has equipped each DCS with a veterinary first-aid kit as a one-off gift and has trained a 'first-aid worker', who charges union members a token Rs. 1 per visit and sells drugs and re-agents. (ii) At the farm gate, veterinary services are provided by 35 veterinary mobile clinics, each comprising a veterinarian, an animal health auxiliary and a vehicle with driver. Each mobile clinic operates along established routes and services are charged at the rate of Rs. 40 for every new call and Rs. 20 for repeat calls. The charges cover the costs of transport, drugs and the veterinarian's fee. A typical call costs some Rs. 77, the difference being paid by the union (i.e. through membership fees). In 1999-2000, the 35 mobile veterinary units operating in Mehsana responded to 234 196 calls (about 18 calls per day per mobile clinic). (iii) Finally, animal health camps are the union's approach to widespread health problems such as infertility, repeat breeders and metabolic disorders. Camps are organised on the initiative of a cluster of DCSs with specific herd health problems and are attended by a large number of livestock keepers, veterinarians of the union and specialists from colleges, universities and the State Department of Animal Husbandry. A total of 22 424 animals were treated in such camps in 1999-2000.

The union demonstrates how farmer organisations, if well organized, can successfully supply their members with both animal health services and drugs/ vaccines. However, it should be noted that India has a long tradition of supporting dairy co-operatives, which currently serve more than 10 million farmers in over 80 000 villages.

Sources: Kurup, 2002; www.indiadairy.com and FAO, Livestock sector policies and programmes in developing countries – a menu for practitioners, 2010

Public health and animal health risk due to increase in animal disease: As per NABARD, the following best scientific practices should be used to protect animals and poultry from disease. The following key best recommended practices as do's and don'ts is given below.

- Protection of animals from diseases

- Be on the alert for signs of illness such as reduced feed intake, fever, abnormal discharge or unusual behaviour.
- Consult the nearest veterinary aid centre for help if illness is suspected.
- Protect the animals against common diseases.

- In case of outbreak of contagious disease, immediately segregate the sick, in-contact and the healthy animals and take necessary disease control measures.
- Conduct periodic tests for Brucellosis, Tuberculosis, Johne's disease, Mastitis etc.
- Deworm the animals regularly.
- Examine the faeces of adult animals to detect eggs of internal parasites and treat the animals with suitable drugs.
- Wash the animals from time to time to promote sanitation.

Source:

<http://www.nabard.org/modelbankprojects/animalhusbandry.asp>

Protection of Poultry from diseases

- Clean, sanitary conditions of poultry shed and equipment, balanced feed, fresh clean water, healthy chicks are essential to prevent diseases.
- Avoid entry of visitors to farm, especially inside the sheds. If visitors come, ask them to dip their feet in a disinfectant solution, wash and clean hands and to wear apron/boots provided by the farm.
- Use proper vaccination schedule.
- Use high quality vaccines purchased from reputed manufacturers. Keep vaccines in cool, dry conditions away from sunlight.
- Any left-over vaccine should be properly disposed off. Vaccines should not be used after their expiry date is over.
- Any dead bird should be immediately removed from the shed and sent to laboratory for post-mortem examination or buried/burnt suitably away from the poultry sheds.
- The waste of farm should be suitably disposed off. Different workers should be employed in brooding and laying sheds.
- Any bird showing advanced signs of a disease, should be removed from the shed and culled. It can be sent to laboratory for diagnosis.

- Birds showing advanced signs of a disease should be shown to a qualified veterinarian and suitable medication/treatment be given as per his/drug manufacturer's recommendations.
- Poultry manure, if infected, can spread disease, from one batch to another. Keep the litter dry, remove it after flock is sold and dispose the manure properly and quickly.
- Keep proper records on mortality and its causes and the treatment given to birds. Dates of vaccination for each flock should be properly recorded.
- Rats are important carriers of poultry disease. Avoid rats. Use suitable rat poisons/rat traps.
- Many poultry medicines can be given in drinking water. When medication is to be given, remove the water in poultry sheds on the previous evening. Next morning give medicine in measured quantity of water, so that entire medicine will be quickly consumed and there will be no wastage of medicines.
- Mild infection of disease may not cause mortality but it will reduce growth. Keep sample record of body weight for growers, mortality rate and egg production. Study the possible causes, if weight is low or egg production is low and take steps to improve the management of the subsequent batches. A constant vigil and analysis of records/results is necessary to keep up the efficiency in farming.

Source:

http://www.nabard.org/modelbankprojects/animal_broiler.asp

Best Practices for integrated bio-security in poultry production can reduce animal and public health risk: A set of recommended bio-security practices to be adopted by the poultry farmers for minimising the disease occurrence is given below.

Locational bio-security:

- Farm should be located
 - At an elevated and well ventilated site
 - Away from any existing farms or complexes
 - Away from water ways/water pools/lakes/tanks
 - Away from any nearby village poultry
- Broiler and layer units should not be established in close vicinity
- Farms having more than 50000 (Layers) should have preferably separate facilities for brooding/growing.
- The new poultry farms may be one kilometre away from the existing farms or complexes.

Structural bio-security:

- Construct separate sheds for brooding/growing/laying operations with East-West orientation.
- A minimum distance of 150 ft. between brooding/growing sector and layer sector should be maintained. The distance between the sheds within the sector should be at least 50 ft.
- In case of farms wherein brooding/growing operations are carried out along with layer operations 1:3 system of rearing may be adopted, while in case of units where brooding/growing operations are carried out at separate places, 1:1:4 or 1:1:5 system of rearing may be adopted.
- Multi-storeyed poultry sheds are not desirable.
- Individual farms should be provided fencing with wheel dip at main gate. Provide foot dips at every doorstep.
- The maximum width of the sheds in case of deep litter system should not exceed 30 feet and the shed should be 2 feet above ground level with pucca floor.

- A minimum over hang of 3 feet must be provided.
- The maximum width of the sheds should be 33.5 feet in case of layer houses under cage system.
- In case of cage system rows as well as tiers should not be more than three.
- The height of the platform from the ground should not be less than 6 feet in case of cage system.
- For ideal farming 3 birds per cage with adequate water and feeding facilities should be ensured
- Provide closed disposal pit or incinerator at least 500 feet away from the active operational area.
- A store house for proper storage of litter material should be provided to avoid contamination.
- Provide proper area for used litter disposal away from the active operational area.
- Feed store/mill should be 150 feet away from the sheds and preferably near the gate.
- Office and egg store should be away from active operational area and preferably at the main gate.
- All the sheds and other structures should have rat proof arrangements.

Operational bio-security:

- Procure the day old chicks, which are free from diseases from reputed hatcheries.
- It is advisable to have cage system of rearing in place of deep litter system of rearing.
- As far as possible automated equipment should be considered to minimise the manual handling of feeds and water.
- Testing feed ingredients/feeds must be arranged to ensure that they are free from

Microbial agents or toxins at periodic intervals:

- Storage facilities for feed ingredients/feeds must be managed in a hygienic manner.
- Ensure the feed manufacturing area is free from dust, cobwebs and should be equipped with appropriate screens to protect from fly problem.
- It is advisable to feed the birds with pellets for improved bio-security.
- Sheds having infected flocks should be served with feed at the end of a delivery day.
- Always ensure the supply of clean and potable water. If necessary use appropriate sanitisers.
- Periodic inspection of wells, piping and tanks to ensure that the water supplied is clean.
- An area specific vaccination schedule as recommended by hatchery doctor must be practiced with utmost care.
- Rodent control programme, where ever necessary, must be adopted by employing mechanical (traps) or chemical techniques along with strict sanitation measures.
- After selling of each crop from the sheds, thorough cleaning of sheds by removing all fixtures, equipment, litter dust, debris followed by brooming and burning. The rat holder cracks, worn out area should be packed with cement.
- Cleaning of the vegetation thoroughly six feet around the sheds and spraying of bleaching powder (1 part) with lime (3 parts) around the sheds a minimum of 3 feet.
- Avoid use of litter as manure around the farms.
- Well cleaning of sheds and equipment with water and appropriate detergent.
- A thorough disinfection of sheds, equipments as well as farm surroundings by formalin spray at recommended concentration.

- Foot baths should be always filled with disinfected.
- Vehicles visiting the farms should be thoroughly disinfected by appropriate disinfectant spray.
- Personnel working in laying sectors should not be allowed into brooding/growing sector or feed manufacturing facilities. All visitors must be ensured to walk through foot baths.
- Disposal of dead birds in hygienic manner either by using incinerator or by pit method is very essential.

Processing/Marketing

- Ensure the constant and steady demand for eggs is available and the market is nearer to the farm.
- Study the market demand for particular egg weight. Provide one nest box for every 5 birds. Collect eggs from the shed 4 times a day. Store them in a cool dry place and market them quickly.
- Birds should not be kept on the farm beyond 18 months of age, as their egg production will go down considerably and their efficiency of feed conversion will reduce progressively as they grow older.
- If live culled birds are sold after dressing (processing) use clean dressing hall and processing equipment. Dressed birds should be chilled in the ice-cold water for 3-4 hours and excess water removed. Birds should then be packed in clean plastic bags and the mouth of bag sealed.
- Processed birds should be marketed as early as possible. If they have to be preserved, deep freezing equipment (-10 to -200C) should be used. Refrigerated vans may be required for long distance transportation.

Source:

http://www.nabard.org/modelbankprojects/animal_broiler.asp

Emergency Prevention System for Trans-boundary Animal and Plant Pests and Diseases (EMPRES) to reduce threats to

human health and losses to livestock productivity: Protecting livestock against diseases and preventing their spread is one of the keys to fighting hunger, malnutrition and poverty. The Emergency Prevention System for Trans- boundary Animal and Plant Pests and Diseases (EMPRES) was established by FAO's Director General in 1994. AGA is entrusted with the EMPRES animal disease component, which provides information, training and emergency assistance to countries to prevent, contain and control the world's most serious livestock diseases, while also surveying for newly emerging pathogens. Most of the emerging human pathogens have an animal (livestock or wildlife) origin. Hence there is the need for national and regional animal disease surveillance systems to prevent not only losses to livestock production, but to reduce threats to human health as well. The EMPRES strategy is to prevent and control diseases at their source. The core EMPRES precepts are: Early Warning, Early Detection, Early Reaction, Enabling Research, Co-ordination, and Communication.

Source:

<http://www.fao.org/ag/againfo/programmes/en/empres.html>

Good practices recommended for sheep farmers to reduce animal and public health risk: Housing and shelter management, dipping and shearing are some of the best practices to reduce animal and public health risk from sheep rearing.

Housing and Shelter Management

- Normally sheep do not require elaborate housing facilities but minimum provisions will definitely increase productivity, especially protection against inclement weather conditions (sun, rain and winds) and predation. Shed could be provided with gunny bags or temporary or removable protections made of thatching material and bamboos. The roof of the shed should be made of the asbestos sheet supported by tubular or angular

steel, but wooden rafters and thatching material could also be used.

- Exotics should be provided 0.9-1.1 m² and native and crossbred sheep 0.8-0.9 m² space per head. Sheds measuring 18m x 6m can accommodate about 120 sheep.
- A chain link fencing or thorny bush enclosure of 12m x 6m can be provided for night paddocking of sheep on each side of the shed.

Dipping: To control the ectoparasites the sheep should be dipped a few weeks after shearing when they have grown sufficient new wool to hold the chemical substance. There are standard designs for sheep dips and there are many products effective against ectoparasites. A foot-bath may also be provided at the entrance of the farm to prevent the spread of contagious diseases like foot-and-mouth and footrot.

Shearing

- Shearing is done mechanically either with clippers, a pair of scissors or by power-operated machines depending upon the size of operations.
- Most flocks are usually shorn twice a year, i.e. March-April after the winter and September-October after the rains. In some States like Jammu & Kashmir and Rajasthan sheep are shorn thrice a year.

Source:

http://www.nabard.org/modelbankprojects/animal_sheep.asp

Good practices recommended for goatrearing to reduce animal and human health risk: Modern and well established scientific principles, practices and skills should be used to reduce animal and human health risk. Some of there commended practices for housing management and protection from diseases are given below.

Housing management

- Construct shed on dry and properly raised ground.
- Avoid water-logging, marshy areas.
- In low lying and heavy rainfall areas the floors should be preferably elevated.
- In temperate Himalayan region the floor may be made of wood.
- The shed should be 10 ft. high and should have good ventilation.
- Bucks should be housed in individual pens.
- Does can be housed in groups upto 60 per pen.
- Provide proper shade and cool drinking water in summer.
- Dispose off dung and urine properly.
- Give adequate space for the animals.
- Avoid over stocking or crowding

Protection of Sheep/Goat from diseases

- Be on the alert for signs of illness such as reduced feed intake, fever, abnormal discharge or unusual behaviour.
- Consult the nearest veterinary aid centre for help if illness is suspected.
- Protect the animals against common diseases.
- In case of outbreak of contagious diseases, immediately segregate the sick animals from healthy one and take necessary disease control measures.
- Deworm the animals regularly.
- Examine the faces of adult animals to detect eggs of internal parasites and treat the animals with suitable drugs.
- Provide clean and uncontaminated feed and water for minimising the health disorders.

Source:

http://www.nabard.org/modelbank/projects/animal_goat.asp

Good Practices Recommended For Commercial Pig Farming to reduce animal and public health risk: Modern and well established scientific principles, practices and skills should be used to obtain maximum

economic benefits from pig farming. Some of the major norms and recommended practices for housing management and protection against disease are given below.

Housing management

- Construct shed on dry and properly raised ground.
- Avoid water-logging, marshy and heavy rainfall areas.
- The side walls of the sheds should be 4-5 ft. high and remaining height should be fitted with GI pipes or wooden poles.
- The walls should be plastered to make them damp proof.
- The roof should be at least 8-10 ft. high.
- The pig stays should be well ventilated.
- The floor should be pucca/hard, even, non-slippery, impervious, well sloped (3 cm per metre) and properly drained to remain dry and clean.
- A feed trough space of 6-12 inches per pig should be provided.
- The corners of feed troughs, drains and walls should be rounded for easy cleaning.
- Provide adequate open space for each animal i.e. double the covered area
- Provide proper shade and cool drinking water in summer.
- Dispose off dung and urine properly.
- Individual pens for boars/lactating sows should be constructed.
- The dry sows/fatteners can be housed in group pens.
- Give adequate space for the animals.

Protection against Diseases

- Be on the alert for signs of illness such as reduced feed intake, fever, abnormal discharge or unusual behaviour.
- Consult the nearest veterinary aid centre for help if illness is suspected.
- Protect the animals against common diseases.

- In case of outbreak of contagious diseases, immediately segregate the sick and the healthy animals and take necessary disease control measures.
- Deworm the animals regularly.
- Examine the faeces of adult animals to detect eggs of internal parasites and treat the animals with suitable drugs.
- Wash the animals from time to time to promote sanitation.
- Identifying one or more environmental good or service that can be provided by livestock farmers as long as they are adequately compensated. Examples include preservation of forest areas and biodiversity; maintenance of soil fertility; protection of water resources and landscapes, etc.
- Appreciating the production/consumption decisions of livestock farmers, including with regard to herd and farm size, production technology, access to input/output markets, level of education, etc., to define a compensation schedule that provides sufficient incentives for farmers to supply certain environmental goods. In view of the nature of differences among livestock farmers, multiple compensation schedules may be needed.
- Providing technical and, in some instances, financial assistance for farmers to produce and supply given environmental goods/services. This is critical when PES programmes are introduced for the first time, and when resource-poor farmers are expected to participate in them.
- Setting up an institutional mechanism for implementing the PES scheme, including funding, targeting, timely payment offarmers and monitoring.

Source:

http://www.nabard.org/modelbankprojects/animal_piggery.asp

Payments for environmental services for environmentally sustainable animal husbandry: Payment for environmental services (PES) schemes is an increasingly popular tool for increasing positive externalities generated by agricultural production systems, including livestock. PES schemes provide incentives/compensate farmers for the production of environment-related goods/services not priced on the marketplace – compensation being linked to an estimated value of the goods/services produced. For instance, livestock farmers might be paid to adjust their husbandry practices in order to protect forest areas, with their compensation schedule linked to an estimated value of the preserved forest areas. Compensation is provided by the State or by associations, not through a market mechanism. Setting up PES schemes calls for the following:

Source: FAO, *Livestock sector policies and programmes in developing countries – a menu for practitioners*, 2010.

Case Study 5

A silvopastoral PES system in Nicaragua: Silvopastoral systems are land-use systems whereby trees and/or shrubs are combined with pasture production for livestock. These systems are expected to generate economic benefits for farmers, i.e. increased biomass availability, livestock productivity and household income, as well as environmental benefits for society – i.e. reduced soil erosion, biodiversity conservation and carbon fixation in soil and standing trees. In the Matiguás-Río Blanco area of Nicaragua, a World Bank Global Environment Facility project has attempted to encourage the adoption of silvopastoral practices by livestock farmers in degraded pasture areas. The project has developed 28 indices of carbon sequestration and biodiversity conservation associated with different types of land uses. These indices are aggregated into a single environmental services index (ESI) for each farm. Farmers are given a one-time payment as an incentive to join the programme and are then compensated for any positive changes in the total ESI scores of their farms. The project started in 2004 and, after one year's operation, more than 17 percent of all farms in the region had made some changes in land use, including the sowing of improved grasses in degraded pastures, planting high-density tree stands and establishing fodder banks.

Following project implementation, the area of degraded pasture decreased by more than half and that planted to annual crops fell by almost one third. It is to be noted that, whereas non-poor households converted an average area almost double that of poor

households, poor farmers recorded the largest proportional changes in ESI points because the programmes allowed for multiple land-use options, some of which were appealing to resource-poor households.

Sources: Pagiola et al., 2007; Pfaff et al., 2000. And FAO, Livestock sector policies and programmes in developing countries – a menu for practitioners, 2010.

Marketing of environmental goods to incentivise environmental friendly husbandry practices: Livestock production systems generate multiple outputs, including animal food, manure, draught power and both positive and negative environmental externalities. As a general rule, markets exist only for meat, milk and other livestock products such as skins and leather, which leads farmers to overlook their other livestock outputs. Public actions to create a market for some of the environment goods/ services associated with livestock farming such as wildlife protection or biogas – could well provide incentives for farmers to shift towards more environment-friendly husbandry practices. Setting up a market for livestock- related environmental goods and services involves the following:

- Identifying opportunities for market-based livestock-environment development, i.e. areas where a market may develop for by-products generated by livestock farming. For example, would eco-tourism enterprises flourish if wildlife were protected? Are there any potential buyers for the biogas produced by animal waste?

- Analysing major livestock production systems to ascertain whether markets for livestock by-products are as remunerative for farmers, if not more so, than markets for traditional livestock products. This is a precondition for the feasibility of any market based livestock- environment scheme.
- Providing public goods necessary to ensure the smooth and fair functioning of a market for livestock-related environmental by- products, such as information campaigns; infrastructure development and ad hoc rules and regulations governing the newly established market.
- Promoting a participatory process to help livestock farmers: (i) adjust their husbandry practices to produce identified livestock-environment- related goods, including technical and financial assistance; and (ii) sell the livestock by-products they produce.

Source: FAO, Livestock sector policies and programmes in developing countries – a menu for practitioners, 2010

Case Study 6

Biogas processing for small-scale farmers in China: The rapid expansion of livestock production poses a number of challenges in terms of waste disposal, particularly in rapidly growing Asian countries. The Eco-Farming Project for China, launched in late 2008 with World Bank support, aims to generate environmental and economic benefits from the integration of biogas in farming and rural household cooking. There are three components to the project. (a) The integrated eco-farming system component targets about 400 000 to 500 000 farmers in Anhui, Chongqing, Guansi, Hubei and Hunan to help them integrate biogas into livestock farming; in particular, beneficiary households, which are required to possess at least three pig equivalents of livestock and 2 mu (0.13 ha) of cropland, receive support to build biogas systems that include digesters (8 to 10m³ in size), gas collectors, pipes, gas purifiers and stoves. (b) The technical extension and biogas service system component aims to strengthen and expand existing rural energy and agricultural extension services so as to provide technical support for the operation and maintenance of biogas systems. (c) The third component of the project has to do with management and M&E.

The expected direct benefits of biogas technology relate to: (i) energy production, as biogas can be used as a fuel alternative to wood and oil; (ii) agricultural productivity, as the sludge from the biogas reactor is transformed into ammonia nitrogen; and (iii) environmental protection, as there will be a reduction in greenhouse emissions and better sanitary conditions. The first two benefits generate immediate savings for farmers in terms of reduced expenditure on fuel and fertiliser. Achievement of the project's

development objectives will be monitored through environmental indicators; measurements of household living conditions; changes in household expenditures and labour savings; and improved human and institutional capacity.

Source: World Bank, 2008c. And FAO, Livestock sector policies and programmes in developing countries – a menu for practitioners, 2010.

Environmental taxes to incentivise in order to contain negative impacts of livestock production: Environmental taxes, such as grazing or discharge taxes, translate the costs of environmental pollution/resource scarcity into appropriate monetary costs, thereby providing farmers (the polluters) with incentives (taxes) to contain the negative impacts of livestock production systems on the environment. At the same time, they generate additional revenue for Government, which may be used for environmental programmes or the supply of other public goods. There exist countless livestock-environment taxes, which differ in terms of objectives, target population and design. For instance, a tax aimed at reducing overgrazing in pastoral zones differs from one for reducing livestock manure emissions in industrial production systems.

Source: FAO, Livestock sector policies and programmes in developing countries – a menu for practitioners, 2010.

Maintenance of forest cover in farms to maintain ecological balance: In the Waikato region of New Zealand, about 70% of the land areas is used for beef production and dairy grazing and 30% is left as forests, native bush and retired riparian areas. These practices are very useful for forest conservation.

Source: "Good Practices in Agricultural Water Management: Case Studies from Farmers Worldwide." 2004. On the International Federation of Agricultural Producers website: [http://www.ifap.org/en/publications/documents/EAUFINALFINAL.pdf] Accessed: July 11, 2005.

Reintroduction of traditional agricultural practices: A pastoralist development project in Kenya reintroduced seasonal grazing lands for agricultural animals with reserves set aside for stress periods. This project would reduce deforestation and conversion to grazing lands.

Source: Houten, Helen Van. 2002. Natural Resource Management best practices from FARM- Africa's Pastoralist

Development Project in Kenya FARM-Africa. On the FAO website

[ftp://ftp.fao.org/docrep/nonfao/LEAD/X6176e/X6176e00.pdf] Accessed: June 30, 2005.

Awareness about Livestock health issues to reduce animal health risk: Modern and well established scientific principles, practices and skills has been used to minimise animal health risk. Some of the major norms and recommended practices for housing of animals and milking of animals are given below.

Housing of Animals

- Construct shed on dry, properly raised ground.
- Avoid water-logging, marshy and heavy rainfall areas.
- The walls of the sheds should be 1.5 to 2 metres high.
- The walls should be plastered to make them damp proof.
- The roof should be 3-4 metres high.
- The cattle shed should be well ventilated.
- The floor should be pucca/hard, even non-slippery impervious, well sloped (3 cm per metre) and properly drained to remain dry and clean.
- Provide 0.25 metre broad, pucca drain at the rear of the standing space.
- A standing space of 2 x 1.05 metre for each animal is needed.
- The manger space should be 1.05 metre with front height of 0.5 metre and depth of 0.25 metre.
- The corners in mangers, troughs, drains and walls should be rounded for easy cleaning.
- Provide 5-10 sq. metre loaf space for each animal.
- Provide proper shade and cool drinking water in summer.

- In winter keep animals indoor during night and rain.
- Provide individual bedding daily.
- Maintain sanitary condition around shed.
- Control external parasites (ticks, flies etc.) by spraying the pens, sheds with Malathion or Copper sulphate solution.
- Drain urine into collection pits and then to the field through irrigation channels.
- Dispose off dung and urine properly. A gobar gas/ biogas plant will be an ideal way. Where gobar gas/ biogas plant is not constructed, convert the dung along with bedding material and other farm wastes into compost.
- Give adequate space for the animals.

Milking of Animals

- Milk the animals two to three times a day.
- Milk at fixed times.
- Milk in one sitting within eight minutes.
- As far as possible, milking should be done by the same person regularly.
- Milk the animal in a clean place.
- Wash the udder and teat with antiseptic lotions/luke-warm water and dry before milking.
- Milker should be free from any contagious diseases and should wash his hands with antiseptic lotion before each milking.
- Milking should be done with full hands, quickly and completely followed by stripping.
- Sick cows/buffaloes should be milked at the end to prevent spread of infection.

Source:

<http://www.nabard.org/modelbank/projects/animalhusbandry.asp>

Water Supply and Wastewater Management from livestock/animal husbandry rearing: An adequate supply of water is required for watering livestock and washing out barns, milking parlours, etc. Water can be taken from municipal sources, abstraction wells,

boreholes or rivers. Permits and charges will usually be required for water abstraction. Animal husbandry will produce large quantities of wastewater contaminated with high concentrations of organic wastes. Waste waters may be sent to soak away, spread on land, discharged to surface watercourse or to sewers. Large husbandry units may have, or be required to have, wastewater treatment facilities. As with abstraction, discharge of waste waters will often require permits and charges.

Source: Sub-Sectoral Environmental Guidelines-Animal Husbandry, European Bank for Reconstruction and Development.

Solid and Hazardous Waste Management from livestock/animal husbandry rearing: Typical wastes might include, solid manure, slurries and sludges, animal carcasses, used dips/pesticides and waste oils. The costs of disposal of wastes on site versus discharge to sewers should be carefully considered. In the long term, on-site storage/disposal may be a cheaper option, though there is the danger that inadequate facilities may cause potential liabilities to accrue. Many husbandry units in CEE countries have been closed down because of surface water contamination. Solid wastes such as carcasses may be subject to specific regulatory requirements. This needs to be checked. On-site disposal sites, location, spreading of slurry on land etc are important factors in the management of the waste. Any waste storage facilities should be located/relocated away from water courses.

Source: Sub-Sectoral Environmental Guidelines-Animal Husbandry, European Bank for Reconstruction and Development.

Good agriculture practices related to animal health, milking, hygiene, animal feeding and water, animal welfare and environment can reduce public/animal health risk and population. These practices are described below in Table 6, Table 7, Table 8 & Table 9.

Table 6: Good Practices related to animal health

Practice (GAP)	Examples of suggested measures to achieve GAP	Objective/Control measure
Prevent entry of disease onto the farm	• Only buy animals of known disease status and control their introduction onto the farm • Ensure cattle transport on and off the farm does not introduce disease • Have secure boundaries/fencing • If possible, limit access of people and wildlife to the farm • Have a vermin control programme in place • Only use clean equipment from a known source	• Keep animals healthy • Comply with national/ regional animal movement and disease controls
Have an effective herd health management programme in place	• Use an identification system that allows all animals to be identified individually from birth to death • Develop an effective herd health management programme focused on prevention that meets the farm's needs as well as regional and national requirements • Regularly check animals for signs of disease • Sick animals should be attended to quickly and in an appropriate way • Keep sick animals isolated and separate milk from sick animals and animals under treatment • Keep written records of all treatments and identify treated animals appropriately • Manage animal diseases that can affect public health (zoonoses)	• Detect animal diseases early • Prevent spread of disease among animals • Prevent transmission of zoonoses • Ensure traceability
Use all chemicals and veterinary medicines as prescribed	• Use of chemicals according to directions, calculate dosages carefully and observe appropriate withholding periods • Only use veterinary medicines as prescribed by veterinarians and observe specified withholding periods • Store chemicals and veterinary medicines securely and dispose them responsibly	• Prevent occurrence of chemical residues in milk
Train people appropriately	• Have procedures in place for detecting and handling sick animals and veterinary chemicals • Make sure all people are sufficiently trained to carry out their tasks • Choose competent sources for advice and interventions	• Follow correct procedures

Table 7: Good Practices related to milking hygiene

Good agricultural practice (GAP)	Examples of suggested measures to achieve GAP	Objectives/ Control measures
Ensure milking routines do not injure cows or introduce contamination to milk	• Uniquely identify individual animals • Ensure appropriate udder preparation for milking • Ensure consistent milking techniques • Separate milk from sick or treated animals • Ensure milking equipment is correctly installed and maintained • Ensure a sufficient supply of clean water	• Use suitable and well maintained equipment for milking and milk storage

Good agricultural practice (GAP)	Examples of suggested measures to achieve GAP	Objectives/ Control measures
Ensure milking is carried out under hygienic conditions	• Ensure housing environment is clean at all times • Ensure milking area is kept clean • Ensure the milkers follow basic hygiene rules	• Harvest milk under hygienic conditions
Ensure milk is handled properly after milking	• 2.3.1 Ensure milk is cooled in the specified time • 2.3.2 Ensure milk storage area is clean and tidy • Ensure milk storage equipment is adequate to hold milk at the specified temperature • Ensure unobstructed access for bulk milk collection	• Refrigerate and store milk under hygienic conditions
Ensure animal feed and water are of adequate quality	• Ensure the nutritional needs of animals are met • Ensure good quality water supplies are provided, regularly checked and maintained • Use different equipment for handling chemicals and feed stuffs • Ensure chemicals are used appropriately on pastures and forage crops • Only use approved chemicals for treatment of animal feeds or components of animal feeds and observe withholding periods	• Keeping animals healthy with good quality feed • Preserve water supplies and animal feed materials from chemical contamination • Avoid chemical contamination due to farming practices
Control storage conditions of feed	• Separate feeds intended for different species • Ensure appropriate storage conditions to avoid feed contamination • Reject mouldy feed	• No microbiological or toxin contamination or unintended use of prohibited feedingredients or veterinary preparations • Keeping animals healthy with good quality feed
Ensure the traceability of feed stuff bought off the farm	• All suppliers of animal feed should have an approved quality assurance programme in place • Maintain records of all feed or feed ingredients received on the farm (specified bills or delivery notes on order)	• Quality assurance programme of feed supplier

Table 8: Good practices related to animal welfare

Good agricultural practice (GAP)	Examples of suggested measures to achieve GAP	Objectives/Control measures
Ensure animals are free from thirst, hunger and malnutrition	• - Provide sufficient feed (forage and/or fodder) and water every day • Adjust stocking rates and/ or supplementary feeding to ensure adequate water, feed and fodder supply • Protect animals from toxic plants and other harmful substances • Provide water supplies of good quality that are regularly checked and maintained	• Healthy, productive animals • Appropriate feeding and watering of animals
Ensure animals are free from discomfort	• Design and construct buildings to be free of obstructions and hazards • Where relevant, provide adequate space allowances and clean bedding • Protect animals from adverse weather conditions and the consequences thereof • Provide housed animals with adequate ventilation • Provide non-slippery floors	• Protection of animals against extreme climate conditions • Provide a safe environment

Good agricultural practice (GAP)	Examples of suggested measures to achieve GAP	Objectives/Control measures
Ensure animals are free from pain, injury and disease	• Have an effective herd health management programme in place and inspect animals regularly • Protect against lameness • Lactating animals should be milked regularly • Do not use procedures and practices that cause unnecessary pain • Follow appropriate calving and weaning practices • Have appropriate procedures for marketing calves • When animals have to be killed on-farm, avoid unnecessary pain • Avoid poor milking routines as they may injure cattle	• Justified and humane actions • Good sanitary conditions
Ensure animals are free from fear	• Provide competent animal husbandry skills and appropriate training	• Absence of ill-treatment • Security of animals and farmer
Ensure animals can engage in relatively normal patterns of animal behaviour	• Have herd management and husbandry procedures that do not unnecessarily compromise social activity	• Freedom of movement • Preserve gregarious behaviour and other behaviors, such as preferred sleeping position

Table 9: Good practices related to environment

Good agricultural practice (GAP)	Examples of suggested measures to achieve GAP	Objectives/Control Measures
Have an appropriate waste management system.	• Ensure wastes are stored to minimise the risk of environmental pollution • Manage pastures to avoid effluent runoff by spreading farm manures in accordance with local conditions	• Limit the potential impact of dairy farming practices on the environment.
Ensure dairy farming practices do not have an adverse impact on the local environment	• Contain dairy runoff on- farm • Use chemicals (fertilisers, agricultural and veterinary chemicals, pesticides, etc) appropriately to avoid contamination of the local environment • Ensure overall appearance of the dairying operation is appropriate for a facility in which high quality food is harvested	• Presenting a positive image of milk production practices.

Chapter 5: Proposed Actions for Different Sectors

5.1 Forests & Wildlife

Proposed actions to address sector specific issues and type of response has been identified and described in Table 1. In Himachal Pradesh, there are many departments with overlapping and inter-connecting responsibilities in providing services. It is required to focus and channelise

their course of work in order to have an integrated planning. For this, inter-sectoral co- ordination in planning, execution and monitoring is required. It is important that planning and execution of any type of response requires identification of coordinating agency and collaborating agency. Table1 clearly delineates these agencies.



Table 1: Proposed Actions, Type of Response and Inter-sectoral Responsibilities

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
1. Forest degradation	Excessive demand for timber and other forest produce often led to removal far in excess of the Annual Allowable Cut (AAC). This led to forest degradation	- Reduced bio-diversity due to loss of habitat for a particular type of flora and fauna. - Irregular water flow, drying up of natural springs and increased vulnerability to flashfloods during rains. - Loss of soil fertility associated with soil erosion, resulting in the reduction of agricultural productivity, down stream	Increasing the effectiveness of participation of community through Joint Forest Management (JFM) programme by setting up new JFM committees where it is nonexistent/non functional.		✓	✓		Forest Department	Gram Panchayat (GP) Village Development Committees (VDCs)/ user groups, Mahela Mandal, SHG
			Implementation of State Plan Scheme on Accelerated Programme of Restoration and Regeneration of Forest Cover.						
			Development of alternate Community based livelihood programmes/ projects around/in the vicinity of protected areas e.g. eco development programmes			✓	✓	Forest Department	Department of Planning, Rural Development Department VDCs
			Maintaining the prescribed forest yield through natural regeneration, afforestation and plantation.			✓		Forest Department	Village Development Committees (VDCs)/ user groups CSOs
			Promote wild fruit trees plantation in forests and degraded lands.						
			Introduction/Strengthening of watershed (macro/micro) Development Programme in the State to conserve soil			✓		Agriculture / Rural Development Department	Forest, NGOs

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
2. High Anthropogenic Pressure	About two third of the State's geographical area is under recorded forests, but a substantial part of this is not conducive for tree growth, being under permanent snow, glaciers and cold deserts. About 90% population is rural who mostly depend upon fuel-wood and other forest products for their day-today energy requirements. The	Faster Degradation of Forests due to deforestation excessive exploitation of forest produce / economic values.	Development Programme in the State to conserve soil and water.					Department	
			Strengthening of Catchment Area Treatment Plan in existing areas based on survival rates and soil & water conservation measures.				√	Forest Department	Project proponents/LADCs/CSOs
			Monitor project programme/ (JFM)/ Eco Development / Watershed/ CAT plan) Implementation.			√		Forest Department	Village Development Committees/ user groups CSOs
			Increase forest cover/ per capita availability through JFM/PFM in degraded forests or wastelands or village common/panchayat land			√	√	Forest Department	Department of Planning, Department of Rural Development, JFM Committees
			Specific development plans for managing wastelands, culturable fallow or other lands		√	√	√	Forest Department	Department of Planning, Department of Rural Development, JFM Committees
			Development of long term literacy and livelihood programmes for migratory gujjar graziers to encourage and adopt new agro-economic activities e.g. dairying, horticulture, livestock rearing, with cottage industry and vegetable cultivation			√		Department of Planning	Department of Planning, Department of Rural Development, Department of Social Justice and Empowerment, Department of Forests
			Develop policy instrument			√		Forest	Department of Planning, Department of Rural

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
3. Increasing Livestock pressure on forest	manner, in which the fuel wood is obtained, has an adverse impact on forests health and vitality. In practice, however, even young poles are hacked and trees are badly lopped. Substantial forest areas of the State, other than areas taken up for regeneration and plantations, are open to grazing. Cultivation of green fodder in agricultural fields is virtually non-existent, as are stall-feeding practices	Continuous grazing diminishes productivity and gives rise to spread of inferior grasses and un-palatable weed plant species like Lantana camara, Parthenium and Ageratum species	for restoration of ownership rights of common land to panchayats for promoting community based forestry projects					Department	Development, ZP/PS/GP
			Promotion of alternatives to fuel-wood like LPG/ and renewable energy sources like Solar Energy through incentives like subsidy.			√	√	Department of Planning, Department of Rural Development	Himurja and Forest Department
			Promoting smokeless 'Dhauladhar chulhas' by providing subsidy for better kitchen hygiene and women's health.						
			Identification & Development of village Common Land / Panchayat for pasture. Plantation of community orchards and fodder crops.			√	√	Forest Department	VDC, Dept of Animal Husbandry, Dept of Rural Development, Dept of Horticulture, Dept of Planning
			Develops stall feeding and developing an equitable system for the distribution of grass from strips with in closed and planted belts programmes at household / community level.			√	√	Dept of Animal Husbandry	VDC, Dept of Rural Development, Dept of Horticulture, Dept of Planning
			Programmes for upgrading breeds and reducing non-productive livestock, thus increasing farmers' returns.			√	√	Dept of Animal Husbandry	VDC, Dept of Rural Development, Dept of Horticulture, Dept of Planning

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
4. Timber Distribution (TD) Rights	Due to the division of the families, the number of right holders is multiplying and the forests are depleting. Almost half of the yield prescribed annually from the forest goes to timber distribution right holders.	Selective harvesting of certain species leads to change in forest composition and depletion of desired species.	Assessment of timber needs and monitoring by Panchayats/VDCs for felling of marked trees.	√	√	√	√	Forest Department	Panchayats/ VDCs
		Loss of Biodiversity.	Regulation related to Timber distribution need to be updated/ amended to plug the economic losses and to identify the genuine and needy users of timber.	√		√	√	Forest Department	HDFDC Panchayats/ VDCs
		Due to growth of single species tree species forests become prone to pest/ diseases	Develop a time bound programme for gradual phasing out of timber distribution rights and provision of timbers at market rates. However, they require amendments in the existing regulation/ provisions on rights.	√		√	√	Forest Department	Panchayats/ VDCs
			Promote multiple timber yielding species e.g. Deodar and Kail along with Chil and fir/spruce in plantation and afforestation projects.			√	√	Forest Department	HPFDC
			Initiate penal action against major defaulters such as suspension of			√		Forest Department	-

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
5. Forest Encroachment	The incidence of encroachment is alarming in the un-demarcated protected forests that are without boundary pillars As these adjoin private lands. They are prone to encroachment Inhabitation at the periphery of the forests Over forests dependence on	Loss of forest land. Over exploration Social Conflicts	timber distribution rights.						
			Community/ Panchayat monitoring of timber distribution/ usage.			√		Forest Department	-
			Promote agroforestry/ from forestry/village common land plantation to meet the timber need locally			√			
			Demarcate protected forests with boundary pillars.			√		Forest Department	Department of Planning, Village Development Comities, Department of forest, Town and Country Planning
			Strict implementation of existing legislation and prosecution of offenders under Forest Act, Town & Country Planning Act.		√		√		
			Periodic monitoring by ZP and PS e.g. ZP to liaison with the forest Department for ejectment; PS to monitor the cases of over exploitation report to Forest Department.						

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
6. Unsustainable Harvesting of Forest Produce	forest & its products ☐ Unscientific harvesting and over-exploitation of forest resources beyond the its carrying capacity or regeneration capacity	☐ Illegal felling of trees ☐ Several species of medicinal and aromatic plants either becoming extinct or being listed as endangered species. ☐ Depletion of forest ☐ Irreversible loss due to extinction of species and natural imbalance	☐ Enforce regulatory measures especially for private pharmaceutical companies harvesting medicinal plants for commercial use.	√		√		Forest Department	State forest Corporation
			☐ Monitoring by Panchayat/Village Development Comities at the time of harvesting of forest produce and MAP and in prospecting activities relating to such forest produce.		√			ZP/PS/VDC	Village Development Comities
			☐ Use existing gene bank/set up a gene bank, preserve and document the germplasm of medicinal and aromatic plants.				√	Forest Department	DEST, State Agriculture Universities.
			☐ Use biotechnology for propagating and harvesting forest produce and MAP.					Forest Department	DEST, Deptt. of Biotechnology, State Agriculture University, (SAR, ICAR) and Central Agricultural Institutes
								Forest Department	

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
7. Inhibited natural regeneration due to ban on green felling	□ The complete ban on green felling in the forests is not conducive for the growth of forests	□ Degradation of forest due to loss of regenerative capacity of forest	□ Develop and implement district wise programme to reduce pressure forest produce.			√			Department of Ayurved
			□ Undertake medicinal plants survey, identification, collection, cultivation conservation, utilization, marketing, value addition, research & development, training, development of nurseries & agro techniques, quality control and inter-linkage with other departments.			√			
			□ Felling in the nature of regeneration felling and thinning can be carried out to induce regeneration and to remove congestion in the crops. Thus, the working plan prescription which is a tool for forest management needs to be implemented. Silvicultural operations are not necessarily commercial harvesting and therefore Govt. of India (MoEF)	√	√	√	√	Forest Department	HPFDC Himalayan Forest Research Institute GB Plant Institute of Himalayan Environment and Development, Kullu

Issues	Causes	Impacts/Risks	Proposed Actions	Response			Institutional Responsibility		
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
8. Lack of stress on Diversification of Forest Plantation	□ Choice of the aforestation species. Fast growing species like Pine are preferred in plantation which leads to rising monoculture plantation	□ Imbalance in natural diversity in forest plantation which promotes monoculture plantations. □ Long term impact on plant and animal species	should be approached for approval. □ Gather scientific data to assess the impacts and review changes by setting up of permanent plots for long term monitoring (in each Forest types) in the State to understand the forest eco- system and dynamics in pristine and wilderness areas and those forest where trees have been logged before the ban on green felling was brought in. (This can be set up to gather scientific data on climatic and biological parameters, especially in Alpine and Shivalik eco- systems).			√		Forest Department	HP University Dr. Y. S. Parmar University of Horticulture & Forestry, Nauni, Solan Himalayan Forest Research Institute GB Pant Institute of Himalayan Environment and Development
			□ Promote Deodar and Kail along with Chil and fir/spruce in plantation and afforestation projects. Promote mixed plantations of willow, poplar, oak, fir, bamboo, wild fruit species and others as per the requirement of the site.			√		Forest Department / HPFDC	Dept of Planning, Dept of rural Development

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
		☐ Lack of undergrowth for grazing ☐ Poone to pest infestation disease outburst	☐ PS to formulate plans in respect of lands identified by the Gram panchayats in coordination with concerned Range Officers for developing/organizing nurseries for afforestation.		√			Forest Department / HPFDC	ZP/PS/GP Dept of Planning, Dept of rural Development
			☐ Gram Panchayats (GP) to identify village common lands, other community and no forest lands for development of village wood lots in consultation with the local forest guards/Block officers. This will also include location of site, species to be planted and details of such areas, which need maintenance.					Forest Department	Dept of Planning, Dept of rural Development
			☐ PS and GP to supervise monitor afforestation, plantation and nursery works within their area and report to the concerned Forest Officer.			√		Forest Department	Dept of rural Development
			☐ Conservation of biological diversity should guide afforestation programmes and not carbon						

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
9. Forest fires and natural hazards	☐ Natural, accidental and sometimes intentional fires in forest areas. ☐ Each year thousands of ha of forest area gets burnt especially in the “Chil” forest belt, primarily due to negligence of the villagers. Fires are very common in the higher altitude “Blue Pine” forests during November and early	☐ Loss of forest cover, flora & fauna. ☐ Adverse impact on soil characteristics and increased soil erosion. The microclimate is also adversely affected.	sequestration potential alone.						
			☐ Promote use of pine needles for making bio briquettes to enable regeneration flora as well as the reduce pres- sure on fuel wood			√			
			☐ GP to enlist the co-operation of the local people to protect forest form fires and to help Forest Department in extinguishing forest fires by constituting fire protection committee.	√	√	√		Forest Department	ZP/PS/GP Department of Revenue State Disaster Management Authority
			☐ PS/GP to recommend action under existing regulation against major and habitual defaulters and to report concerned authorities of the Forest Department.			√		Forest Department	ZP/PS/GP Department of Revenue State Disaster Management Authority
			☐ ZP/PS/GP to incentivize community involvement in some mainstream forest department activities					Forest Department	ZP/PS/GP Department of Revenue State Disaster Management Authority

Issues	Causes	Impacts/Risks	Proposed Actions	Response			Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency
			including forest protection, afforestation and fire fighting.					Forest Department
			☐ Revise Relief manual			√		
10. Diversion of forest for non forestry purposes	☐ Forest diverted for various users/department s namely PWD, other roads/Hydroelectric Project/Mining Irrigation/TL/RL etc. Transmission lines railway lines	☐ Degraded quality of catchment area ☐ Loss of forest cover soil erosion, water resources flora and fauna ☐ Increased sedimentation from clear felling, mining and other activities. ☐ Disturbance to wild life habitat.	☐ Strict implementation of Policy Guidelines for recommendation of FCA Cases approved by Government of H.P. on 30 th September, 2009.				√	Forest Department
			☐ Strict implementations of notification for the preparation of the Catchment Area Treatment Plans stipulated vide notification no. FFE-B-F (2)-72/2004-Pt-II dated the 30.09.2009.				√	Forest Department
			☐ Promote usage of alternatives solutions like bio-engineering under catchment area treatment plans, instead of only thrusting engineering solutions.				√	Forest Department
11. Fragmented Protected	☐ Protected areas	☐ Inadequate protected	☐ Review of existing			√		Forest Department
								DEST/HP SCST

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
Area Network	are few and far in between and do not protect full assemblage of gene, species and ecosystem level diversity in the state	area network threatens long term survival and viability of species, especially of the critically, endangered and vulnerable species.	protected area network with respect to biogeographic zones and forest types at regular intervals. (Coverage/ species protection) (Extent/ Boundaries) to assess the needs for conservation and effectiveness of existing network at regular intervals.					Forest Department	
			☐ Develop action plan based on needs identification.		√				DEST/HP SCST
12. Crop damage by wild animals	☐ Habitation and settlements and cropping practices (agri-horticulture) close to forest and protected areas.	☐ Increase in Human – Wildlife conflict. ☐ Poaching/killing of wild animals	☐ Creation of buffer zones around the Pas.			√	√	Forest Department	Dept of Planning
			☐ Compensation payment			√		Forest Department	Dept of Rural Development
			☐ Implement Crop Insurance Schemes			√		Forest Department	Dept of Agriculture
	☐ Shrinking of wildlife habitat due to deforestation & development activities.		☐ Re-orienting afforestation programmes including vegetative barriers to focus on species that help mitigate man-animal conflict			√			Dept of Horticulture ZP/PS/GP

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
13. Stress on wild life population	□ Hunting of wild animals is one of the main causes for the loss and decline of wildlife in the State.	□ Decline in population of species and even extinction of threatened wild life in the long term	□ Develop & implement awareness programme for ZP to educate masses against illicit felling and poaching			√		Forest Department	ZP/PS/PG
			□ Monitoring offences of illicit felling/poaching ZP/PS monthly reporting to Range Officer for action			√		Forest Department	ZP/PS/PG
			□ GP to prevent and report the cases of illicit felling/poaching to the DFO concerned and take cognizance of patrolling of Forest Guards in their jurisdiction			√		Forest Department	ZP/PS/PG
14. Loss of naturally occurring vegetation due to spread of alien and invasive species	□ Lantana camara, Ageratum conyzoides Parthenium hysterophorus have spread far and wide in the State as a result of clear felling and wherever there is opening	□ Degraded habitats due to extensive colonization of open areas by alien species. Replace native species in the long term and would also affect area under cropping.	□ Working plans to identify areas infested with alien and invasive species and prepare a plan suitable intervention depending on the species, extent of the areas infested. □ Eradication of invasive and alien species from forest areas to check infestation of invasive and		√			Forest Department	Dept of Planning, Rural Development Agriculture Horticulture

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
	in the natural forest cover. ☐ Lack of eradication, rehabilitation and alternative use of exotic weeds		alien species into cropped areas						
			☐ Develop techno-economic feasibility study and market based incentives for utilization of products derived from Lantana bush.				√	Forest Department	Dept of Planning, Rural Development Agriculture Horticulture
			☐ Promote use of forest produce for value addition, like use of pine needles for making of bio-briquettes to be used as domestic fuel.			√		Forest Department	Dept of Planning, Rural Development Agriculture Horticulture

Monitoring and Reporting

Monitoring and reporting requirements with respect to response have been described below and performance indicators have been identified in Table 1. These monitoring requirements should be strictly followed for vulnerable areas with respect to forest and wildlife.

Monitoring and reporting of forest cover: Collect forest cover data by area, forest type and canopy cover. This data should be processed, analysed and published as per Forest Survey of India (FSI) norms of reporting and publication every two years. .

Monitoring and reporting of fuel wood extraction: All data related to fuel wood extraction has to be collected, documented, reported and published on quarterly basis to monitor the trend of extraction.

Monitoring and reporting of fodder extraction: All data related to fodder extraction from ghasnis has to be documented, reported and published on quarterly/annual basis to monitor the trend of extraction.

Monitoring and reporting of Timber distribution rights: All data related to timber distribution rights has to be documented, reported and published on quarterly/annual basis to monitor the trend of extraction.

Monitoring and reporting of Encroachment in the Forest areas: Data related to encroachment has to be regularly documented, reported and published by the Forest Department on quarterly basis to monitor the trend of forest area loss and for devising strategies and actions for regulation and control.

Monitoring and reporting of Forest Produce: Collect forest produce data in terms of species and quantity on quarterly basis to monitor the trend of extraction/harvesting. All the data should

be reported and documented quarterly/annually.

Monitoring and reporting of diversification in forest plantations: Monitor the implementation and progress of introducing diverse species plantation and its impact on the components like flora and fauna. All data has to be documented, reported and published at an appropriate frequency or timing with FSI forest cover assessment every two years.

Monitoring and reporting of forest fire and hazards: All forest fires instances have to be documented annually to analyse the reasons and taking pre-emptive and mitigation measures. Set up and monitor community based incentive programme to address forest fire and hazards. All data has to be documented, reported and published annually.

Monitoring and reporting of diversion of forest for non forestry purposes: Forest Department has been monitoring the trend of diversion of forest land. Based on the available data any particular sector which is responsible for major areas under forest cover should be flagged and accordingly an appropriate strategy should be devised for suggesting use of alternatives.

Monitoring & reporting of Protected Area Network: Assess the Protected Area network with a view to its representativeness and coverage of conservation of flora and fauna and ecosystems. Collect and monitor data especially on endemic and threatened species at individual PA level to examine fragmentation aspect and the scope of expansion of the existing Protected Area network. All relevant data has to be documented, reported and published by the relevant departments at an appropriate frequency like annual report.

Monitoring and reporting of Crop damage by wild animals: All data has to be documented, reported and published by the

concerned departments on quarterly/annual basis to monitor the trend of crop damage. Monitoring & reporting of land use changes in vulnerable areas or hot spots areas where crop damage by wild animals is frequently reported. All relevant data has to be documented, reported and published by the relevant departments' annual report.

Monitoring & reporting of hunting/over exploitation of wild animals: All data has to be documented, reported and published by the relevant departments on quarterly basis to monitor the trend of hunting and over exploitation of wild animals. All relevant data has to be documented, reported and published by the relevant departments annually.

Monitoring & reporting of spread of alien and invasive species: Monitor working and management plans with a view to eradicate such species including the vermins. All relevant data has to be documented, reported and published by the relevant departments annually.

Monitoring of programmes/plans/projects e.g. PFM/PFM/CAT: Monitor and report on the implementation and status of programmes/plans/ projects. All relevant data has to be documented, reported and published by the relevant departments annually.

Monitoring & reporting of Awareness programmes: Annual tracking of awareness

programmes/campaigns needs to be carried out. Conduct annual surveys to find the effectiveness of the different campaigns and reformulate the communication strategy of the awareness programmes.

Creation of common platform for inter-departmental co-ordination: Conduct monthly meetings. Co-ordinating agency should prepare minutes of these meetings and distribute to all the relevant agencies. Publish the abstracts of the meeting via different media.

Daily update of GoHP website and other State Department's websites should be carried out. Publish State of Environment Report annually containing a chapter on Forests and Wildlife in the State. This chapter will summarise the analysis of monitored data and performance of the sector based on following performance indicators.

Performance Indicators

For macro-level management of Forests and Wildlife issues identified and gauge the performance of the above proposed actions, following indicators are suggested to measure the outcome of these guidelines. These indicators as outlined in Table 2 will be monitored and reported by coordinating agency/department.

Table 2: Performance Indicators

Outcomes	Indicator
1. Implementation of forests and wildlife programmes/projects.	• Increase in area under forest cover, by types of forest and canopy cover. • Increase in Protected Area network as per biogeographic zones. • Decrease in human- wildlife conflict, as indicated by number of such instances and compensation offered.
2. Inter-sectoral co-ordination and integrated planning	• Increase/Decrease in fuel wood. • Increase/Decrease in forest produce e.g. fodder medicinal plants NTFP.
3. Awareness about the issues	• Increase/Decrease in alternate fuel/usage e.g. LPG, Solar, Dhauladhar Chulha. • Increase/Decrease in harvest/extraction of species.

Outcomes	Indicator
	• Increase/Decrease in incidences of fire (Area & Periodicity). • Increase/Decrease in incidence of poaching (species). • Increase/Decrease in crop damage by wild animal. • Increase/Decrease in areas of alien & invasive species. • Increase/Decrease in incidence of forest land encroachment.
	• Creation of Inter-sectoral forums/platforms. • Regular meetings of such forums. • New and effective enforcement mechanisms in force.
	• Number of awareness campaigns conducted on each issue via different media. • Number of trainings imparted to officers of various State departments. • Creation of Data bank at co-ordinating agency and regular publications on State Government website on the status of forests and wildlife.

5.2 Wetlands

Proposed actions to address specific issues related to Wetlands and type of response has been identified and described in Table 3. In Himachal Pradesh, there are various departments which have direct and indirect role in conservation and management of wetlands in terms of planning, development and implementation of various projects/schemes which directly or indirectly impact

wetlands. Therefore, it is required to focus and channelise the course of work of these agencies in order to have an integrated planning and development. For this, inter-sectoral co-ordination in planning, execution and monitoring is required. It is important that planning and execution of any type of response requires identification of co-ordinating agency and collaborating agency. Table 3 clearly delineates these agencies.

Table 3: Proposed Actions, Type of Response and Inter-sectoral Responsibilities

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
1. Shrinking of Wetland area due to change in land use and human & livestock activities.	An anthropogenic activity, unplanned urban and agricultural development, industries, road construction, impoundment, resource extraction and dredge disposal is leading to continuous shrinking of wetland area. Encroachment because of unclear land tenure and lack of property rights of the wetlands and surrounding areas is the major reason for shrinkage of the wetland area	☐ Catchment degradation ☐ Loss of wetlands and their productive functions ☐ Exert biotic pressure on the immediate environment micro habitats and riparian forests. ☐ New wetland formation due to retreating glaciers in high altitudes (moraine) and due to commissioning of hydroelectric projects. New species in wetlands e.g. Grebe (<i>Podiceps</i> sp.) have been recorded for Himachal Pradesh/ India)	☐ Demarcate wetland boundary with clear core and buffer areas which can be regulated ☐ Assign clear land tenure of wetland and surrounding area. ☐ Under take research studies for understanding impact of creation of new wetlands on local ecology, flora and fauna. ☐ Eject encroachment in coordination with relevant authorities e.g. BBMB which owns land in Pong but the catchment of Pong Dam is owned by the State of Himachal Pradesh. ☐ Identify clear roles and responsibilities of authorities related to wetland management. ☐ Undertake bathymetric mapping of wetlands. ☐ Conduct Regular Monitoring of physiochemical parameters. Water quality and land use of wetland.			√		H.P. Forest Department	-H.P. State Pollution Control Board -Dept of Agriculture -Dept of Horticulture
						√		HP State Council for Science, Technology and Environment (SCSTE)	-Dept of Animal Husbandry -Dept of Tourism and Civil Aviation -Watershed Development Committees -CSOs, CBOs -Bhakra Beas Management Board and other concerned dam management authority/agency LADCs
						√			
						√		H.P. Forest Department	-Department of Revenue & HP State Council for Science, Technology and Environment -HP PCB -Dept of Agriculture -Dept of Horticulture -Dept of Animal Husbandry -Dept of Tourism and Civil Aviation -Watershed Development Committees -CSOs, CBOs -Bhakra Beas Management Board and other concerned dam management authority/agency LADCs
						√			
						√			
						√			
						√			-Department of Revenue & HP State Council for Science, Technology and Environment -HP Pollution control Board -Dept of Agriculture -Dept of Horticulture -Dept of Animal Husbandry

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
						✓		H.P. Forest Department	-Dept of Tourism and Civil Aviation -Watershed Development Committees -CSOs, CBOs -Bhakra Beas Management Board and other concerned dam management authority/agency LADCs
									-Department of Revenue & HP State Council for Science, Technology and Environment -HP Pollution control Board -Dept of Agriculture -Dept of Horticulture -Dept of Animal Husbandry -Dept of Tourism and Civil Aviation -Watershed Development Committees -CSOs, CBOs -Bhakra Beas Management Board and other concerned dam management authority/agency LADCs
									HP Pollution Control Board
									HPSPCB, HPSCSTE, DEST
								H.P. Forest Department	

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
2. Catchment degradation is leading to soil erosion and siltation of the wetland	□ Continuous deforestation both legal & illegal in the catchment is leading to declining forest cover and productivity of forests and support lands. Further, uncontrolled grazing in meadows & pasture land is leading to increased pressure and reduced water holding capacity of forests and other lands. This is causing of continuous soil erosion & siltation. The combined effect of the visitors and graziers does contribute to increased siltation and organic influx	☐ Loss of wetlands and their productive functions. ☐ Siltation leading to reduction in capacity of reservoir/dam. Loss of habitat ☐ Feeding and breeding of aquatic fauna and birds. ☐ Disturbance to breeding and nesting of birds. ☐ Ecological degradation due to the vast quantity of sediments that flow into water body from the degraded uplands.	☐ Preparation and implementation of catchment area treatment plans ☐ Introduce fruit bearing trees in the CAT activities ☐ Ensure implementation of soil conservation measures should be taken to stop land slides. ☐ Create check points for controlling graziers/cattle/ livestock. ☐ Undertake carrying capacity study of the number of cattle/livestock depending on area around the wetlands. ☐ Conduct regular monitoring of catchment area treatment plans, muck disposal sites and grazing. ☐ Ensure muck disposal at designated sites.				√	H.P. Forest Department	
								H.P. Forest Department	
								H.P. Forest Department	-HPSEB, HPPCL/SJVNL/ZP/PS/GP/LADCs -Department of Agriculture -Department of Horticulture
								H.P. Forest Department	-Department of Rural Development -Department of Animal Husbandry -Watershed Development Committees
								H.P. Forest Department	-HP SC STE -HP SPCB -IQPH -Dept of Tourism & Civil Aviation -ULBs -NGOs
								H.P. Forest Department	DEST Department of Animal Husbandry
								H.P. Forest Department	DESTE, HPSCST, Department of Animal Husbandry
							√	H.P. Forest Department	DEST HPSCSTE/ HPPCL, Department of Rural Development Department of Agriculture.
								H.P. Forest Department	DEST

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
	into the wetland. □ High incidences of grazing pose serious threat to the biodiversity of the sanctuary area. The natural habitat linked by the migratory birds is thus destroyed by the hoofs of the cattle. □ The blasting of the hard rocks, deforestation of the area, throwing of muck in the water stream, etc. in the Hydel projects.	□ Silt on the edge of the lake subsequently provides fertile ground for the growth of the weeds.	□ Air, water & noise pollution. Avoid blasting during exceeding/nesting season of birds.			√		Department	HPSCSTE/ HPPCL, Department of Rural Development Department of Agriculture
						√	√	H.P. Forest Department	DEST HPSCSTE/ HPPCL, Department of Rural Development Department of Agriculture PWD
3. Agricultural-Horticulture activities in the wetland buffer zone and fringe areas	□ Shift in land use and agricultural production patterns in the catchment, buffer zone and fringe areas. □ Shoreline of lakes/wetlands is farmed during the draw down phase.	□ Disturbance/ loss of feeding and breeding habitat of aquatic fauna and birds. □ Increased siltation due to tilling.	□ Identify and map wetlands where draw down areas are being farmed. □ Zonation and inclusion of draw down areas in core area. □ Regulate farming lakes, wetlands during draw down areas.				√	H.P. Forest Department	HP State Pollution control Board Bhakhra Management Board (BBMB) Department of Revenue Department of Agriculture
4. Unrestricted dumping of sewage, solid wastes	□ Infrastructure development and poor management	□ Impairment of water quality	□ Prepare Wetland Management Plan for each wetland. As part of this plan, prepare & implement.			√	√	H.P. Forest Department	ULBs, IQPH, Department of Tourism & Civil Aviation,

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
and toxic chemicals from households, tourists destination, industries leads to pollution and eutrophication of wetlands, siltation and weed infestation.	of waste (municipal solid waste and waste water) in the catchment and vicinity of wetland leads to water pollution & eutrophication. Dumping of dung of horse and ponies near wetlands frequented by tourists (e.g. Khajjiar) also of organic influx into wetland. Increased runoff in the degraded catchment areas leading to siltation and weed growth. Excessive nutrient influx into wetlands contributes to water pollution & eutrophication. Littering of non-biodegradable materials by pilgrims and tourists increases pollution load in the wetland.	☐ Loss of wetland and its productive function weed infestation and proliferation. ☐ Health risk to public & livestock. ☐ Decrease in value of public amenities (tourism, recreation)	☐ Waste material including solid waste management plan. ☐ Suitable camping sites should be identified. ☐ Walking trails should be constructed. ☐ Prevention of pollution from point sources by intercepting, diverting and treating the pollution loads entering the lake. ☐ The interception and diversion works may include sewerage & sewage treatment for the entire lake catchment area. ☐ Weed removal and wetland monitoring should be carried out.						HP State Pollution control Board
5. Increased health risk in the surrounding	☐ Deteriorating water quality due to pollution led to the spawning of	☐ Major health risk e.g. vector borne disease in the vicinity of wetland.	☐ Major health risk e.g. vector borne disease in the vicinity of wetland. ☐ Ensure integration &				√	H.P. Forest Department H.P. Forest	

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
area of wetland due to pollution	mosquitoes in the absence of predators, such as aambusia affinis & lulli fish, which prey on mosquito larvae.		implementation of Awareness programme on health and sanitation of different line agencies e.g. IPH, health, tourism, forest & wild life.			√		Department	IPH, Deptt. of Health & Family Welfare, Dept of Tourism & Civil Aviation NGO, CSOs
6. Depletion of wetland's flora and fauna due to pollution/ dredging / Introduced and Invasive plant species	☐ Congestion of natural outdoor recreational sites aquatic by plant species such as e.g. eishhoni cnaassipes, Azolla and Salvinia molesta which clog waterways and compete with native vegetation, leading to loss of wetland's flora and fauna. ☐ Further, natural species also assumes weedy proportions e.g. Typha, Trapa, Thalia, Echinodorus, etc. Removal of natural vegetation spurs spread of alien and invasive species e.g. Lantana, Adhatoda, etc. This leads to reduction of area under palatable grasses used by wild	☐ Damage to the function and health of wetlands by Introduced and Invasive species. ☐ Local or regional species extinctions and replacement by other species. ☐ Loss of biodiversity and reduced ecosystem stability. ☐ Loss of biodiversity and reduced ecosystem stability. ☐ Reduction in agricultural productivity, reduction in livestock productivity, disruption of ecosystem services	☐ Study of ecosystem dynamics. ☐ Inventories biodiversity of the wetlands as part of Wetland Management plan. ☐ Carry out scientific study on wildlife and avifauna and its habitat and possible connectivity corridors with larger landscape as part of wetland management plan. ☐ Prevent and Control of introduced and invasive alien species specific to the wetland as part of wetland management plan.			√		H.P. Forest Department H.P. Forest Department H.P. Forest Department	-DEST -HP SCSTE -NGOs -Department of Fisheries -CSOs -Department of Fisheries -DEST -HP SCSTE -NGOs -Department of Fisheries -CSOs Department of Agriculture Department of Fisheries.
						√			

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
	grazing animals. Indiscriminate introduction of new species of fishes for commercial exploitation, over harvesting of particular species and fishing methods are leading to depletion of wetland's native fauna. Commercial fisheries lead to change in composition of fisheries. ☐ The fertilizers and insecticide i.e. the chemicals such as CAN, Urea, 12-32-16, DAP, Super-Phosphate etc. and insecticide pollute water of the reservoir and this deteriorates aquatic flora and fauna.	and reduction in land values. ☐ Alteration in nutrient cycling. ☐ Change in habitat ☐ Alteration in water flow ☐ Decrease in water retention							
7.. Inadequate enforcement of regulatory-provision due to	☐ Some of the unchecked activities include poaching of avifauna, illegal harvesting of crops and	☐ Unabated poaching and wildlife trade can deplete flora and fauna and further threaten species.	☐ Formulation and implementation of Wetland's Management Action Plan. ☐ Activities regarding conversion of wetlands to non- wetlands use, and				√	H.P. Forest Department	Department of Agriculture Department of Fisheries Specialist National Institutions

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
9. Uncontrolled / Unregulated tourism in the buffer zone leading to disturbance to the ecology and critical habitat	- Introduction of fish in wetlands (e.g. Renuka and Khajjiar wetlands) led to fish feeding by Tourists with bread, biscuits, wheat flour dough, grains, nuts, etc resulting in organic pollution. - Sports & Training activities disturbing the habitats of aquatic animals & plants.	- Water, air & noise pollution. - Public health risk & safety - High BOD level resulting in fish mortality	Develop water bodies as tourist spots with adequate ecological protection independently or as part of tourism master plan.			√	H.P.	Forest Department	Department of Tourism & Civil Aviation PWD IPIA, ULB,

Monitoring and Reporting

Monitoring and reporting requirements with respect to response have been described below and performance indicators have been identified in Table 4. These monitoring requirements should be strictly followed for critically polluted areas, vulnerable areas with respect to wetlands.

Monitoring and reporting of pre and post monsoon water spread area and water levels of wetlands Monitoring and reporting of seasonal (pre and post monsoon) species variation, biomass production and actual silt load. This data should be processed, analysed and published as per forests department norms of reporting and publication at least twice in a year (pre and post monsoon season).

Monitoring of implementation of Catchment Area Treatment (CAT) Plans and documenting, reporting and publishing should be carried out on an annual basis using remote sensing and GIS applications.

Monitoring and Reporting of cases of encroachments, follow up of cases in courts, through inter-department/inter agency co-ordination and identification of areas/wetlands prone to encroachment should be done. This data should be documented, reported and published annually.

Monitoring & Reporting of graziers/cattle /livestock should be carried out for trend analysis and identification of areas/wetlands exploited by graziers. This data should be documented, reported and published annually.

Monitoring and reporting of cropping in terms of area under cropping and pattern/practices of cropping in draw down areas should be carried out to establish trend and areas/wetlands prone to such crops and identifying trend in change in land use. This data should be documented, reported and published annually.

Seasonal (pre & post monsoon) water quality monitoring, analysis and reporting to establish trend for scientific management of wetlands. This data should be documented, reported and published annually.

Monitor trend of eutrophication in terms of percentage area covered especially by alien and aggressive species like water hyacinth. Seasonal algal growth in terms of inventory of species and percentage area covered by such species also need to be monitored. This data should be documented, reported & published annually.

Conduct seasonal/annual water fowl count as they are indicators of the quality of wetland habitat which support roosting, breeding and nesting activities of avifauna (both resident and migratory). This data should be documented, reported and published annually.

Monitoring of harvesting of floral and faunal components of wetlands e.g. fisheries to understand the trend of harvesting and for taking remedial measures like regulation of harvesting, putting a cap or setting an upper limit on harvesting/seasonal bans. This data should be documented, reported and published annually.

Monitoring and reporting of indicator species to be determined after data collection on the same. This data should be documented, reported and published annually.

Conduct annual wildlife census and compare with baseline data to monitor trend. This data should be documented, reported and published annually.

Seasonal and annual reporting of instances of poaching of wetland's fauna especially the resident and migratory birds to establish trend, identify species which are vulnerable to poaching. This data should be documented, reported and published annually.

Monitoring and reporting of desilting/dredging operations (Silt load/dredged material/silt disposals) by wetland/dam/reservoir management agency. This data should be documented, reported and published annually.

Seasonal and annual monitoring and reporting of flow from small hydro projects. Seasonal and annual monitoring and reporting of release of water from dams/reservoir in command and downstream areas should be carried out. Monitor and report water regime or hydrology of the system, water levels at various points, inflows, retention and outflows. This data should be documented and recorded seasonally along with climate data. This data should be reported and published annually.

Seasonal and annual monitoring and reporting of mechanised and high speed boats for fishing and water sports practices in terms of new registrations and licence issued to the operators. This data should be documented, reported and published annually.

Monitoring of wetland management plan. Monitoring should be carried out every year to report durations & slippages. This data should be documented, reported and published annually.

Performance Indicators: Performance indicators are bound by certain specified limits, which represent thresholds for action and should trigger an appropriate response. These specified limits define the degree to which the value of a performance indicator is permitted to fluctuate without creating any cause for concern, for example, no less than a 10% drop in a species population.

As per “Managing Wetlands”, Ramsar Handbook No. 16, 3rd edition, 2007, some of these indicators may fall in the category of ‘early warning’ indicators. Inclusion of early warning indicators in a monitoring programme is a precautionary management approach. Information on early change is acted upon as management interventions before real and important eco-system-level changes have occurred. Most early warning indicators available have been developed to predict or forewarn important chemical changes, (namely, pollution) in wetlands. These can be grouped into three broad categories: a. rapid response, toxicity tests; b. field early warning tests, and c. rapid assessments. There fore, for macro-level management of the wetlands, issues identified and to gauge the performance of the above proposed actions, indicators are suggested to measure the outcome of these guidelines.

Table 4: Performance Indicators

Outcomes	Indicator
1. Improvement of water quality.	- Meeting at least designated Best Use Class D for surface waters as given by Central Pollution Control Board. - Percentage reduction of silt load - Percentage reduction of dredged material. - Percentage reduction in volume of silt disposal.
2. Desiltation for removal of organic/toxic sediments.	
3. Catchment treatment to check erosion/Scientific Management Plans	- Percentage of area treated under CAT plan each year. - Monitoring of Management Action Plan of Wetlands
4. Diversion and treatment of sewage in the catchment of wetland	Percentage of sewage generated versus treated.
5. Conservation of	i. For species

Outcomes	Indicator
wetland's flora and fauna. Conservation of water spread area.	a. Quantity : Percentage decrease/increase in size of a population of individuals present; • Percentage increase/decrease in total number of breeding adults, • Percentage increase/decrease in total population at a specified point in an annual cycle; • Percentage increase/decrease in the extent or distribution of a population b. Quality: Percentage increase/decrease of controlled grazing/cattle/livestock; survival • Number and location of check points in the catchment. ii. For habitats a. Quantity: Percentage increase or decrease in the area of the habitat • Percentage increase or decrease in the number of wetlands. • Percentage increase or decrease in the depth of water. b. Quality: Percentage increase or decrease in the population of threatened species/individual or groups of species. • Percentage increase or decrease in the population of invasive faunal species. • Percentage increase/decrease in the number and area occupied by floral invasive species. • Percentage increase/decrease in the quantity of flora harvested. • Percentage increase/decrease in the quantity of fauna harvested e.g. fisheries. • Percentage increase/decrease in the number of cases of poaching filed under the Wildlife Protection Act, (1972).
6. Degree of local participation in wetland management.	• Number of wetland management committees formed. • Number/Gender in wetland management committee. • Number of local issues raised. • Documented in the wetland management committee.
7. Encroachments	• Percentage increase/decrease in number of reported cases of encroachment. • Percentage increase/decrease in number of clearances.
8. Scientific Management of wetlands	• Number of wetland proposed for wetland management plan development and implementation. • Number of wetland management plan approved versus proposed.
9. Inter-sectoral co-ordination and integrated planning	• Creation of Inter-sectoral forums/platforms • Regular meetings of such forums • New and effective enforcement mechanisms in force
10. Awareness about the issues	• Number of awareness campaigns conducted on each issue via different media • Number of trainings imparted to officers and staff of department of tourism, hotel/resort association, forest and wildlife, transport/taxi association, PRIs and other line agencies. • Creation of data bank at co-ordinating agency and regular publications on State Government website on the State of wetland water, air & waste scenario and its implications.
11. Improved overnance	• Greater participation of CSOs/CBOs in co-ordination with other departments.

5.3 Fisheries

Proposed actions to address specific fisheries issues and type of response have been identified and described in Table 5. In Himachal Pradesh, there are many departments with overlapping and inter-connect responsibilities in providing services. It is required to focus and channelise their course of work in order to

have an integrated planning. For this inter-sectoral co-ordination in planning, execution and monitoring is required. It is important that planning and execution of any type of response requires identification of co-ordinating agency and collaborating agency. Table 5 clearly delineates these agencies.

Table 5: Proposed Actions, Type of Response and Intersectoral Responsibilities

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
1. Shrinking of Wet- land/ water body/ reservoirs area due to change in land use, human & live-stock activities	☐ Anthropogenic activities, unplanned urban and agricultural development, industries, road construction, impoundment, resource extraction and dredge disposal. Illegal encroachment because of unclear land tenure and lack of property rights of the wetland/ water body/ reservoir and surrounding areas. ☐ Continuous deforestation both legal & illegal in the catchment is leading to declining forest cover and productivity of forests and support lands. Further, uncontrolled grazing in meadows & pasture land is leading to increased pressure and reduced water holding capacity of forests and other lands. This is causing continuous soil erosion & siltation	☐ Siltation leading to reduction of capacity of reservoir/dam/ wetland. ☐ Loss of habitat/ biodiversity/ productivity. ☐ Disturbance to feeding, breeding and nesting of birds including migratory birds. Loss of Eco-system function, fish species and productivity.	Assessment of baseline fisheries production in each wetland/ reservoir/ water body and conduct root cause analysis for decline in production and species. The baseline study should include the following: ☐ Inventories fish species as part of aquatic biodiversity of the wetlands/ water body/ reservoir and its Management plan. ☐ Breeding season and the spawning grounds of major fish species. ☐ Silt tolerance study of major fish species including species wise tolerance and duration. ☐ Study of effect of sediment and silt on benthic communities. ☐ Assist line department in identifying and implementing measure for dredge spoil stabilization as part of the reservoir/water body/wetland operation plan. ☐ Desilting as part of reservoir/water body/wetland operation plan e.g. timing of desilting vis a vis flooding (1 st /2 nd /3 rd desilting with 1 st , 2 nd , and 3 rd flood)	√	√	√	√	Department of fisheries	-HP State Council for Science, Technology and Environment (HP SC STE) -hp State Pollution Control Board -Dept of Agriculture -Dept of Horticulture -Dept of Animal Husbandry -Dept of Tourism & Civil Aviation -Zila Parishad (ZP) -Panchayat Samiti (PS) -Gram Panchayat (GP) -Watershed Development Committees -CSOs, CBOs -Directorate of Energy (Power Utilities), PWD LADCs -Department of Revenue (H.P. State Council for Science, Technology & Environment)

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
			☐ Suggest improvement measures to address directly negative impacts on fish breeding and feeding grounds as part of the restoration of habitat while developing and implementing catchments area treatment plan and watershed development programmes. ☐ Assist line department to implement measures to reduce fish mortality by maintaining adequate depth all the year round as part of the operation plan. ☐ Water body/ wetland/ reservoir monitoring plan. ☐ Monitor the post project (catchment area treatment plan and watershed development programme) production to assess the efficacy of implemented measures for replications. ☐ Coordinate with line departments to formulate multi stakeholder's action plan based on route cause analysis. ☐ Implementation other fish breeding programmes for Endangered/ indigenous species. ☐ Develop and implement pilot				√		

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
2. Agriculture-horticulture activities in the wetland/ reservoir/ water body buffer zone, fringe areas and catchments area	☐ Shift in land use and agricultural production patterns in the catchment, buffer zone and fringe areas. It has been reported in Pong wet- land report of forest department that the chemicals such as CAN, Urea, 12-32-16, DAP, Sulpher Phosphate and insecticides such as nuvan, etc. pollute water for reservoir and deteriorates flora and fauna	☐ Fish mortality and de- cline in productivity. ☐ Disturbance/loss of feedings nesting and breeding grounds of in- habitants including fish.	project to reduce fish mortality related to annual silt fishing linked to operational strategy of reservoir ☐ Undertake research studies on the impact of insecticides and fertilizer residues on biotic life of aquatic lotic ecosystems and prioritize water bodies based on the level of concern. ☐ Assist department of agriculture and horticulture in formulating action plan for the identified areas based on level of concern according to research studies. ☐ Promote bio-farming, IPM, IPNM, bio-fertilizer, bio-pesticide, etc.		√		√	Department of fisheries	-HP State Pollution Control Board - Directorate of Energy (utilities) - ZP/PS/GP -Department of Revenue -Department of Agriculture -Department of Horticulture -H.P. Forest Department
3. Poor surface water quality due to unrestricted dumping of sewage, solid wastes and toxic chemicals from household, tourists destination and industries leads to water	☐ Infrastructure development and poor management of waste (municipal solid waste, Construction and demolition waste and waste water) in the catchment and in vicinity of wetland/ water bodies/ reservoirs. Further, increased influx of organic waste which leads to water pollution & eutrophication.	☐ Loss of aquatic flora and fauna. ☐ Fish mortality and de- cline in productivity. ☐ Decrease in value of public amenities (tourism, recreation).	☐ Assist the respective line departments to prepare wetland/ water body/ reservoir management plan (sewage, solid wastes, toxic chemicals, tourists destination and industries) for each prioritized wetland/ water body/ reservoir. As part of this plan, take measures to protect and rehabilitate spanning and feeding areas. ☐ Carry out regular monitoring of the prioritized wetland/ reservoir/ water body as part of wetland/ reservoir/ water body management plan.	√	√	√	√	Department of fisheries	Deptt. of IQPH, Municipalities, Deptt. of Forrest, SPCB, Deptt. of Health, Deptt. of Urban Development, NGOs, CSOs, CBOs Directorate of Energy (Utilities)

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
pollution and eutrophication of wetlands/water body/reservoir	Increased runoff in the de-graded catchment areas of wetlands leads to siltation and weed growth, water pollution & eutrophication. Littering of non-biodegradable materials by pilgrims and tourists increases pollution load in the wetland.								
4. Depletion of benthic flora and fauna in wetlands/ reservoir/ water body due to dredging/ desilting	☐ Depletion of benthic flora and fauna in wetlands/ water body/ reservoir due to dredging/ desilting. Depletion of fisheries due to introduction of invasive plant and fish species. Congestion of natural outdoor recreational sites is leading to depletion of wetland flora & fauna. Indiscriminate introduction of new	☐ Damage to the function and health of wetlands by introduced and invasive species. ☐ Local or regional fish species extinctions and replacement by other fish species. ☐ Disturbance to wetland/ ecology and food chain.	☐ Ensure dredge spoils do not re-enter the water body/ wetland/ reservoir.	√	√			Department of Environment Science & Technology	-HP State Pollution Control Board -HP SCSTE -NGOs -Department of Fisheries -CSOs, CBOs -ZP/PS/GP -H.P. Forest Department

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
	species of fishes for commercial exploitation, over harvesting of particular species and fishing methods are leading to depletion of wetlands/ reservoir/ water body fauna.	☐ Disruption of breeding and feeding of fish. ☐ Alteration in water flow and decrease in water retention which Leads to high TDS/ turbidity and decreased oxygen level thereby increasing fish mortality.	☐ Since the introduction of new species is fraught with certain risks as such the biotic material if necessary be imported as strict quarantine procedures be adopted prior to their release in natural waters		√	√	√	Department of Fisheries	-Department of Environment Science & Technology -HP State Pollution Control Board -HP SCSTE -NGOs -Department of Fisheries -CSOs, CBOs -ZP/PS/GP -H.P. Forest Department
5. Poor Enforcement of regulated activities due to jurisdiction issues on account of unclear land tenure and other aspect related to fisheries	☐ Indiscriminate hooking, netting, dynamiting and electrocuting have greatly affected the qualitative and quantitative availability of fishes in the rivers, streams, lakes and reservoirs. Further, due to reduction in the large-sized fishes, fishing pressure has shifted to the juveniles	☐ Loss of fish species Ecological imbalance ☐ in aquatic flora and fauna including fisheries ☐ Loss of wetland/ water body/ reservoir area due to institutional gaps ☐ Deteriorate surface water quality	☐ Formulation and implementation of Wetlands Management Action Plan ☐ Enforce strict regulations related to poaching and other issues. Enhance capacity of personnel & training of enforcement/ regulatory staff and augmentation of enforcement infrastructure. ☐ Develop awareness programmes for all the stakeholders for education on conservation of fish.		√		√	Department of Fisheries, Department of Forests	Department of Agriculture, NGO's, CSO's, Department of Tourism & Civil Aviation, Directorate of Energy (Utilities), ULBs, IPH and HPPCB
6. Change in	☐ Construction of a large	☐ Changes in Hydro-	☐ Assist line department in assessment				√	HP State	Deptt. of Fisheries,

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
natural flow/hydrology and water dynamics of the reservoir/wetland/ water body	number of reservoirs and dams; diversion of streams and rivers and hydro-electric projects lead to reduced flow into wetlands/ water bodies/ reservoir. Further, release of impounded water by dam/reservoir depends on the management authority. Small hydropower projects and other infrastructure development projects requiring water diversion also change the hydrology of the wetland/ water body/ river.	logical regime leading to variation in ecology of the small stream/khud which in turn affects large streams and rivers. ☐ Ecological imbalance in aquatic flora and fauna including fisheries	of the hydrology in the immediate catchment/ river basin for small hydro projects. ☐ Assist line departments to ensure coordination between relevant authorities on the timing and volume for release of water. ☐ Assessment of sustainable environmental flow for each river and stream. ☐ Ensure release of minimum 15% of lean flow or environmental flow downstream. ☐ Assist line departments in developing, design and implementation of appropriate fish ladder or fish pass from diversion structure or additional measure to facilitate minimum downstream discharge in order to maintain aquatic longitudinal connectivity (At the moment sluice gate are not designed in a manner to release 15% of minimum flow). ☐ Ensure minimum downstream discharge to be maintained through fish pass.		√	√		Council of Science, Technology & Environment	DEST, IPH, Himurja Directorate of Energy (Utilities).
7. Uncontrolled / unregulated tourism in the buffer zone leads to	☐ Tourists feed fish and turtles with bread biscuits, wheat, flour, grains nuts etc. thereby disturbing and decline	☐ Water, air & noise pollution public health risk & safety.	☐ Identifying and advising on regulation on the number of motorized tourist vessels in water bodies.	√		√	√	Department of Tourism & Civil Aviation, HP SPCB	Deptt. of Fisheries, PWD, IPIA, ULB, Zila parishad, Gram Panchayat

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
disturbance of fish feeding and breeding habitat	of habitat and fish productivity. Movement of high speed motorised boats of tourists, allied activities of water sports like training programmes and fishing vessels. Poor camp management and waste disposal	□ Disturbance in feeding and breeding of fish.	□ Ensure adequate ecological/fish habitat protection measures taken before development water bodies as tourist spots.						

Monitoring and Reporting

Monitoring and reporting requirements with respect to response have been described below and performance indicators have been identified in Table 6. These monitoring requirements should be strictly followed for critically polluted and vulnerable areas.

Monitoring and reporting of pre and post monsoon water spread area and water levels of wetlands/ water bodies/reservoirs. This data should be processed, analysed and published as per forests and wildlife department norms of reporting and publication at least twice in a year (pre and post monsoon season).

Monitoring and reporting of seasonal (pre and post monsoon) fish species variation, and yield. This data should be processed, analysed and published as per forests department norms of reporting and publication at least twice in a year (pre and post monsoon season).

Monitoring of Catchment Area Treatment (CAT) plans related to critical fisheries habitat and documenting, reporting and publishing on annual basis using remote sensing and GIS applications should be carried out.

Monitoring and Reporting of cases of encroachments in the fish spawning, breeding & feeding area through inter-department/interagency co-ordination and areas prone to encroachment should be identified. This data should be documented, reported and published annually.

Seasonal (pre & post monsoon) water quality monitoring: To generate baseline data and establish trend line with respect to water quality, seasonal water quality sampling and analysis annually. Monitoring and Reporting past may also be represented in tabulated form.

Monitor trend of eutrophication if any in critical fishery reservoir/ wetlands/water body in terms of percentage area covered especially by alien and aggressive species like water hyacinth should be carried out. This data should be documented, reported & published annually.

Monitor of harvesting of floral and faunal components of fisheries to understand the trend utilization of harvesting and for taking remedial measures like regulation on harvesting, putting a cap or setting an upper limit on harvesting/ seasonal ban. This data should be documented, reported and published annually.

Monitoring and reporting of desilting/ dredging operations (Silt load/ dredged material/silt disposals) of wetland/ dam/ reservoir critical to fisheries by management agency. This data should be documented, reported and published annually.

Seasonal and annual monitoring and reporting in terms of new registrations and licence issued to the operators of mechanised and high speed boats for fishing and water sports practices. This data should be documented, reported and published annually.

Monitoring of awareness campaign: Annual tracking of awareness programmes/ campaigns needs to be carried out. The areas include industrial effluents, depletion, degradation of water quality, use of pesticides, depletion of wetland's/water body/reservoir flora & fauna, unrestricted dumping of sewage solid waste and toxic chemicals, deforestation. Conduct annual surveys to find the effectiveness of the different campaigns and reformulate the communication strategy of the awareness programmes.

All the above have to be documented and reported by relevant departments on quarterly basis. Also, the remedial measures taken to combat the situation have to be documented.

Table 6: Performance Indicators

Outcomes	Indicator
1. Improvement of water quality/desilting	• Meeting designated Best Use criteria upto Class D for surface waters as given by Central Pollution Control Board. • Deviation from existing/targeted sustainable silt load levels. • Quantum removed periodically
2. Catchment treatment to check erosion	Percentage of area treated under CAT plan each year.
3. Diversion and treatment of sewage in the catchment of wetland/reservoir/water body	Percentage of sewage generated versus treated.
4. Conservation of Fish in wetlands/reservoir/water body conservation of water spread area.	i. For species a. Quantity : Percentage decrease/increase in size of individual species; • Percentage increase/decrease in total quantity • Number and location of check points in the catchment. ii. For habitats a. Quantity: Percentage increase or decrease in the area of the water body. • Percentage increase or decrease in the number of wetland/reservoir/water body. • Percentage increase or decrease in the average depth of water. b. Quality: Percentage increase or decrease in the population of threatened species/individual or groups of species. - Increase/decrease of migratory avian fauna • Percentage increase or decrease in the population of invasive fish species. • Percentage increase/decrease in the number and area occupied by floral invasive species. • Percentage increase/decrease in the quantity of fauna harvested e.g. fisheries. • Percentage increase/decrease in the number of cases of poaching filed under fisheries Act, 1976.
5. Degree of local participation in wetland/reservoir/water body management.	• Number of wetland/reservoir/water body management committees formed and number of meetings held. • Number of local issues raised related to fisheries. • Documented in the wetland management committee.
6. Encroachments	• Percentage increase/decrease in number of reported cases of encroachment in the fish spawning/feeding/breeding areas. • Percentage increase/decrease in number of eviction wetland/reservoir/water body clearances.
7. Scientific Management of wetland/reservoir/water body	Number of wetland/reservoir/water body proposed for wetland management plan development and implementation.

Outcomes	Indicator
8. Inter-sectoral co-ordination and integrated planning	• Creation of Inter-sectoral forums/platforms • Regular meetings of such forums • New and effective enforcement mechanisms in force, proposed and decisions taken.
9. Awareness about the issues	• Number of awareness campaigns conducted on each issue via different media • Number of trainings imparted to officers and staff of department of fisheries, tourism, forest, PRIs and other line agencies and numbers trained. • Creation of data bank at co-ordinating agency and regular publications on State Government website on the state of wetland water, air & waste scenario and its implications.

5.4 Horticulture

Proposed actions to address specific horticulture issues and type of response has been identified and described in Table 7. In Himachal Pradesh, there are many departments with overlapping and inter-connecting responsibilities in providing services. It is required to focus and channelise their course of work in order to have an integrated planning. For this inter-sectoral co-ordination in planning, execution and monitoring is required. It is important that planning and execution of any type of response requires identification of co-ordinating agency and collaborating agency. Table 7 clearly delineates these agencies.



Table 7: Proposed Actions, Type of Response and Inter-sectoral Responsibilities

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
1. Predominant rain fed horticultural crops	☐ Irrigated Area is 19% 81% area is rain fed. Abnormal pattern of rainfall Hilly Terrain ☐ Limited Water Resources Improper Management of resources.	☐ Low Productivity ☐ Increased incidences of disease and pest infestation	☐ Introduction of water efficient micro-irrigation system. ☐ Approach on rainwater harvesting. ☐ Increased use of mulch, organic manures, drought tolerant crops, etc.			√	√	Horticulture	Agriculture, CSSRI, Horticulture/ Agriculture Universities, NGO's, PRI's, IPH
2. Shift in cropping pattern by market driven forces	☐ Diversification to vegetable and Floriculture etc.	☐ Dwindling Soil health due to intensive cultivation. ☐ Nutritional requirement of vegetable crops not properly met.	☐ Adherence to fruit and vegetable crops based cropping systems in line with soil fertility status in different agro climatic zones as per their suitability. ☐ Integrated Nutrient Management needs more emphasis implementation. Package of practices for the horticultural crops to be developed and practiced accordingly	√	√	√		Agriculture	CSSRI, Horticulture/ Agriculture Universities, NGO's, PRI's, IPH
3. Threats of wildlife to horticultural crops	☐ Enhancement in Fight for food	☐ Reduction in crop production Degradation of water and soil. ☐ Risk to Human and Domestic animals.	☐ Proper surveillance of wild animals. ☐ Protection of crops by advocating use of wired fencing. ☐ Enactment of some policy.	√	√	√	√	Forest	Agriculture, Horticulture deptt.
4. Inadequate soil and water conservation measures	☐ Soil and water erosion due to sloppy land and less depth.	☐ Sheet, rill and gully erosion.	☐ Promote soil conservation measures by people participation.					Agriculture	Horticulture / forest

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
5. Use of Agro Chemicals in horticultural crops	☐ Lack of vegetation cover in catchment area. ☐ Growing flood menace due to high intensity of rainfall ☐ Use of pesticides Inadequate awareness	☐ Loss of soil fertility. ☐ Low productivity ☐ Loss of useful microbial flora & fauna. ☐ Application of agrochemicals may result in ground water contamination. ☐ Risk to human and animal health.	☐ Increasing vegetation underfruits with concerted efforts. ☐ Emphasis on water harvesting and water conservation. ☐ Propagation of micro irrigation system ☐ Promotion of Bio pesticides & Bio-fertilisers. ☐ Promotion of organic based farming			√	√	Horticulture	Agriculture
6. Threat from obnoxious weeds	☐ Outflow of weeds through rain, wind, irrigation water, animals, birds, etc.	☐ Adversely affecting yields of horticultural crops & soil fertility. ☐ Reduction in cropped area. ☐ Increased disease and pest infestation by acting as alternate host.	☐ Identify and map areas infested with obnoxious weeds and prepare a plan with suitable interventions depending on the species, extent of the areas infested. ☐ Conduct techno economic feasibility study and market based incentives for utilisation of products derived from obnoxious weeds.			√	√	Horticulture	Agriculture, Research Institutes and ICAR
7. Genetically modified seeds	☐ Inadequate information.	☐ May affect existing germplasms	☐ Genetically modified seeds to be thoroughly evaluated, tested and			√	√	Agriculture	Horticulture

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
			then promoted through R & D.						
8. Low adoption of latest technology by farmers and deceleration in extension activities	☐ Large scale testing is not being carried out/conducted before recommending GM seeds ☐ Low purchasing power. ☐ Small land holding. ☐ Incompatibility of technology developed at research station vis-à-vis farmers field.	☐ Low productivity of fruit and vegetable crops	☐ Strengthening extension network ☐ Need to provide better communication network ☐ Investment in developing infrastructure			√	√	Horticulture	Agriculture
9. Generation of waste due to spoilage/disposal of horticultural produce because of lack of Road & Transportation/storage facility	☐ Lack of infrastructure facility particularly primary processing ☐ Delay in access to the market due to lack of post harvest storage / transportation. ☐ Improper packaging. ☐ Losses in processing and handling Freezing/ chilling injury. ☐ Unsuitable transport containers	☐ Reduced income due to loss of produce. ☐ Pollution due to disposal on land/ water. ☐ Increased public/ animal health risk.	☐ Accelerate / initiate actions envisaged in project implementation plan for management of infrastructure facilities like local market/storage. ☐ Monitor climatic conditions, e.g. moisture content, temperature, relative humidity, etc. as part of post harvest management plan. ☐ Develop and implement MSW management Plan through APMC.			√	√	Horticulture	HPMC, APMB, Agriculture, PWD
10. Use of chemicals	☐ For high revenue	☐ For high revenue	☐ Enforcement of regulation strictly.					Horticulture	Horticulture/

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
	for enhancing the size, color and ripening of produce	generation	generation			√	√		Agriculture Universities, ICAR
11. Inadequate use of hitech Horticulture	☐ Poor purchasing power of the farmers. ☐ Ignorance of the farmers about adoption of such need based technology for generation of higher income	☐ Failure of the high value crops due to unforeseen circumstances.	☐ Creating awareness among farmers. ☐ Capacity Building of the Farmers. ☐ Promotion of Polyhouse/ Nethouse and micro- irrigation system. ☐ Awareness / training to the farmers about benefits of such technology and its full crop geometry. ☐ Promotion of Insurance Incentive schemes.			√	√	Horticulture	Horticulture/ Agriculture Universities, ICAR
12. Dwindling health	☐ Long duration fruit crops and continuous cropping of vegetable crops. ☐ Replenishment of nutrient is less Soil erosion. ☐ Low use of organic matter.	☐ Poor soil health leading to low productivity. ☐ Increase in cost of cultivation.	☐ Integrated nutrient management and technology need more emphasis. ☐ Soil testing and judicious use of fertilizers. ☐ Promotion of organic farming.		√	√	√	Agriculture	Horticulture/ Agriculture Universities, ICAR
13. Suffering of farmers due to loss of crops on account of weather risk	☐ Frequent occurrence of natural calamities like drought, cloud bursts, heavy rains, hailstorms and fluctuation in temperature	☐ Result in lot of problems of soil and water erosion. ☐ Productive soil is lost. ☐ Lot of loss to crops.	☐ Early warning of natural calamities of heavy rains, hailstorms, cloud burst and temperature variation to be given by IMD Crop insurance and contingency crop planning to be implemented. ☐ Integrated Natural Resource					Horticulture	Agriculture, IMD University/Research Institutes

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
		☐ Impaired quality of produce.	Management need to be implemented. ☐ Develop (through R & D) and promote varieties tolerant to fluctuations of weather Strong support for protected cultivation need to be implemented. ☐ GIS methods for detailed soil resource mapping and land use planning to be carried out.			√	√		
14. Poor post harvest management	☐ Lack of awareness about sanitary conditions to handle produce. ☐ Lack of integrated handling system to manage produce. ☐ Improper storage, drying, grading practices at farm level. ☐ Lack of processing/ storage facilities/ orchard management.	☐ Loss of produce/ loss of revenue. ☐ Input Resource loss like fertilizer, pesticide, soil nutrients and water. ☐ Increased health risk.	☐ Promote awareness and training programmes for post harvest management for farmers / handlers / warehouse managers / transporters. ☐ Develop and implement agriculture produce market management / solid waste management programme.			√	√	Horticulture	HPMC, Agriculture, APMB, Horticulture/ Agriculture Universities and ICAR
15. Inadequate marketing and post harvest infrastructure	☐ Inadequate investment	☐ Unremunerative price. ☐ Low returns and losses	☐ Creation of better marketing infrastructure facilities like marketing yards, transportation, collection, storage, grading and packing near the production area.					Horticulture	HPMC, Agriculture, APMB, Horticulture/ Agriculture Universities and ICAR

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
16. Impact of Climate change on horticultural crop	☐ Global Warming. ☐ Aberration in weather	☐ Unorganized producers	☐ Need to develop and promote efficient post harvesting technologies like primary processing units. ☐ Need to establish rural connectivity by constructing farm access roads.			√	√		
		☐ Introduction / extinction of new flora and fauna. ☐ More Biotic and Abiotic stresses on crops. ☐ Uncertainty in yields of horticultural crops.	☐ Need to develop sound market intelligence network. ☐ Need to strengthen R & D to develop varieties / techniques/ technologies to mitigate the adverse impact of climate change. ☐ Conservation of germplasm strengthening of IMD to forewarning about weather up to micro level in hilly areas. Creating awareness among farmers	√				Horticulture	Agriculture, Horticulture/ Agriculture Universities, IMD and ICAR

Monitoring and Reporting

Monitoring and reporting requirements with respect to response have been described below and performance indicators have been identified in Table 8. These monitoring requirements should be followed with respect to the sector.

Monitoring of climatic conditions e.g. temperature, wind speed, wind direction, sunshine, rainfall, snowfall, hail, humidity, cloud cover etc. on daily basis. This data needs to be published on a daily, monthly and yearly basis.

Monitoring of fertiliser and pesticide consumption. Both chemical and biological fertiliser and pesticide consumption need to be monitored and documented on seasonal basis. This data needs to be published on seasonal and yearly basis.

Monitoring can be done on Climate & soils in relation to horticultural crops:

Effect of Frost on Crop Yield:

- Severe loss of crop yield.
- Shape & appearance of fruit affected.
- Damage at blossom time

Effect of Wind on Crop Yield:

- Fallen fruits
- Tattered leaves
- Broken branches

Effect of Rainfall on Crop Yield:

- Temporary suffocation of roots
- Temporary nutrient deficiency.
- Fruit cracking.
- Hastened fruit maturity
- Effect of Hailstorm on Crop Yield:
- Tattering or stripping of leaves.
- Deformed fruits.
- Effect of Drought on Crop Yield:
- Restricted fruit Size.

Creation of common platform for inter-departmental coordination: Conduct monthly meetings. Co-ordinating agency should prepare minutes of these meetings and distribute to all the relevant agencies. Publish the abstracts of the meeting via different media.

Monitoring & reporting of disease: Regular inspections should be carried out on plants and data related to work place diseases should be recorded, documented and published every year.

Awareness programmes to be conducted: Annual tracking of awareness programmes/campaigns needs to be carried out. The areas include farming technologies, storage and marketing facilities, health of farmers, use of bio pesticides, etc. Conduct annual surveys to find the effectiveness of the different campaigns and reformulate the communication strategy of the awareness programmes of soils for fruit growing: Soil should have good water holding capacity e.g. loamy soil.

Daily update of State Government's website and other State department's websites should be carried out. Publish an annual State Environment Report which will contain a chapter on horticulture sector and environment in the State.

Performance Indicators for macro-level management of Horticulture issues identified and gauge the performance of the below proposed actions, following indicators are suggested to measure the outcome of these guidelines. Indicators as outlined in Table 8 will have to be monitored and reported by co-ordinating agency/department.

Table 8: Performance Indicators

Outcomes	Indicator
1. Implementation of Horticulture improvement programmes/projects.	• Decreased/increased percentage of occurrence of fruit disease • Monitoring of irrigation water quality including pesticides residue • Monitoring of soil quality including pesticides residue • Number of market facilities per districts • Per ha production of horticulture produce • Percentage share of income from horticulture produce • Number of cold storage and their capacity per district. • Decreased/increased percentage of horticulture area • Fertiliser consumption per ha • Increase/decrease in consumption of bio-fertilisers, fertiliser and pesticide per ha • Increase/decrease in horticulture yield versus fertiliser consumption • Increase/decrease in horticulture yield versus pesticide consumption • Period of chilling/snowfall • Percentage of damaged horticulture produces during storage/packaging/ transportation/handling. • Horticulture yield versus annual expenditure on horticulture activities • Number of programmes/projects identified and implemented to address each issue
2. Inter-sectoral co-ordination and integrated planning	• Creation of Inter-sectoral forums/platforms • Regular meetings of such forums • New and effective enforcement mechanisms in force
3. Awareness about the issues	• No. of awareness campaigns conducted on each issue via different media • No. of trainings imparted to officers of various State departments • Creation of Data bank at coordinating agency and regular publications on State Government website on the state of water, air, waste & health scenario and its implications.

5.5 Agriculture

Proposed actions to address specific sector issues and type of response has been identified and described in Table 10. In Himachal Pradesh, there are many departments with overlapping and inter-connecting responsibilities in providing services. It is required to focus and channelise their course of work in order to have an integrated planning. For this, inter-sectoral co-ordination in planning, execution and monitoring is required. It is important that planning and execution of

any type of response requires identification of co-ordinating agency and collaborating agency. Table 10 clearly delineates these agencies.

Table 10: Proposed Actions, Type of Response and Inter-sectoral Responsibilities

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
1. Predominant rain fed agriculture	☐ Irrigated Area is 19 % only	☐ Frequent failures.	☐ Crop			☒	☒	Agriculture	Horticulture, SAU's and R.& D Institutes, NGO's, PRI's, IPH, Rural Development, I&PH
	☐ Abnormal pattern of rainfall	☐ Vegetable productivity. low	☐ Introduction of water efficient micro- irrigation system.						
	☐ Non-availability of water sources hilly terrain		☐ Approach on a large scale rainwater harvesting Increase use of mulch, organic manures, drought tolerant crops, etc. Watershed development approach for rain fed agriculture.						
2. Shift in cropping system by market driven forces	☐ Cereal- legume cropping system being shifted to vegetable crop due to increased income.	☐ Soil health dwindling.	☐ Adherence to crops and cropping systems in line with soil fertility status in different agro climatic zones as per their suitability.	☒	☒	☒		Agriculture	SAU's & HPMB
	☐ Increased availability of irrigation water.	☐ Reduction of area under Food Crops.	☐ Need to identify crops which can adapt to climate change suitability.						
	☐ Climate Change		☐ Package of practices for the crops to be developed and practiced accordingly						
3. Inadequate soil and water conservation measures	☐ Soil and water erosion due to sloppy land, poor textured and less soil depth.	☐ Sheet, rill and gully erosion.	☐ Promote soil conservation measures by people participation Increase vegetation and vegetative conservation. Emphasis on rain water harvesting and conservation. Promotion of contour terracing on sloppy fields. Follow watershed development approach			☒	☒	Agriculture	Horticulture, Forest, IPH, Rural Development, SAU's, R & D Institute, I&PH
	☐ Lack of vegetation cover in catchment area.	☐ Low productivity. Washing away of cultivable area.							
	☐ Growing flood menace due to high intensity of rainfall.	☐ Cultivation of crops on high slope (> 30 %)							

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
4.. Use of Agro Chemicals in agriculture	☐ Indiscriminate use of pesticides. ☐ Inadequate awareness.	☐ Loss of useful microbial flora in soil. ☐ Adverse impact on environment. ☐ Ground water contamination and risk to human health due to residual effect.	☐ Promotion of Bio pesticides. ☐ Promotion of organic farming. Promotion of IPM technology. Awareness campaigns to educate farmers.			√	√	Agriculture	Horticulture
5. Threat from obnoxious weeds	☐ Outflow of weeds through rain, wind, irrigation water, cattle, birds, etc.	☐ Adversely affecting crop yields, pasture lands & soil fertility. ☐ Damage in crop area. Poisonous to human & animals. ☐ Environmental degradation	☐ Identify and map areas infested with obnoxious weeds and prepare an action plan with suitable interventions depending on the species and extent of the areas infested, through community involvements. ☐ Conduct techno – economic feasibility study and market based incentives for utilization of products derived from obnoxious weeds			√	√	Agriculture	Forest & Rural Development, SAU's & A.H.
6. Low adoption of latest technology by the farmers	☐ Incompatibility of technology developed at research station vis-à-vis farmer's field. ☐ Lack of awareness. Poor financial conditions.	☐ Low productivity crop and farm income.	☐ Strengthening extension network. ☐ Need to provide better extension and communication network. ☐ Need based and location specific R&D.			√	√	Agriculture	Horticulture, SAU's and R&D institute.
7. Dwindling soil health	☐ Continuous cropping, high intensity.	☐ Poor soil health leading to low productivity.	☐ Integrated nutrient management. Soil testing and judicious use of nutrients Promotion of organic	√		√	√	Agriculture	Horticulture, SAU's and R&D institute.

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
8. Suffering of farmers due to losses of crops on account of weather risk	☐ Replenishment of nutrient is less. ☐ Soil erosion. ☐ Low use of organic matter.	☐ Increase in cost of production. ☐ Result in lot of problems of soil and water erosion. ☐ Productive soil is lost. ☐ Loss to the crops and quality of produce is affected. ☐ Loss to productive Soil	farming ☐ Early warning of natural calamities of heavy rains, hailstorms, cloud burst and temperature to be given by IMD. ☐ Crop insurance and contingency crop planning Integrated. ☐ Natural Resource Management. ☐ Develop and promote varieties tolerant to fluctuations of weather. ☐ Strong support for protected cultivation. GIS methods for detailed soil resource mapping and land use planning.						
	☐ Frequent occurrence of natural calamities like drought, cloud bursts, heavy rains, hailstorms, temperature fluctuations, hailstorm, frost etc.				√		√	Agriculture	Horticulture, IMD, SAU's & R&D Institutes
9. Inadequate marketing and post harvest infrastructure	☐ Inadequate investment. ☐ Inaccessibility of production area. ☐ Difficult topography. ☐ Lack of knowledge about modern system of	☐ Unremunerative price to farmers. ☐ Low returns due to inefficient marketing ☐ Loss in quality of produce. Damage/ rottage.	☐ Market led production System. ☐ Sensitization of farming community regarding efficient marketing & post Harvest technology. ☐ Creation of better marketing infrastructure facilities like marketing yard, transportation,					Agriculture	HPMC, Horticulture HPMB, SAU's and R&D Institutes

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
	marketing.		collection, storage, grading and packing near the production area. ☐ Need to develop and promote efficient post harvesting technologies. ☐ Need to establish rural connectivity by constructing farm access roads. ☐ Needs to develop sound market intelligence network. ☐ Organize farmers into commodity groups & their capacity building. Contract farming.			√	√		
10. Increasingly small holdings may lead to non-cultivable land	☐ Average size of land holding is 1.1 ha and may further go down in view of fragmentation of holdings	☐ Subsistence farming results in unemployment. ☐ Low crop yields. ☐ Increase in current fallows.	☐ Promotion of precision farming. ☐ Increasing cropping intensity. ☐ Promotion of high value crops. ☐ Bringing fallow land under cultivation. ☐ Bringing more area under efficient irrigation through rain water harvesting.	√	√	√	√	Agriculture	Horticulture, & I&PH Revenue
11. . Impact of climate change on	☐ Global Warming. ☐ Aberration in weather	☐ Introduction/ extension of new flora and fauna.	☐ Consolidation of holdings. ☐ Need to strengthen R&D to develop varieties/ techniques/technologies to mitigate the adverse impact of climate					Agriculture	Horticulture, SAU's and R&D Institute

Issues	Causes	Impacts/Risks	Proposed Actions	Response				Institutional Responsibility	
				Policy	Plan	Programme	Project	Coordination Agency	Collaboration Agency
agriculture	Industrialization.	☐ Change crop/cropping seasons. ☐ More biotic and abiotic stresses on crops.	in change. ☐ Conservation of germplasm. ☐ Strengthening of IMD to forewarning about weather up to micro level in hilly areas. ☐ Creating awareness among farmers.	√	√				

Monitoring and Reporting

Monitoring of fragmentation of agricultural farmlands: Identify and map districts/agroclimatic zones where fragmentation or rate of fragmentation is high so that priority actions can be taken in terms of planning alternate livelihood schemes/programmes and diversified agriculture schemes. All relevant data has to be documented, reported and published by the Department of Agriculture annually.

Monitoring of areas witnessing loss of agrobiodiversity and narrow crop base: Identify and map those districts/agroclimatic zones where farming is based on few crops only so that priority action can be taken in terms of planning diversified agriculture schemes/programmes and promoting additional and suitable crops under various schemes. Monitor the existing schemes which are aimed at revival of traditional crops for their assessment of efficacy and scaling up in other areas. All relevant data has to be documented, reported and published by the Department of Agriculture annually.

Monitoring of areas witnessing shift in cropping practices: Identify and map those districts/agroclimatic zones where such a shift is more pronounced in terms of extent (area) and number of crops which are catalysing/indicating the shift in cropping practices. This would enable identification of priority actions and schemes in those districts/agroclimatic zones where shift has changed the soil productivity or is posing a threat to long term farm income or food and nutrition security. Monitor the existing schemes which are aimed at revival of traditional crops/new crops for their assessment of efficacy and scaling up in other areas. All relevant data has to be documented, reported and published by the Department of Agriculture annually.

Monitoring of areas witnessing heavy reliance on high energy input and chemicals: Identify and map those

districts/agroclimatic zones where higher farm inputs/chemicals is acute to enable initiation of priority actions in terms of strengthening organic farming and reviving traditional farming practices and introducing best practices. Monitor the existing schemes which are aimed at revival of traditional and organic farming for their assessment of efficacy and scaling up in other areas. All relevant data has to be documented, reported and published by the Department of Agriculture annually.

Monitoring of areas where soil and water conservation programmes are inadequate in terms of outreach and efficacy of such programmes: Identify and map those districts/agroclimatic zones where such programmes are inadequate and ineffective to enable priority actions like introducing watershed (micro-watershed) development programmes, catchment area treatment programmes, command area development programmes and suitable best practices. Monitor the existing schemes which are aimed at increasing the outreach of soil and water conservation programmes and assessment of their effectiveness and where the programmes have not yielded desired results. All relevant data has to be documented, reported and published by the Department of Agriculture annually.

Monitoring & reporting of spread of alien and invasive species: Monitor Comprehensive District Agriculture plans with a view to eradicate such species. All relevant data has to be documented, reported and published by the Department of Agriculture annually.

Monitoring of effect of climate on agriculture crop: Monitoring of parameters like effect of frost on crop yield, effect of wind on crop yield, effect of rainfall on crop yield, effect of hailstorm on crop yield, effect of drought on crop yield etc, should be taken up.

Monitoring of implementation of Comprehensive District Agriculture Plans

(CDAP): The monitoring report containing, progress, achievements, constraints and lessons learnt should be published by the Department of Agriculture annually.

Creation of common platform for inter-departmental co-ordination: Conduct monthly meetings. Co-ordinating agency should prepare minutes of these meetings and distribute to all the relevant agencies. Publish the abstracts of the meeting via different media.

Monitoring & reporting of disease: Regular inspections should be carried out on plants and data related to work place diseases should be recorded, documented and published every year.

Awareness programmes to be conducted: Annual tracking of awareness programmes/campaigns needs to be carried out. The areas include farming technologies, storage and marketing facilities, health of

farmers, use of bio pesticides, etc. Conduct annual surveys to find the effectiveness of the different campaigns and reformulate the communication strategy of the awareness programmes.

Daily update of State Government's website and other State department's websites should be carried out. Publish an annual State Environment Report which will contain a chapter on horticulture sector and environment in the State

Performance Indicator

For macro-level management of agriculture issues identified and gauge the performance of the below proposed actions, following indicators are suggested to measure the outcome of these guidelines. Indicators as outlined in Table 11 will have to be monitored and reported by co-ordinating agency/department.

Table 11: Performance Indicators

Outcomes	Indicator
1. Implementation of agriculture development and improvement programmes/projects.	- Decreased/increased percentage of occurrence of disease. - Monitoring of relevant parameters of irrigation water quality including pesticides residue. - Monitoring of relevant parameters of soil quality including pesticides residue. - Number of market facilities per district. - Per ha production of agriculture produce. - Percentage share of income from agriculture produce. - Number of warehousing and storage facilities and their capacity per district. - Decreased/increased percentage of agriculture area. - Consumption per fertilisers per ha. - Consumption of bio-fertilisers and pesticides per ha. - Period of chilling/snowfall. - Percentage of damaged agriculture produces during storage/packaging/ transportation/handling. - Knowledge about new technology and HYV seeds. - Annual export of agriculture produce. - Road and Transport status. - Quality of agriculture produce and their market value. - Annual expenditure on agriculture activities. - Major reasons for increased/decreased agriculture produce. - Number of programmes/projects identified and implemented to address each issue.
2. Inter-sectoral co-ordination and integrated planning	- Creation of Inter-sectoral forums/platforms. - Regular meetings of such forums. - New and effective enforcement mechanisms in force.

Outcomes	Indicator
3. Awareness about the issues	• Number of awareness campaigns conducted on each issue via different media • Number of trainings imparted to officers of various State departments. • Creation of Data bank at co-ordinating agency and regular publications on State Government website on the state of water, air, waste & health scenario and its implications.

5.6 Animal Husbandry & Livestock

Proposed actions to address specific livestock issues and type of response has been identified and described in Table 12. In Himachal Pradesh, there are many departments with overlapping and inter-connecting responsibilities in providing services. It is required to focus and channelise their course of work in order to have an integrated planning. For this inter-sectoral co-ordination in planning, execution and monitoring is required. It is important that planning and execution of any type of response requires identification of co-ordinating agency and collaborating agency. Table 12 clearly delineates these agencies.



Table 12: Proposed Actions, Type of Response and Inter-sectoral Responsibilities

Issues	Causes	Impact/Risks	Proposed Actions	Policy	Plan	Programme	Project	Coordination Agency	Collaborating Agency
1. Degradation of all kind of land (Alpine pastures vegetation, forest area).	• Overgrazing	• Increase in soil erosion due to over- grazing. • Decrease in soil fertility.	• Prepare and implement community level projects to overcome overgrazing. • Demarcate boundaries of grazing land and prepare grazing plans.	√		√		Forest	Agriculture, Animal Husbandry/ Allied Departments
2. Shrinkage of private grasslands and village common lands due to over grazing by livestock, Construction of Roads, Buildings, Government Institutions.	• Unscientific grazing practices/ Lack of proper grazing management practices.	• Increase soil compaction.	• Make people aware about harmful effects of overgrazing/soil erosion. • Ensure participation of villages/ PRI. • Departments should act as facilitators. • Improvement of Indigenous live- stocks.	√		√		PRI's	Agriculture, Animal Husbandry/ Patvaaris/ Gram Sewaks/ Forest Guards
3. Research on effect of climate change on animal health.	• Climate change is being witnessed every where and so is the case in HP.	• May lead to many problems related to adaptability and occurrence of diseases (Zoonotic). • Lowering of Production.	• Plan need to be prepared to monitor the effect of climate change on animal health • Livestock breeds to be developed, which can adapt to a particular climate.	√		√		Research Institutes	Animal Husbandry/ allied (village level workers)
4. Public and animal health risk due to inadequate animal/ Public health Infrastructure.	• Inadequate drugs availability and distribution. • Inadequate capacity of health	• Increased burden of disease/mortality • Consumption of milk,	• It is proposed to have polyclinics in the remaining districts of the State to provide better diagnostic services to the People. • Constant monitoring of					Animal Husbandry	PRI's and stakeholders concerned.

Issues	Causes	Impact/Risks	Proposed Actions	Policy	Plan	Programme	Project	Coordination Agency	Collaborating Agency
	infrastructure/facilities including buildings & equipment	Milk products and meat of infected livestock may affect on human health.	surveillance of livestock diseases and mortality. - Specialised diagnostic centres to be established like laboratories at Sub-division and block levels. - Create awareness among masses about consumption of only non-infected milk and meat products.	√		√			
5. Transfer of diseases from animals to human & vice versa (Zoonotic diseases).	Inadequate awareness and dissemination of knowledge pertaining to Zoonotic diseases.	Human health risk due to transfer of communicable diseases from animals and vice versa.	- Animal health care centres/labs to be properly equipped for diagnosing various diseases in animals - Information to be disseminated of such communicable diseases to people - Increased collaboration between Veterinarians and Medicos regarding public health issues.	√		√		Animal Husbandry	Health & Family welfare.
6. Inadequate awareness about animal health issues leading to higher public and animal health risk.	- Inadequate awareness due to peculiar topographical conditions in hilly terrain - Use of banned drugs e.g. Oxytocin. - Lack of NGO/CSO participation.	- Health risks on livestock population - Increased burden of disease/mortality - Consumption of milk, milk products and meat of infected livestock may lead						Animal Husbandry.	Health & Family welfare PRI's and Local Bodies.

Issues	Causes	Impact/Risks	Proposed Actions	Policy	Plan	Programme	Project	Coordination Agency	Collaborating Agency
		to human health problems.							
7. Public health and animal health risk due to increase in animal disease	Unscientific livestock's management practices	- Increase in morbidity and mortality of Livestock. - Human health risk due to spread of diseases (Zoonotic).	- Awareness regarding scientific livestock's management - Establishment of registered slaughter houses at hospital level and amendment of laws for enforcing compulsory meat inspection at the slaughter houses before selling in the market even in the rural areas. - Upgradation of Veterinary dispensaries to Veterinary Hospital so that the ratio of hospital: dispensary is not more than 1:8. - Enhancing awareness of livestock diseases which adversely impact public health.	√	√	√		Animal Husbandry.	Health & Family welfare, PRI's, Local bodies and NGO's.
8. Increasing pressure on forest area/other land use.	- Due to peculiar geographical and hilly terrain transportation of fodder becomes difficult. - Due to shrinkage of common grass-lands and waste-land in the residing villages.	- Depletion of vegetation in the forest area. - Soil Erosion. - Loss of soil fertility.	- Encourage stall feeding of live-stock by farmers. - Promoting fodder cultivation. - Establishment of fodder banks at Panchayat level. - To increase the nutritive values of roughages by Urea treatment. Molasses treatment of rice crops/wheat straw, rice straw & poor nutrient value grasses etc.	√		√		Forest/ PRI's	Animal Husbandry, Agriculture, Rural Development

Issues	Causes	Impact/Risks	Proposed Actions	Policy	Plan	Programme	Project	Coordination Agency	Collaborating Agency
9. Environmental pollution due to animal waste.	Unscientific livestock waste disposal practices. (Faeces, urine, carcasses etc.)	- Emission of green house gasses (CO₂, CH₄, N₂O). - Water pollution. - Offensive odour.	- Promote fodder (grass & trees) species in JFM and community forest projects. - Encourage biogas plants. - Encourage the use of organic manure. - Proper scientific disposal of dead animals' carcasses.	√		√		PRI's	Agriculture, HPPCB, Local Bodies, Rural Development
10. Impact of migrating animals on the environment.	- Availability of Grazing Area - Centuries old migrating system of rearing animals by communities like Gaddies and Gujjars.	- Degradation of soil quality/fertility. - Decrease in vegetative cover. - Increase pressure on common land, wasteland and Forest.	- Steps to monitor and allow the migration of animals according to carrying capacity/availability of grazing lands/grazing facility. - Rearing of high yield improved breeds of animals - Promoting fodder cultivation. - Encouraging plantation of fodder trees/improved fodder grasses etc.	√		√		Forest	Animal Husbandry, Agriculture, PRI's, Representative s of migratory community like Gaddies and Gujjars.
11. Threat of obnoxious weeds affecting fodder availability for animals.	Rapid spread of obnoxious weeds like Parthenium, Lantana, Ageratum etc in the grasslands/wastelands/forest area.	Fodder production adversely affected.	- Extensive mass campaign to eradicate obnoxious weeds. - Re-plantation of fodder trees, grass etc on a massive scale. - Plantation of improved variety of fodder roots.	√		√		Forest/ PRI's	Animal Husbandry, Rural Development, Public Health department and HP,PCB.
12. Water, soil and air pollution due to lack of dead animal	No scientific animal management practices.	Release of Green house gasses.	Development of community level dead animal carcasses management system.	√		√		PRI's	Animal Husbandry,

Issues	Causes	Impact/Risks	Proposed Actions	Policy	Plan	Programme	Project	Coordination Agency	Collaborating Agency
management.		- Increased offensive odour problem in nearby area. - Pollution of water bodies spread of diseases to animals and human beings.	Identification of proper sites/ places for the disposal of carcasses .						Rural Development, Public health, HPPCB.
13. Increase in environment and public health (Effect on human/ animal health.) risk due to unscientific management of slaughter houses.	- Inadequate awareness among people working at slaughter houses - Improper slaughter waste disposal practices - Lack of treatment facilities for slaughter house effluents.	- Effect on human health, animals/birds - Increased water and land pollution - Increased foul odour. - Adverse Effect on quality of meat and meat by-products.	- Establishment of modern slaughter houses at appropriate locations. - Strict monitoring of slaughter houses' waste generation and its proper disposal.	√		√		Local Bodies	Animal Husbandry, Public health, PRI's, IPH and HP SPCB.
14. Menace of stray cattle/dogs	- Lack of compassion to domestic animals - Inadequate identification of owner of the livestock	- Spread of live-stock animal disease - Traffic hazards - Pollution of Environment (Water bodies etc).	- Policy encouraging compassion towards animals in the society - Improved animal husbandry infrastructure i.e. provision for operation theatre facilities, medicines and kennels at sub-division level and imparting training to more Vets/Para Vets in sterilisation techniques. - Compulsory registration of live-	√		√		PRI's	Local bodies, Animal Husbandry, NGO's

Issues	Causes	Impact/Risks	Proposed Actions	Policy	Plan	Programme	Project	Coordination Agency	Collaborating Agency
15. Menace of wild animals like monkeys, bears, Nilgai, pigs etc.	Encroachment by human beings on the habitat of wild animals.	- Destroying crops horticulture /agriculture etc. - Endangering human beings. - Spread of zoonotic diseases.	stock with the panchayats. - Provision of penalty for letting their animal stray. - Implementation of animal birth control programme. - Strengthening of existing Go sadans and opening of new ones. - Scientific culling of monkeys					Forest (wild-life wings)	PRI's, Animal Husbandry, NGO's
			- Provision of encouraging plantation of wild fruits trees etc in the forest area, promotion of water bodies etc. - Policies that aim at minimum encroachment of human activities in the forest area. - Policies encouraging exports of monkeys etc.	√		√			

Monitoring and Reporting

Monitoring and reporting requirements with respect to response have been described below and performance indicators have been identified in Table 13. These monitoring requirements should be strictly followed for critically polluted and vulnerable areas.

- Water quality monitoring & reporting: Collect the data both for surface and groundwater (district wise) and analyse the trends & level of contamination. This should be carried at the source and at household levels. This data should be processed, analysed and published quarterly. The ground water quality parameters should be tested as per IS 10,500 and surface water quality parameter as per CPCB, Designated best use criteria.
- Monitoring & reporting of animal/poultry disease occurrence: Monthly monitoring of occurrence of animal/poultry disease should be carried out. Data of admission and mortality should be recorded every month. The monitoring report has to be documented and reported quarterly by the co-ordinating department.
- Monitoring & reporting of cases of animal malnutrition: Annual monitoring of occurrence of cases of animal malnutrition should be carried out. The monitoring report has to be documented and reported quarterly by the co-ordinating department.
- Monthly monitoring has to be carried out for the following
 - Animal Health infrastructure (Veterinary hospitals per thousands of livestock)
 - Checking of supply of water source
 - Availability of pasture land per livestock
 - Numbers and types of animals
 - Soil status e.g. fertility, nutrition status etc.
 - Changes in wildlife population and habitat due to livestock production

- External land use changes and demographic changes which have impacts on the range resource and livestock producers
- Sanitation infrastructure e.g. pit latrines, trash bins, compost pits
- Biomedical waste collection, treatment & disposal all the above have to be documented and reported to the relevant departments on quarterly basis. Also, the remedial measures taken to mitigate the situation have to be documented.

- Awareness programmes to be conducted

Annual tracking of awareness programmes / campaigns needs to be carried out. The areas include animal & poultry health aspects, preventive & curative aspects related to diseases occurring on account of sanitation, health, water supply & hygiene, fodder and exposure to public health risk. Conduct annual surveys to find the effectiveness of the different campaigns and reformulate the communication strategy of the awareness programmes.

Creation of common platform for inter-departmental co-ordination. Conduct monthly meetings. Coordinating agency should prepare minutes of these meetings and distribute to all the relevant agencies. Publish the abstracts of the meeting via different media.

Daily update of GoHP website and other State department's websites should be carried out. Publish an annual State Environment Report which will contain a chapter on health sector and environment in the State. This chapter will summarise the analysis of monitored data and performance of the sector based on following performance indicators.

Performance Indicators

For macro-level management of animal/poultry health issues identified and gauge the performance of the above proposed

actions, following indicators are suggested to measure the out come of these guidelines. These indicators as outlined in Table 13 will have to be monitored and

reported by co-ordinating agency/ department.

Table 13: Performance Indicators

Outcomes	Indicator
1. Implementation of Livestock improvement programmes/projects.	• Reduce/increased percentage of occurrence of disease/mortality • Regular monitoring of water supply and demand of water • Monthly monitoring of percentage of livestock has been treated. • Number of Veterinary hospitals per thousands of livestock • Availability of pasture/grazing land per livestock • Numbers and types of animals • Soil quality, Soil fertility and nutrition status. • Availability of fodder (Green and Dry) per livestock (in Metric tonnes) • Percentage share of income from livestock • Quantity of Biomedical waste generated per day from slaughter houses • Number of programmes/projects identified and implemented to address each issue
2. Inter-sectoral co-ordination and integrated planning	• Creation of Inter-sectoral forums/platforms • Regular meetings of such forums • New and effective enforcement mechanisms in force • No. of awareness campaigns conducted on each issue via different media
3. Awareness about the issues	• No. of trainings imparted to officers of various State departments • Creation of Data Bank at co-ordinating agency and regular publications on State Government website on the state of water, air, waste & health scenario and its implications.

Chapter 6: Inter-Relation between Monitoring & Evaluation with Vulnerability Assessment

All the monitoring measures will provide input for redefining the 'Vulnerability' of the State for different regions in Himachal Pradesh. This will ultimately influence the Environmental Master Plan and may call for

readjustment and fine tuning the scope of sector specific plans. It is a dynamic process and will need to be continually updated with changing pressures, need and attitude of the society. This can be shown by Figure 1.

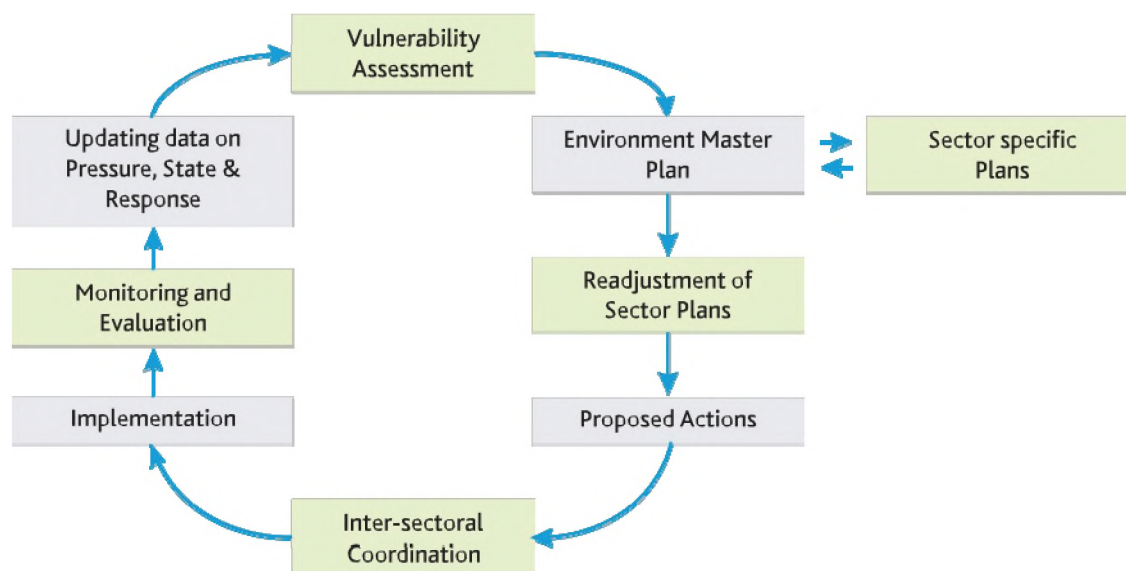


Figure 1: Inter-relation between monitoring measures with Vulnerability Assessment

In the above sections, good practices and issue specific mitigating measures/action plans have been proposed for betterment and strengthening the services and management of the sub sectors given in Natural Resources Sector. This calls for inter-sectoral co-ordination for effective implementation of these proposed actions.

The monitoring and evaluation of the proposed actions delineated in chapter 5 will provide an input to define the state of Forests and Wildlife, pressures and response in the region which will redefine the vulnerability of the region and hence the EMP and the Forest and Wildlife sector plans.

Chapter 7: Recommendations

7.1 Forests & Wildlife

There is a need to suggest necessary changes to amend forest policy for Himachal Pradesh in view of their high vulnerability to climate change; conservation of forests for providing clean water and fresh air, their critical role as watershed for the northern Indian plains; and unique ecosystems and forested landscapes rich in biodiversity.

Map climate change driven adaptations in natural resource use and livelihood patterns across eco-zones. Development of a database on Carbon sequestration potential of forest flora in the State is also required. Further, periodic assessment of carbon stock including soil carbon under different ecosystems is required.

Establish long-term monitoring plots across representative eco-zones, to gather scientific data on climatic and biological parameters across the State.

Re-orient developmental interventions adopting watershed as the unit for planning and fund flows. There is a need to revisit forestry operations to realise full water conservation potential of forests leading to development of 'water sanctuaries'.

Effective deployment of new and advanced technologies, such as GIS, remote sensing, climate modelling in natural resource management should be carried out at top priority.

Integrating and extending the concept and practice of Payment for Eco- system Services (PES) within the States to compensate for foregone land-use and occupation options adversely impacting the environment. Impress upon Government of India to move beyond Green Bonus to adequately compensate these States for

ecosystem services flows. The Central Finance Commission should take cognizance of the concept of interdependence and interconnectivity of the forest-producer States and the user States in developing a sustainable environmental relationship and mutual economic benefits. Incentivise local protection and restoration through PES: Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD)/CDM/CAMPA.

Gender mainstreaming is required to help cope with the loss of control over natural resources, technologies and to deal with seasonal and episodic weather and natural disasters.

Forest Cover: In the current scenario, there seems to be limited options except to consider the unculturable areas forming vital eco-systems and wildlife habitats as part of forest/tree. Therefore, in order to increase forest cover, the area under Moderately Dense (7883 sq. kms.) forest requires protection and enrichment operations (ANR) for improvement of crop density; The area need to be afforested; the scrub area (389 sq. km.) needs to be converted into some useful tree cover; the post 1980 plantations (6807 sq.km.) which may be still surviving require, re-visit/re-forestation (say about 40% = 2700 sq. km.). For all practical purposes, the area above 4000 meters altitude, which is also referred to as 'tree line', is not suitable for increasing forest cover through afforestation activities. However afforestation activities may not be limited up to 4000 m altitude only, as shift of geological niche due to climate change may result in even higher altitude beyond 4000m becoming favourable for afforestation in the near future.

The village grazing lands and even the permanent pastures require improvements

interms of soil and moisture conservation and increase in the nutritious and palatable grass. Low altitude pastures are available for Silvi pastoral activities also. These grazing lands and pastures require frequent revisiting at short intervals keeping in view the high grazing pressure.

Forest management: A holistic approach is required to reduce the dependence of communities on forests, by providing them with direct and indirect opportunities; directly, by encouraging the use of locally available and renewable energy sources (e.g. solar, wind and hydel energy sources to reduce dependence of people on forest based use of fuel-wood and timber). Currently biomass is extensively used because of its ready availability and lower costs. Communities, however, may be encouraged to help produce more biomass per unit area so that their production exceeds requirement. Indirectly, by increasing their economic status through skill-oriented vocational training, so as to give them an opportunity to join either the mainstream economy or forest-related activities, such as afforestation, nurseries, fodder cultivation, etc.

Monoculture in Plantation/Afforestation: Monoculture should give way to multiple species culture so as to encourage biodiversity at different levels of forest regeneration. For instance, monoculture of eucalyptus is less economical and destructive to regenerations of willow, poplar, oak, fir, bamboo, wild fruit species and others are both economically viable and allow ground vegetation. Therefore, following the nature and natural species in plantation, mixed plantations of adaptable species, which are economically useful need to be encouraged.

Migrant grazer Communities: Traditionally, the Gujjar communities migrate along with their cattle to the high alpine pastures during summer and return to the lower hills during winter. Their perennial movement leads to degradation and destruction of

pasture lands and forests, which have a great impact on soil erosion. Efforts were made by the Government to rehabilitate them in permanent settlements, by providing them with free houses, opening schools and dispensaries for them and stall-feeding arrangement for their cattle. There is need for an attitudinal change, in altitude through training, exposure and vocational skill upgradation. Residential, health and educational services for their women and children, along with a collection of mechanism for their produce, such as milk, milk products, meat and handicrafts, should be developed, so that they are motivated to settle down permanently.

Medicinal and Aromatic Plants in Himachal Pradesh are of special value, since these are localised and very few of them are available elsewhere. Medicinal and aromatic plants in common use need to be listed and their multiplication techniques perfected, so that their exploitation does not lead to their extinction. Naturally-growing morels and slow-growing plant species should be protected with care so that they can regenerate naturally. The role of the Forest Department should be more in preserving and conserving the rich biodiversity of such a resource, and private and community lands should be allowed to grow this on scientific lines for multiplication and mass propagation for commercial exploitation. In view of the occurrence of large number of NTFP species which includes species of medicinal and aromatic values, it is necessary to implement State NTFP Policy for their conservation, sustainable management and useful practices. With Joint Forest Management in place and in view of high returns these elements of biodiversity (NTFPs) promise to provide to locals, it is possible to formulate a participatory Policy for sustainable use of available resources. This will go a long way in reconciling the aspect of bio-diversity conservation vis-a-vis the sustainable livelihood of NTFP gatherers. Primary processing units at the local level are essential, not only from the point of

view of employment, but also for preserving their inherent values. However, a strong modern research - based organisational support is necessary to extend the forests, preserve the dwindling plant and animal species and develop quick regeneration and multiplication technologies for medicinal and aromatic plants etc., with support from extension agencies, laced with modern information and communication technologies for making all concerned aware of the wealth that the forests represent.

Role of Panchayats: The Panchayats need to be strengthened so that they can monitor forest development, check illegal encroachment and destruction, and remove bottlenecks and defects of a centralised administrative system. Training and capacity building of PRIs should be taken up at priority.

Role of Research and Development in Participatory Forest Management: The research component is essential in developing suitable technologies in forest development and forest produce utilisation. Forest development activities are dependent upon management planning and efficient administration with the support of well trained executives and field workers, participatory involvement of juniors and field staff along with local communities is a must for increasing and managing the forest cover on a sustainable basis.

Crop Damage/Human wildlife conflicts: There is a need for a wide ranging campaign to promote 'Tree Farming' across the region in order to cover the hill slopes with such species of trees and shrubs which are of value to the hill people in the form of food, fodder, fuel, fibre and leaf, manure, etc. Under this initiative, planting of species of trees with edibility value for wildlife in forest gaps and margins is likely to minimise the incidence of crop and property damage by wild animals. This would also help in the reduction of man-animal confrontation. Reorienting afforestation programmes

should focus on species that help mitigate man-animal confrontation.

Integrate community based water and forest management committees at village level: Forest Department should formalise partnerships for local watershed and provisioning services, as per Shimla declaration on Sustainable Himalayan Development, October 30, 2009.

Plantation on forest and community lands to supplement green cover and to increase the overall forest cover of the State in the context of a project framework should receive adequate attention. Propagate 3tier forestry and promote use of locally useful and indigenous species particularly planting on community lands. In order to increase their ownership, communities should be consulted for the choice/selection of species.

All the sectoral recommendations related to project and programme implementation for afforestation/reforestation of degraded land, management of human and livestock pressure, forest fires, poaching, forest produce, PA management and other issues in the State need to be tackled as per the existing Forest Department's guidelines. All the proposed actions related to response in terms of projects, programme and plans identified & highlighted in Table 2 should be attempted.

Inter-departmental co-ordination among different departments like Department of Tourism & Civil Aviation, ULBs, PWD, IPH, Transportation, HIMURJA, DEST, HPPCB, PRIs, Public Relations, NGOs, CSOs, CBOs is needed for effective planning, implementation & monitoring intervention programmes.

Establish a system of data collection and analysis of statistics related to forest & wildlife sector. Monitored data should be compiled and updated regularly. It should be linked to district level information system in the State so that area specific

plans, programmes and projects can be monitored and information can be accessed.

For efficient and smooth functioning of forest & wildlife sector adequate monitoring and supervision is necessary. All the monitoring and reporting programmes identified in proposed actions should be implemented in a time bound manner. Monitoring of measures suggested in CAT plans needs to be carried out as per the plan. Monitoring result should be shared and evaluated by an independent agency/committee.

Use of Criteria and Indicators (C&I) for Sustainable Forest Management. All the above issues can be scientifically monitored by using C&I format adopted and approved by Government of India. The format is enclosed as Annexure 1. This format has been pilot-tested in the State after due discussion with the PCCF and other officials of H.P. Forest Department.

5.2 Wetlands

A comprehensive and integrated National and State wetlands policy needs to be developed in sync with National/State water and National/State Environment Policy guidelines. Formulating and implementing a regulatory regime should be done to ensure wise use of wetlands at the national, the State and district levels. Further, “Wetlands Authority” at the State level should be constituted. Under the HP Forest Department keeping in view that the wetlands at the Central level are under the Ministry of Environment and Forests. This will help facilitate biodiversity conservation of wetland by the HP Forest Department.

Data deficiency has been observed with most of the Wetlands in the State. This can be addressed by mapping of catchments and surveying and assessing land use patterns with emphasis on drainage, vegetation cover, silting, encroachment, human settlements and human activities and its

impact on catchments and water bodies. GIS database including satellite imageries should be developed for the wetlands. The delineation of wetland's boundary should include catchment area and notified as part of protected area (National Park/Wildlife Sanctuary). Such delineation of boundary of wetland increases the effectiveness of protected area management. Preparation of Biodiversity registers will also help in generating data on community knowledge of wetlands natural resources and management.

An integrated pest management approach is recommended involving bio- regulation for prevention of pollution and maintenance of proper biological balance.

A number of specific recommendations have been proposed as part of wetland management plan for Khajjiar, Pong, Chandratol and Renuka by Department of Wildlife, Government of Himachal Pradesh. Such wetland management plan for other sacred lakes/sites like Mani Mahesh, etc. may also prepared. These recommendations are in line with the proposed actions identified in Table 2.

Tourism Regulation & Management Plan for Khajjiar: The objective of this plan is to engage stakeholders in tourism management and in regulating commercial activity around the wetland. As disturbance due to commercial activities is increasing on the meadow around the lake, such activities should be restricted to an area away from the meadow. As number of stakeholders depend for their livelihood on these activities, these have to be regulated and not eliminated. Moreover, such commercial activities help with tourism management.

Proposed recommendations to improve tourism management for Khajjiar lake include: Co-ordination with the tourism department, joint implementation of plan for regulating commercial activity and their active engagement in awareness programmes; demarcation of ‘tourism zone’

and limiting tourism related commercial activity to this zone; diversion of tourist pressure off the lake, through orientation programme making choices available in form of trekking etc.; identification and development of short treks in the nearby forest and nature trails to improve visitor experience; reduce time spent by visitor on meadows by generating other options; capacity building of stakeholders- training as guides duly certified by the forest department and maintaining a roster of such guides to facilitate trekking; limiting traffic passing through the area; entry of visitors under check and their entry in the sanctuary has to be regulated in such a way that there is no undue stress and disturbance to the wildlife; provision of other facilities like sitting area, toilets, garbage bins, etc; provision of signages for directions, do's and don'ts, placing of information boards about history, culture and ecology of the area; removal of unnecessary structures that were perhaps put to beautify the area. Unnatural structures are an eye sore and constitute to 'sight pollution'. These should be avoided in the meadows.

Stakeholder engagement and eco-development strategy for Khajjar wetland should be implemented. Most of the stakeholders have other sources of income and are not entirely dependent on tourism related activities. There are several hawkers who are entirely dependent on tourism as well. Some of the measures, which have been recommended include: Study of dependency levels of stakeholders should be initiated; allocation of area to regulate commercial activity away from the meadow. This would restrict hawkers in an area thereby reducing disturbance and also providing stalls catering to tourists' needs. The area should have space to house local artifacts, providing space to local women's self help groups; a programme for capacity building of stakeholders by providing them communication training to improve their behavior towards tourist should be developed and implemented.

Establish health camps for horses to ensure that these animals are disease free; educate horse owners on proper disposal of horse dung, food material etc to reduce impact on wetland ecology, conduct vaccination camps for horses and cattle.

Invasive and alien species management strategy for Khajjar includes adoption of the eco-system-wide approach rather than a tactical approach focused on battling individual invaders.

Specific conservation measures have been proposed for Wetlands designated as Ramsar sites in Himachal Pradesh. For Pong dam lake, three types of measures are proposed: To manage the habitat; to co-exist with the local community and Eco-tourism.

Some of the suggested measures for habitat management are: Creation of permanent shallow-water area where reed-beds and other perennial aquatic vegetation will develop and attract additional bird species; the establishment of trees on the main island to provide nesting sites for colonial nesting birds such as storks, herons and egret; planting of variety of trees on the lake periphery to attract more and more birds; one area, the mouth of the Baner Khad (on river Banganga) just below Haripur Guler, is recommended for development. This can be done by erecting an earthen dam with water regulatory mechanisms so that shallow areas are developed. If this is successful, then one or two areas can be developed and managed for wildlife.

To co-exist with the local community: Efforts to conserve forests and wildlife have gradually begun to shift away from law enforcement and use restrictions during the last two decades and towards more participatory approaches emphasizing equitable and sustainable use of natural resources by local people. This change in approach is particularly important in rural areas of the Pong Dam Bird Sanctuary,

where biodiversity is concentrated and where poverty tends to be pervasive.

Prepare strategies and action programmes for Community Awareness and Mobilisation (CAM) and Conservation Education (CE) in the villages situated in the catchment area of Pong Dam. The National Literacy Mission is active in the Pong Dam bird sanctuary area which can become conservation-oriented through proper planning. The catalytic force to do such a job is involvement of local wisdom in nature conservation through formal and informal nature education programmes. The bird sanctuary management needs to evolve strategies to publicise the wetland values among the local people. Proper publicity of the biological, ethnic and social aspects of the sanctuary can attract a number of educational institutions and donor agencies to contribute to the cause of conservation of such values. A well co-ordinated effort between the bird sanctuary management and these agencies would help in spreading the message to people about conservation friendly eco-development project.

Plan and integrate Pong Dam bird sanctuary concerns in the regional planning and district development plans. The involvement of local people from the stage of conceptualising and designing a plan and then its implementation is to be emphasised. Establishing contact and rapport with various agencies (both Government and Non-Government), setting up co-ordination mechanisms at village and park management levels, collecting information on government schemes, preparing comprehensive plans for various programmes under eco-development are some of the issues that need to be addressed. The Pong Dam reservoir is a man-made structure, and all the biological resources thus created are incidental. From a legal point of view any type of activity, which damages a natural eco-system is prohibited under the Indian Wildlife Protection Act 1972. However, the consumptive benefits from fisheries are of

significant nature to the local people. In this context, there may be a situation in which the existing policies regarding the conservation of man-made and natural eco-systems need to be reviewed. In order to incorporate the above concerns, the existing management plan needs to be appraised. The plan should emphasise the ways of integrating PA planning into the regional planning and of making the buffer zone management compatible with the management of wetland.

Encourage community based eco-tourism at Pong Dam lake. Fish valued Rs. 400 lakhs is being produced from this water body and sale proceeds to the tune of Rs. 3.40 Crores (after deducting the Government charges/royalty) is assisting over 2000 families in their livelihood. The location of the Pong Dam Lake is highly suited for eco-tourism. It is close to the towns of Pathankot in Punjab and religious places of Kangra, Chamunda in Himachal Pradesh. The natural grandeur of the lake with its magnificent backdrop invites an eco-tourist. "Community – based eco-tourism" (CBET) ensures that the benefits, both social and economic, are realised by local communities. If local people receive direct economic benefits from a protected area, they are less likely to resent its presence and more inclined to support management activities..

The Pong Dam lake and the surrounding areas have excellent potential to be developed as a CBET destination. Community interest in tourism is very high but they lack the skills, knowledge and support to develop it. From a product perspective, the jagged peaks provide breathtaking mountain scenery, the waterfowl viewing opportunities are good, recreational opportunities are diverse and local cultures are alive and quite interesting. It is quiet, uncrowded and unpolluted. From a conservation perspective, CBET can engage a wide cross section of people, and given the other factors mentioned above, it is the most promising strategy to reduce

fishing and poaching of waterfowl inside the Pong Dam Lake.

Specific recommendations for Renuka Wetland include development of the management plan to address the threats to the Renuka Wildlife sanctuary (WLS) and also to engage stakeholders in the process so as to ensure better utilisation of resources as well as inculcate a sense of shared responsibility towards conservation of Renuka WLS, particularly those agencies that are operating in the area to earn revenue. The management objectives should be habitat improvement, tourism management, education & interpretation, zoo management, pilgrim management, eco-development, protection of wildlife sanctuary and awareness programmes.

Measures for Habitat improvement include; (a). Plantation in degraded areas with native broad leaved species of fodder value, to phase out old plantations of non-native species; (b). Gradual eradication of weeds like *Lantana camara* and *Adhatoda vasica* and other introduced and exotic species; (c). Carrying out soil stabilisation works in the erosion prone areas to reduce the silt of Renukaji lake and to prevent and improve the general habitat of the sanctuary. Soil erosion control would require a study to map unstable slopes and high soil erosion areas, slope stabilisation using geo-textile material, plantation of grasses, plantation of trees and shrubs and (d). Improving lake eco-system.

Measures for tourism management include; (a). regulation of movement of tourist around the temples and lake; (b). Providing basic amenities to tourists by developing facilities like, benches, rain shelters around Parikrama road, toilets at appropriate distances for the benefit of the tourists. Care should be taken that these shelters are designed in such a manner that it blends with the local surroundings and architecture.

Engendering awareness among local people about the need to conserve nature by laying out; (a). nature and educational trails; (b). information and interpretation centres and (c). placing signages- directional signage, interpretation signage, educational signages, 'dos & don'ts'.

Zoo management measures include; (a). construction of new enclosures for Leopard and improvement and maintenance of existing enclosures; (b). to make the strategy to overcome the inbreeding problem of lions in the lion safari and (c). releasing of the excess animals from the zoo to the other areas after getting approval of the competent authority.

During the annual fair, organised in the fair ground, tens of thousands of people visit the area. Special arrangements are made for movement and stay of people. However, this also causes disturbance to the area. Certain core areas should be restricted off during such events. Special arrangement for disposal of garbage, sanitation facilities, etc should be made. On-site treatment of wastewater should be incorporated in fair-management to ensure that high number of visitation cause minimal pollution. Post-fair cleaning of ghats also needs to be taken up.

Eco-development measures include involvement of people in conserving and improving ecology of the area by carrying out eco-development works in the surrounding villages. As the population of domestic animals is high in the surrounding villages, biotic pressure in extraction of fodder is high. Villagers should be encouraged to stall feed animals in the buffer zone but this may not be a long term solution as eventually the fodder will be extracted from the sanctuary. Local handicraft should be promoted, which could be sold at shops near the temples. Training in arts and crafts should be appropriately provided.

Protection of wild life sanctuary include reducing the incidence of illicit logging and

grazing by effectively fencing the area and patrolling by the staff. After proposed Renuka dam is constructed (inundating 40 ha of forest land), water spread area of the dam reservoir should be declared a sanctuary.

An out reach programme targeting tourists and various stakeholders needs to be designed. This can be divided into three components- direct contact programmes, print media and interactive media.

Specific recommendations for Chandratat Wetland include: Identification of suitable camping sites for tourists; construction of walking trail; installation of prefabricated shelter for Environment Interpretation Centre; extensive biodiversity research is required to be taken in this area and Regular water quality monitoring of the wetland.

Other recommended management measures for Khajjiar wetland include:

Feeding of fish should be stopped immediately. The feeding action of fish too dislodges sediments from the inner vegetation zone and increases turbidity and silt in the open water area. As this is a small wetland any additional organic load would have immediate effect; a study on seasonal species variation and related biomass generation in the lake as well as determination of actual organic load to the lake, should be carried out to determine timing of harvesting biomass and quantities to be removed;

Restore hydrology of the lake. Outlet level should be surveyed to restore it to its original level. In the past there have been several interventions in the lake. During 1980s or later, the outlet to the lake was lowered. This has resulted in quick runoff and reduction in retention time. As the runoff comes from the catchment, and reached the outer marsh, it circumvents the lake and is drained away through the outlet. If the waters were retained longer some of the organic matter, nutrients and solutes

would have drained away with the runoff. But, as the outlet is much lower, this phenomenon has ceased to happen resulting in further enrichment of open water area, its siltation and reduction. This quick draining away of water may have resulted in non percolation to the lake, therefore effectively lowering the water level inside the lake. As the water level would have lowered slowly over the years, simultaneously biomass and organic load increased resulting in less buoyant force to keep the Phragmites island floating. The island would have thus got trapped due to lower water levels.

An institutional mechanism should be established for wetland/lake management at State level. In this context guidance can be taken from the Wetlands (Conservation and Management) Rules, 2010 has suggested Constitution and Composition of Central/State/District Regulatory Authorities below:

- At the Central Government level, an Expert Appraisal Committee (EAC) constituted under the provisions of sub-section (3) of section (3) of the Environment (Protection) Act, 1986 vide Notification No.1067 dated 14.09.2006 will function as Regulatory Authority.
- The regulatory functions at State/UT level will be discharged by the State Environment Impact Assessment Authority (SEIAA) constituted under the provisions of sub-section (3) of section (3) of the Environment (Protection) Act, 1986 vide Notification No.1067 dated 14.09.2006 will function as Regulatory Authority.
- At the District level, the regulatory functions will be discharged by the District Wetland Conservation Committee (DWCC). At present, such DWCC doesn't exist.

Capacity building of lake/wetland managers from the line departments: The State may undertake measures for capacity building in the area of lake conservation by deputing the concerned officers to MoEF sponsored

programmes on capacity building (e.g. 2 years M. Tech and short term programmes being offered by AHEC, IIT Roorkee) or any other State level programmes.

As per the NLCP of MoEF, the State Government proposing to participate in the National Lake Conservation Programme (NLCP) must ensure availability of a 3-tier Institutional Mechanism as given below, for proper & timely implementation of the approved projects and its post implementation maintenance/sustenance: i. The State Government must identify a nodal department in the State for all interactions with MoEF, receipt & disbursement of funds, physical & financial monitoring of Project implementation. Lake Development Authority (LDA) or Lake Conservation Authority (LCA) if already existing at State level, shall be the nodal dept./ agency; ii. A Project Implementation Unit (PIU) with requisite expert manpower may undertake/oversee the Project Implementation ensuring no time & cost overruns; iii. The agency owning the lake (Municipal Council/Corporation/local body) may undertake the O&M of the lake and be equipped with dedicated human resources. In case of multiple agency structure, the concerned District Collector/Commissioner is authorised to take the O&M responsibility. A similar type of institutional mechanism could be implemented in Himachal Pradesh.

Develop intensive agriculture/horticulture and livestock improvement programmes aiming at increased production rather than increasing the current area under production which also triggers land use changes.

Annual and seasonal monitoring of the avifauna and arrival of migratory birds to understand and correlate with instances of poaching and hunting. This is required for assessment of seasonality aspect during which such instances are recorded so that preemptive, punitive and incentive measures can be taken. Further, enforcement mechanism

(human resources, structure and material) could be beefed up during such identified periods. Besides, role and scope of honorary wardens needs to be revisited in order to increase their efficacy and increasing and improving community participation in regulatory activities.

NLCP recommends that a Steering Committee under the DM/Collector of each district may be constituted with representation from Lake Development Authority (LDA)/Lake Conservation Authority (LCA) State Government and all executing agencies of the projects sanctioned in each district. Representation of stakeholders and a prominent NGO of the area may be ensured. Alternatively, a lake specific monitoring committee may be constituted at local level.

In the absence of specific water quality criteria developed in respect of lakes, Designated Best Use criteria for surface waters as given by Central Pollution Control Board (CPCB) shall be adopted for lake water quality for the time being.

Develop wetland related infrastructure as per area specific master plan. These master plans should be based on zonation land use and expected population pressure. Provide basic tourist infrastructure and reliable services at tourist destinations as per master plan. De-congestion of roads by restricting vehicular traffic near the pilgrim centres should be carried out. Provide upgraded and new amenities and services to meet their needs. Water supply, sewage, MSW, traffic and transportation should be essential component of these master plans.

All the sectoral recommendations related to project and programme implementation to address wetland development/management, sanitation, waste management and transportation, air pollution, disturbance to ecology, tourist infrastructure should be implemented both in rural and urban areas. All the proposed actions related to response in terms of projects, programme and plans

identified & highlighted in Table 2 should be implemented.

The State should ensure strict implementation of wetland management plan by surveillance and monitoring through community participation, Department of Forests, Himachal Pradesh, State Pollution Control Board, I&PH, ULBS, CSOs, CBOs and NGOs. ULBs can provide co-operation to develop water bodies as tourist spot with adequate ecological protection as part of Tourism Master Plan.

Inter-departmental co-ordination among different departments like Department of Forests, Department of Tourism & Civil Aviation, Tourism Development Corporations, ULBs, PWD, IPH, Department of Transport, Himurja, DEST, HPPCB, PRIs, Public Relations, Tourism Unit Operators, NGOs, CSOs, CBOs is needed for effective planning, implementation & monitoring of health intervention programmes.

Establish a system of data collection and analysis of statistics related to wetland in the State. Wetland monitoring data should be compiled and updated regularly. It should be linked to district level information system in the State so that area specific plans, programmes and projects can be monitored and information on wetland can be accessed.

For efficient and smooth functioning of wetland sector, adequate monitoring and supervision is necessary. The performance of various indicators would improve to a large extent if there is regular monitoring and supervision. All the monitoring and reporting programmes identified in proposed actions should be implemented in a time bound manner.

A database on present status, sustainable use, management & conservation including a detailed scientific database on aquatic biota of fresh water resources should be maintained so as to formulate the strategies

for long-term management of wetlands. Most of the small and medium scale lakes will be dried deliberately or due to lack of conservation attempts. In such cases the scientific database and monitoring of wetlands will help in attempting timely conservation actions.

Regular monitoring system may be through the involvement of schools, colleges & Universities, there by inculcating environmental consciousness and promote research acumen among students in protecting wetlands.

Mass awareness programmes to be planned: Utilizing the IEC technology to reach masses will go a long way in protecting the functioning of fragile wetland eco-system. Further, outreach programme should be components of aquatic eco-system restorations programmes. Lake Association and citizen monitoring groups have proved helpful in educating the general public and effort should be made to ensure that such groups have accurate information about the causes of lake degradation & various restoration methods. The role of NGOs in protecting & preserving lakes and disseminating the importance of wetlands should be recognized and promoted.

5.3 Fisheries

The Fisheries Department of the state should have complete control of the fishery rights of inland watercourses and water bodies.

The punishment for breaking rules should be severe enough to deter offenders, as has been attempted in the Fisheries Act, 1972 and the The Environment (Protection) Act, 1986.

Detailed Environmental Impact Assessment (EIA) should be carried out before implementing any project which might have negative impacts on fish and their habitats and management plans for ecologically sustainable development should be adopted.

Construction of dams, barrages, canals, etc. for development should keep in view the potential for requirements of fishery development and maintain adequate flow in the rivers for the breeding and conservation of fish, especially indigenous species.

Dam and reservoir fisheries should be closed for about two months, during the rainy season, to safe-guard pre-spawning and spent fish.

Fish sanctuaries should be established in consultation with experts from the State Fisheries Department and local people, particularly those inhabiting the river basin and depending upon the fishery resources. Deep pools in rivers should be designated as sanctuaries.

Rules should be formulated to control the introduction of exotic species and diseased fish. The enforcement of rules and the protection of river fisheries require the creation of a river police force under the Fisheries Department; provided with necessary equipment, including motor boats.

Factory effluents should be treated by appropriate physical, chemical or biological methods before discharge into rivers or reservoirs. Discharges from sewage treatment plants should comply with the provisions of the Water (Prevention and Control of Pollution) Act, 1974.

There should be frequent monitoring of water bodies to assess whether water quality is suitable for healthy fish development and other aquatic biota.

Deforestation close to rivers and their tributaries, on reservoir catchments and in other environmentally sensitive areas, should be prevented so as to check soil erosion. For this purpose, the Forest (Conservation) Act, 1980 should be strictly applied. Large-scale afforestation of

catchment areas should be carried out to rejuvenate springs and streams.

Whenever possible, pesticides and agricultural wastes should be properly treated before their discharge into water bodies. An integrated pest management approach is recommended involving bio-regulation for prevention of pollution and maintenance of proper biological balance.

Hatcheries for the propagation of endangered and commercial species should be established at important river sites.

Sustained awareness programmes should be established in the vicinity of the rivers and other water bodies to encourage the conservation and management of fish genetic resources.

Mapping of catchments and surveying and assessing land use patterns with emphasis on drainage, vegetation cover, silting, encroachment, human settlements and human activities and its impact on catchments and water bodies should be carried out.

Specific conservation measures have been proposed for wetlands designated as Ramsar sites in Himachal Pradesh. For Pong dam lake, three types of measures are proposed namely to manage the habitat; to co-exist with the local community and Eco-tourism.

To co-exist with the local community: Efforts to conserve forests and wildlife have gradually begun to shift away from law enforcement and use restrictions during the last two decades towards more participatory approaches emphasizing equitable and sustainable use of natural resources by local people. This change in approach is particularly important in rural areas of the Pong Dam Bird Sanctuary, where biodiversity is concentrated, and where poverty tends to be pervasive.

Prepare strategies and action programmes for Community Awareness and Mobilisation (CAM) and Conservation Education (CE) in the villages situated in the catchment area of wetland/reservoir/water body. The National Literacy Mission is active in the Pong Dam sanctuary area which can become conservation-oriented through proper planning. The catalytic force to do such a job is involvement of local wisdom in nature conservation through formal and informal nature education programmes. Proper publicity of the biological, ethnic and social aspects of the sanctuary can attract a number of educational institutions and donor agencies to contribute to the cause of conservation of such values.

Develop wetland/reservoirs/water body related infrastructure as per area specific master plan/management plan/basin plan. These master plans should be based on zonation land use and expected population pressure. Water supply, sewage, MSW and traffic and transportation should be essential component of these master plans.

All the sectoral recommendations related to project and programme implementation to address fisheries development/management, sanitation, waste management, disturbance to ecology should be implemented in the State. All the proposed actions related to response in terms of projects, programme and plans identified & highlighted in Table 2 should be implemented.

Inter-departmental co-ordination between different departments like department of fisheries, forests & wildlife, department of tourism, tourism development council, ULBs, PWD, IPH, BBMP, SJYNCL, transportation, Himurja, DEST, HPPCB, PRIs, public relations, tourism unit operators, NGOs, CSOs is needed for effective planning, implementation & monitoring health intervention programmes.

Establish a system of data collection and analysis of statistics related to fisheries in the State. Fisheries monitoring data should be compiled and updated regularly. It should be linked to district level information system in the State so that area specific plans, programmes and projects can be monitored and information on wetland can be accessed.

For efficient and smooth functioning of fisheries sector, adequate monitoring and supervision is necessary. The performance of various indicators would improve to a large extent if there is regular monitoring and supervision. All the monitoring and reporting programmes identified in proposed actions should be implemented in a time bound manner.

A database on present status, sustainable use, management & conservation including a detailed scientific database on fisheries of fresh water resources should be maintained so as to formulate the strategies for long-term management of the sector. Most of the small and medium scale lakes may get dried deliberately or due to lack of conservation attempts. In such cases the scientific database and monitoring of water bodies will help in attempting timely conservation actions.

Mass awareness programmes to be planned. Utilising the IEC technology to reach masses will go a long way in protecting the functioning of fragile fisheries eco-system. Further, outreach programme should be components of aquatic eco-system restorations programmes, e.g. Lake Association and citizen monitoring groups have proved helpful in educating the general public and effort should be made to ensure that such groups have accurate information about the causes of lake degradation & various restoration methods. The role of NGOs in protecting & preserving lakes/water bodies and disseminating the importance of fisheries should be recognised and promoted.

7.4 Horticulture

A strong network should be made between farmers and researchers of the horticultural advanced countries to prevent post-harvest loss of horticulture produce. This interaction should take place at the national level and it should further percolate to the district and village level. For this purpose, a Horticulture Information Centre (HIC) should be established in every district where horticulture production is substantially high.

Inter-departmental co-ordination between different departments like Horticulture, Agriculture, Transportation, IPH, PWD, HPMC, Rural, Deptt. Environment, science & technology, NGOs, CSOs is needed for effective planning, implementation & monitoring of horticulture intervention programmes.

Training and awareness programmes should be taken up at priority. Because there is a huge knowledge gap between farmers and researchers an awareness campaign should be taken up by the respective State Governments in collusion of national horticulture board, so that farmers of the remote rural areas may become aware of the prevention technologies.

To boost horticulture export, transport should be upgraded and cold storage facilities should also be expanded. Government should give financial incentives to purchase refrigerated vehicles and to establish multi-chamber/multi-product cold storage and for the existing cold storage, adequate finance should be made available at concessional rate of interest so that they can be upgraded and converted for multi product storage.

Government should encourage the involvement of the private sector by providing an enabling environment, in the provision of essential export infrastructure for the horticulture trade, which will attract required investment and infusion of

technology to ensure the development and growth of the horticulture sector.

Enhancement of the development of the seed industry in the State by ensuring that there is protection for breeders' rights so as to attract investment in the sector and thus enhance growers' access to quality seeds and other planting materials.

Credit facilities should be extended to farmers at a low interest rate. Government should give subsidy to the farmers on the application of bio-pesticides for the management of pest.

Introduction of the programmes for the creation of infrastructure for research and development, extension, post harvest management including processing and providing production support services and incentives to the farmers for all round development of the horticulture industry of Himachal Pradesh

Horticulture monitoring parameters mentioned in section (V) should be compiled & updated regularly. It should be linked to district level information system. It will help in identifying hotspots and planning of sector/area specific plan, programmes & projects.

All the project and programmes related to horticulture and related infrastructure facilities such as road and transport, storage facilities, marketing facilities and inadequate environmental, issues like chilling, relative humidity, soil erosion should be implemented both in rural & urban areas. All the proposed actions related to response in terms of projects, programmes and plans identified & highlighted in Table 2 should be implemented.

Government should introduce new courses in different streams of horticulture in the universities at State level to spread knowledge in an effective way. Further, upgradation of university infrastructure should be carried out.

Emphasis on formulation of a strategy to discourage the use of pesticides and chemical fertilisers by popularising and demonstrating the use of bio fertilisers and bio-pesticides.

7.5 Agriculture

Review of existing land use in the State and exploration of possibilities of taking steps to putting lands to use according to their capabilities. This would inter – alia include programme for plantation of fuel and fodder trees, development of pasture, etc in areas not fit for agriculture production.

Effective measures to be taken to protect good agriculture land against depletion on account of: Soil Erosion due to wind, water and shifting cultivation; water logging and salinity; loss of fertility including micro-nutrients and urbanisation and industrialisation.

Implementation of Command Area Development Projects and Dry Land Farming Techniques include: Reclamation of land with alkaline, saline and acidic soils, and ravines; review of agriculture laws, in general, with particular reference to the problems relating to consolidation of holdings; formulation and implementation of plans for rehabilitation of allottees of ceiling surplus land.

Identification of problems and bottlenecks in bringing culturable wastelands, fallow lands etc. to crop productions. Promulgation and effective enforcement of land use statutes.

Increasing land and water efficiency by adopting suitable cropping patterns, increasing intensity of cropping/irrigation.

Planning and survey of soil and water resources in selected blocks for their optimal utilization.

Planning for integrated development of areas such as Diara/Khadar lands Kandi and arid areas include: Setting up of land reclamation and Development Corporation; formulation and implementation of schemes for flood protection; to create an informed public opinion in order to obtain their co-operation with regards to matters concerning better land and soil management; to mobilise youth following Land Army concept for implementation of land and water use project.

Diversification from traditional crops to commercial crops in area where irrigation facilities have been created. The farmers shall be motivated to produce organic vegetables without the use of pesticides and chemical fertilisers.

Development of rain fed areas through watershed approach on a large scale for efficient use of natural resources. Increased funding should be arranged under RIDF.

Rainwater harvesting is another area, which will not only provide irrigation to the crops but shall also recharge the ground water and check erosion. The department shall seek financial assistance from Government of India for small irrigation tanks/shallow wells and pumping sets.

Increase in maize productivity through high yielding hybrids. Organic farming shall be the thrust area.

Post harvesting and efficient marketing system.

Farm mechanisation with special reference to hill agriculture shall be given major thrust in the years to come. This is necessary to reduce cost of cultivation in view of high cost of labour.

Constituted a Technical Working Group to identify new farm implements and machinery, which can be introduced in the State.

A strong research extension interface directed towards problems oriented research programmes is needed. Research projects should be identified and funded in problem areas.

Extension reforms through public-private partnership include: Agro processing and value addition; increase in productivity and quality; formulation of Agricultural Policy/Organic Farming policy.

Specific recommendations

Progressive fragmentation of agricultural farmlands leading to unremunerative agriculture: It is not enough to provide for prevention of fragmentation in the Prevention of Fragmentation and consolidation of Holdings Acts of different States. A careful study has to be made of the relevant provisions of the consolidation of Holdings Acts and the Acts relating to succession and the suitable amendments made wherever necessary to prevent the re-emergence of fragmentation.

The publicity work for consolidation should be directed at showing the advantages of consolidation and at pointing out the irrationality of attachment to a particular piece of land. For demonstrating the advantages of consolidation, organised publicity at official level is necessary and the organisational and administrative arrangements as well as the publicity should be carefully worked out.

In order to ensure the smooth and satisfactory progress of consolidation programme, the valuation of the land should be done by a high powered committee consisting of retired senior official of the Revenue department and two men of public importance. Whatever be the agency to value the land or to hear the appeals, the whole procedure should be streamlined and followed expeditiously.

Inadequacy of systematic resource survey and planning in Agriculture: The

development in the agricultural sector requires a systematic resource survey followed by planning all over the State. This should have been the first step to leap forward. This required knowledge of soil type, soil fertility, slope condition, water availability for irrigation, areas afflicted by severe frosts, floods weather conditions, occurrence of wild relatives of crops, hill aspect, crops well suited and vegetation type.

Moreover, there is a need to regulate the seed supply of high yielding varieties and the quality standards must be strictly enforced so that farmers do not suffer. Research thrusts have since been confined to major crops, thus millet and pseudo cereals are under threat of extinction.

Untapped potential of varied agro-ecological sub zones: The State of Himachal has been divided into ten agro-ecological zones by the National Bureau of Soil Survey and Land use planning (NBSSLUP, Nagpur) on the basis of data on rainfall, temperature, soil characteristics and available crop duration. These sub zones offer ample opportunities to plan for growing cereal crops, millets, pseudo cereals, pulses, oil seeds, vegetables, flowers, fruits, nuts, medicinal and aromatic plants. Condiments like ginger, turmeric, onion, garlic, red chillies etc. are another group of plants which hold promise. Specialty crops such as tea, kala jira, hops, Stevia, Saffron etc. also need special efforts if small and marginal farmers have to continue to earn their livelihood from farming.

Unexploited organic farm produce: Himachal Pradesh hold a vast potential for pursuing organic farming in the years to come. Still there is a vast area where fertilisers are not easily available or where farmers prefer to use FYM only on account of the cost factor. In hills where cultivation is done on terraces below large forests, the leaf humus is carried by the rainwater to the fields and this natural process occurs uninterruptedly enriching the land with

humus. The growing demand for organic fruits, vegetables and medicines opens up new avenues of production and marketing for farmers in these Himalayan hills. These may even find market in countries abroad. However, lot of research and policy level effort is needed for its success. This may have to be linked to the eco-friendly tourism concept by encouraging people to serve local organic produce in fresh bracing climate for health. Trend of organic farming in traditional hill agriculture shows that there is a growing realisation about chemical fertilisers and pesticides being major cause of pollution of food articles and water and production of organic food crops are essentially eco- friendly. However, production and use of biofertilisers and bio-pesticides need a boost and as also the awareness about benefits of animal husbandry with cropping practices.

Recommendations relating to Waste Land Development include: (i) To formulate within the National and State Forest Policy, a perspective plan and programme and guidelines for development of wasteland/afforestation plan for the State; (ii) To collect statistics and identify wastelands for afforestation purposes; (iii) To act as anodal agency for co-ordinating, funding and activities relating to different schemes of afforestation and wasteland development; (iv) Review the progress and monitor/evaluate the implementation of programmes and schemes for development of wasteland by different agencies; (v) Approve afforestation and related projects for development of wasteland; (vi) Collaborate with the Central and State Government Departments, agencies, local bodies and voluntary agencies with a view to mobilising manpower, funds and other inputs required for afforestation and wasteland development; (vii) Prepare budgetary requirements for the afforestation programme and interact with financial institutions for funding; (viii) To fix afforestation targets and norms for afforestation and maintenance; and (ix) To set up expert group/inter disciplinary

bodies for preparing projects/schemes on specified schemes.

Land reforms: Land relations have a major impact on agricultural productivity and production. Inequality in land distribution and in security of tenure etc., are often at the bottom of many forms of social discrimination and domination based on gender, caste, minority and tribal affiliations. The National Commission on Farmers has placed the unfinished agenda in land reform first in its list of five factors central to the present agrarian crisis, and states “the first and foremost task of the National Policy for Farmers should be in the area of land reform with particular reference to tenancy laws, distribution of ceiling surplus land, attention to common property and wasteland resources and the consolidation of holdings. Following the conferment of land rights to women under the Hindu Succession Amendment Act (2005), the provision of appropriate support services to women farmers has become urgent. Joint Pattas are essential for women to get access to credit. Also, there should be stringent restrictions on the diversion of prime farmland for non-farm purposes.”

Since migration and feminisation are increasing trends, land reforms that make tenancy legal and give well defined rights to tenants and to women are now more necessary than ever not only to reduce distress but also to increase agricultural growth. Facilitating leasing of land for cultivation is necessary to prevent cultivated land from turning fallow due to migration of owners to urban areas. Inadequacy of recognised tenancy rights makes it difficult for de facto tenants to get credit from formal sources. Tenants without legal rights do not have proper incentive to develop the land and this explains part of the yield gap. Similarly, a woman without property title is unable to get credit when the male member is away. Giving access to land and homesteads not only reduces poverty but is the most powerful way to bring dignity in the lives of the excluded. This, along with

the more general need to record land titles properly where these are weak, is also one way to deal effectively with encroachment and non-participation that plague watershed and wasteland development programmes. With Mahatma Gandhi National Rural Employment Guarantee Act in place, such programmes can be stepped up very substantially to address natural resource regeneration but the incentive issues related to land should be addressed.

Water Management and irrigation: Water is a critical input for agricultural and this calls for more effective utilisation of existing irrigation potential, expansion of irrigation where it is possible at an economic cost and better water management in rain fed areas where assured irrigation is not possible. This is clearly an area where past policies have been inadequate. Performance in expanding irrigation has been disappointing with resources being spread thinly over many projects and a large number of irrigation projects remaining under construction for many years. At the same time, flood forecasting, control and management are also vitally important for many parts of the country.

The Bharat Nirman programme envisages creation of 10 million ha additional assured irrigation during the 4 years period (2005-2009). To achieve this, the pace of potential creation will have to increase from 1.42 million ha per year in recent years to 2.5 million ha per year. Of the new potential envisaged under Bharat Nirman, about half is planned for 2007-08 and 2008-09 that is first 2 years of the 11th plan. Assuming the same rate continues thereafter, a total of about 11 million ha of new potential can be expected in the 11th plan consisting of 5.5 million ha in major & medium irrigation, 3.5 million ha through minor irrigation and about 2.0 million ha through ground water development. In addition, another 3-4 million ha of land is to be restored through modernisation of major, medium and minor projects and restoration of tanks.

Investments in the major and medium irrigation sector will require large resources from the State Governments supported by Central Assistance under AIBP. However, prioritisation by proper cost-benefit analysis and timely implementation of these projects by State Governments is also important and should be taken up on priority. Besides regular monitoring by Central Water Commission, it is proposed to expand usage of remote sensing techniques for this purpose which has been initiated on a pilot basis in the 10th Five Year Plan.

Along with expansion of irrigation facilities, it should be ensured that water is distributed equitably and used efficiently. The pattern observed in the past where tail-enders are denied water because upper end-users appropriate it for highly water intensive crops must be avoided. Participatory Irrigation Management (PIM) should be promoted by facilitating and setting up democratically organised water user associations to set and collect water charges, and retain a substantial part of the collection, would help to maintain field channels, expand irrigated area, distribute water equitably and provide the tail enders their just share of water. Experience in Andhra Pradesh and Gujarat has shown the effectiveness of such PIM. Therefore, in the 11th plan, focus on PIM should be given on a large scale.

Water is also critical for rain fed as well as unirrigated land which accounts for more than 60% of cultivable area. Water conservation and ground water management is critical for these areas and will therefore need much more focused attention. The urgent need is for discipline on groundwater use to avoid the deepening agricultural crisis in dry land areas. Some policies being followed by State Governments encourage wasteful use of water. As the National Commission on Farmers (NCF) has pointed out, having access to cheap power use almost doubles the amount of water per unit of crop compared to farmers using diesel pump

sets. Continued provision of free power by some States, and highly subsidised power by all States, encourages excessive use of ground water. This is reflected in the fact that semi-critical, critical and over exploited areas of groundwater use is increasing.

Watershed management, rainwater harvesting and ground water recharge can help augment water availability in rain fed areas. Micro irrigation is also important to improve water use efficiency. Building structures for water management and managing them provides immediate opportunities for employment generation in rural areas. The enhanced productivity of land will generate further sustainable demand for labour in rural areas. The National Rain fed Areas Authority, which will be set up shortly should provide for developing concerted action plans for rain fed areas in close consultation with State Governments.

Serious efforts at addressing water management issues will require a substantial commitment of public resources. Average expenditure of Rs. 10,000 per ha, is needed for treatment of watershed. For this magnitude of funds to be available, it is essential that these programmes be converged with or at least supplemented by the Mahatma Gandhi National Employment Guarantee Programme Funding. Local level schemes which conserve moisture and recharge ground water should be strengthened.

Reclaim Degraded land and focus on soil quality: Due to expansion of urban areas net sown area has reduced significantly in recent years. While conversion of agricultural to non agricultural land in an unavoidable concomitant of the development process, it should be ensured that this does not put undue pressure on agriculture or lead to inefficient land-use, for example loss of water bodies and speculative land purchase that reduces cultivation without any productive use for several years. Existing regulatory procedures should be reexamined

since delay in converting land from farm use to more productive non-farm use does have costs. But this must go hand-in-hand with the creation of a new regulatory framework governing such conversion, based transparently on principles of sound land-use planning.

Since land-use patterns will change, it is necessary to offset the loss of agricultural land by bringing more land under cultivation. There is a large amount of degraded land that can be reclaimed through watershed development. There is also a considerable amount of saline and sodic land, which can be brought back to cultivation with treatment. Although schemes exist, these have so far suffered from inadequacy of funding. As with watershed development, State Government should upscale using all the scope for convergence with other rural development programmes including, where possible, e.g. Mahatma Gandhi National Rural Employment Guarantee Programme (NREGP).

The scope for improving the quality of land that is currently being cultivated also needs further exploitation. Vast areas of cultivated land are acidic, where significant yield increases are possible through treatment using waste material from industry. There is sulphur deficiency, but this can be treated effectively, resulting in better yield, particularly for pulses and oilseeds. More generally, Indian soils are relatively deficient in organic matter and are suffering in adequate manuring and composting, aggravated in many regions by unbalanced use of chemical fertilisers, especially excessive application of nitrogen. This raises serious issues of long-term sustainability, but also offers the possibility that fairly large yield increases can be obtained in the short-run by applying the other nutrients, including micro-nutrients, that have been seriously depleted. Subsidies are, to a considerable extent, responsible for excessive use of some fertilisers, for example, Urea. Fertiliser pricing therefore

requires urgent reform to end the present irrational discrimination across nutrients.

Bridging the knowledge gap: The National Commission on Farmers (NCF) has drawn attention to the knowledge deficit that exists at present and explains much of the difference between yields realised in experiments and what farmers actually get. One reason for this is the virtual collapse of extension services in most States, with 30-40% of positions remaining vacant. Farmers are not fully aware of the adverse consequences of unbalanced fertilizer use or of benefits of micro-nutrient application and soil testing to determine optimal nutrient requirements is hardly practiced on a regular basis even by State Agriculture Departments. Similarly, although many new varieties of seeds and pesticides have entered the market during the last decade and farmers are using these, they do not appear to have significantly higher productivity and there are frequent complaints about quality. A problem is that input dealers, who have narrow commercial interests have emerged as the main vehicle for technology diffusion and farmers do not have access to reliable third-party advice which an effective and knowledgeable extension service should be able to provide. Inadequacy of credit also pushes farmers to purchase inputs from local suppliers who often provide sub-standard inputs.

To overcome information gaps and for advice in contingencies such as pest-attacks, it is necessary to revitalise the extension system in a manner that links universities and best practices effectively to farmers. Himachal Pradesh needs to take urgent steps in this area. Central initiatives on this also need to be strengthened. Krishi Vigyan Kendras set up by Indian Council of Agricultural Research (ICAR), have very little interaction with

the Agricultural Technology Management Agency (ATMA) model extension being promoted by the Department of Agriculture & Cooperation (DAC). Due to this

inadequacy of co-ordination not only are farming practices in large parts of the country sub-optimal, plans and programmes are failing to converge technical and development aspects even across Centrally Sponsored Schemes (CSS) of the Ministry of Agriculture (MoA), let alone converging effectively with those of other central ministries, such as on watershed development. The inadequacy of synergy between different public efforts should be addressed urgently to multiply returns to plan expenditure.

The NCF has suggested ways to synergise at the village level, for example, through Farmer Knowledge Centres, which is already being implemented in some places with PRI and NGO help. Since synergies between line departments and CSS can be derived best through district plans, the Planning Commission and Ministry of Panchayati Raj have begun strengthening the process of district planning. The recent MoA initiative to set up technical bodies such as the National Fisheries Board and the National Rain fed Areas Authority should help to improve synergy.

The nature of technical constraints and crop/livestock development possibilities vary considerably across different agro-climatic zones and the agricultural strategy should aim at evolving packages specific to zones. In this context, there is a need to bring a much more regionally focused technical content into all CSS of MoA. However, while strategies can emerge through consultation between the Centre and the States, the task of implementing these on the ground falls almost wholly on the State Government. Administrative structures need to be optimised for region-specific implementation.

Diversification to high value output while ensuring food security: Faster agricultural growth will require diversification into higher value output, for example horticulture, floriculture etc. This is partly because demand patterns are shifting in that

direction and also because in many cases this is the most efficient way to increase incomes of farmers from their limited land and water resources. Recognising this, the newly launched National Horticulture Mission (NHM) is already the largest single plan scheme of MoA, which is even larger than the macro – management in agriculture (MMA) scheme that provides main support from the centre to almost all other crop activity. The NHM allocation is large because apart from including significant new interventions for ensuring availability of quality planting material; crop and regions-wise, the programme also provides for structural changes in the relationship between agriculture and non – agricultural sectors. Horticulture products are perishable commodities and therefore very efficient linkages need to be put in place between farms and final buyers. This requires modern methods of grading, post- harvest management, coldchains, etc. For this purpose, besides providing for direct public investment in marketing infrastructure, NHM incentives amendment of APMC acts to enable larger private sector participation in marketing and processing. This process should be accelerated in Himachal Pradesh.

Diversification also means that the produce must meet the specific requirements of the different markets being serviced and these requirements vary depending on whether the market is domestic consumption, agro-processing or exports. Producers' co-operatives are one way of achieving these linkages. Contract farming is another way of attracting corporate investors to help establish these linkages and also provide farmers with necessary inputs, extensions and other advice. Many States have taken steps to facilitate contract farming as a way of assisting the process of diversification. A much greater focus is also necessary on enabling small farmer participation by encouraging group formation and providing suitable and effective regulatory frameworks. Entrenched interests dominating traditional trade channels often oppose change. But such opposition, if it

seeks simply to restrict market competition or to hinder the growth of co- operation among the farmers, is against the interest of both farmers and consumers.

In a mission so demanding of public resources and with a scope that can alter how agriculture is carried out and how it relates to the rest of the economy, there is also bound to be genuine concerns. Some experts believe subsidising shift of land from food grains to horticulture can be uneconomical and at the cost of food security. Such fears are somewhat exaggerated, but have become more relevant now that our food stocks have depleted to the point where large and high cost wheat imports have become necessary again. It is important that encouragement to diversification is not driven purely by subsidy but reflects a logical shift towards higher sustainable productivity. There is need to exploit fully the scope for co- operation between different agencies.

Priority should be placed on technology to improve yields and on post- harvest management, infrastructure and processing. The objective is not to attain any particular level of production for a particular horticultural crop but to enable farmers to earn the highest possible sustainable income. Therefore, as far as possible, subsidies should be neutral across crops, whether covered by NHM or other programmes such as MMA with this, food security will not be endangered by diversification if food grain yields grow at around 3% per annum. This rate of yield increase had actually been achieved during the 1980s.

Agricultural Research: Since the green revolution in the sixties there has been no major technological innovation which could give fresh impetus to agricultural productivity. The absence of productive technology which also reduces risks is particularly serious for rain fed, dry land situations. In the longer run, growth in agricultural productivity can be sustained

only through continuous technological progress. This calls for a well considered strategy for prioritised basic research, which is now all the more urgent in view of mounting pressure on scarce natural resources, climate change and also the shrinking availability of spill-overs from international public research. The strategy should be operationalised in the form of challenge programmes in which central institutes and the State agricultural universities work with organic integration.

The 11th Plan is intended to energise the Agricultural Research System and improve its capacity to develop and deliver innovative and effective technologies relevant to the current context and needs. Strategic research to be undertaken to tackle well identified problems in a good directed way but also strengthen basic research that may contribute to growth. Fund for National Strategic Agricultural Research must be expanded and oriented to stimulate research that responds to newer and more formidable challenges and provides region-specific problem solving capacity. A delivery-targeted operational mechanism should be designed for its meaningful operation. The agricultural system also needs to be thoroughly revamped and restructured in the light of the recommendations of the high powered committees chaired respectively by Dr. M.S. Swaminathan and Dr.R.A. Mashelkar

7.6 Animal Husbandry & Livestock

Some important recommendations for livestock are as given below:

It should be recommended to use responsible and prudent use of anti microbial agent in veterinary medicine with an aim of protecting both animal and human health. The Competent Authorities responsible for the registration and control of all groups involved in the production, distribution and use of veterinary antimicrobials have specific obligations. Prudent use is principally determined by the

outcome of the marketing authorisation procedure and by the implementation of specifications when antimicrobials are administered to animals. Prudent use includes a set of practical measures and recommendations intended to prevent and/or reduce the selection of antimicrobial-resistant bacteria in animals.

A. Augmenting Fodder Resources and Production in Livestock

1. Programme for augmenting productivity of grazing land including private grasslands, common property resources, farm field and alpine pressure needs to be strengthened with adequate budgetary support and enhanced co-ordination between animal husbandry, agriculture, rural development and forest department.
2. There is need for eradication of invasive weeds from grass land and forest land which ultimately decreases the productivity of fodder availability and reduces area under grazing land which ultimately affects the livelihood of rural population.
3. The programme for stray cattle management, opening of new Gosadan, registration of cattle and fodder production on degraded land needs to be intensified further.
4. Regulating and controlling grazing and improving quality of both grazing and livestock will lead to more stall feeding. General awareness for promoting stall feeding, adoption of cut and carry method for grass collection need to be promoted to avoid over grazing and degradation of land along with loss of biodiversity.
5. Monoculture especially chir and pine plantation needs to be discouraged as it leads to reduced grass production and may some time lead to forest fire.
6. Plantation of broad leaved fodder trees may be promoted in various afforestation programme.
7. The mechanism of JFM needs to be utilised beneficially. Efforts for

improving high altitude pasture with action participation of local community and other stake holders like Gaddi & Gujjars should be made for improving the pasture land with eradication of unwanted weeds.

8. For increasing fodder availability the silvi pasture based farming system should be adopted along with improvement of private grassland, common propriety resources through removing unwanted bushes; proper grazing policy and introduction of leguminous and other nutritious fodder varieties needs focused attention.
9. Fodder banks needs to be established to collect and store surplus residue/ fodder under private/public participation for distribution in scarcity area.
10. For enhancing productivity from livestock balanced feeding area specific mineral mixture promoting livestock health through better management practices and introduction of adequate policy frame work for decreasing transmission of all contagious and zoonotic disease.
11. The breed upgradation programme needs to be intensified further for door delivery of A.I services.
12. Further programme to discourage unrestricted breeding of less productive cattle will have to be undertaken vigorously.
13. The policy intervention is needed to stop the diversion of grass lands for other purpose and other land use.
14. The State being leading producer of fruits and vegetables the use of Agro industrial by products (AIBF) and Non conventional feed resources needs to be tapped for livestock feeding through intervention of appropriate technology.

Best Management Practices (BMP) for Environment Protection

1. Best practices are considered to be fundamental management practices

that are necessary for production operation to function in an environmentally sound and protective manner.

2. BMP and nutrition are central to the prevention and control of many diseases besides high level of production performance. BMP have to be followed not only in bio security management of livestock but also in handling of livestock manure.
3. There is need to make the farmers aware regarding reducing the risk of physical, chemical, microbial hazards entering the human food supply chain through production on farm. The farmers need to take initiative for safety of food products by adopting bio-security management on the farm.
4. Simple management practices such as vaccination, adequate access to balanced feed and clean water, appropriate space allowance, ventilation and temperature control, improved sanitation and bio- security measure management system.
5. The routine practice for use of antimicrobial growth promoters and production promoters in livestock feed needs to be curbed. The antibiotics must be used to treat specific diseases on the recommendation of RMP as there is increased concern for potential link between microbial resistance in humans.
6. Many different management practices for reducing the GHG emission through the mechanism of soil carbon sequestration on grazing land needs to be adopted
7. The role of herbal medicines in the treatment of animal especially for the control of ectoparasites needs to be explored.

Biotechnological Tools

1. There is need to exploit the use of modified micro-organism or their

products for controlling and treatment of animal waste and other pollutants.

2. Biotechnological advents like ETT, Embryo splitting can be most rapid and effective methods for obtaining of improved genetic make up to get high producing females and superior males for breeding purpose.
3. Transgenic animals can be used for improving genetic traits for disease resistance, better performance, bioreactor's of human pharmaceutical proteins and many other applications.
4. Transgenic plants can be used for increasing the nutritional quality of the plant feed stuff and byproducts and thereby offers many more opportunities and potential in animal nutrition.

Method for pathogen reduction in manure

1. Promote use of vegetative or grass filter strips to remove sediments bacteria and nutrientsetc. from runoff and erosion in animal confined areas.
2. Control excess water from entering manure stockpiled areas. Eliminate or reduce livestock access to streams, lakes, ponds and rivers and other water resources with fencing of the area.
3. Biological treatment of manure like composting anaerobic storage and anaerobic digesters helps inreducing pathogenc on centration in manure.
4. Other treatment like ultra violet light irradiation, pasteurisation, treatment with lime, ozone and chlorine helps in making manure harmless from micro-organism.
5. As bacteria are susceptible to UV light and drying, manure should be stored before land application, it should not be left on field surface and not to be applied during raining season.
6. In order to minimise odour from the manure, always cover the stored manure with roof/fibrous mats and

cleanliness is key to control flies population.

7. Animal should be slaughtered in humane way in modern slaughter houses in registered premises where fitness is ensured by trained veterinarian sand animal wastes are properly disposed off. Registered slaughter houses needs to be established not in towns but also at Panchayat level.

Application of GIS tools in betterment of Environment

1. There is need for microplanning on NRM which willbe more effective through application of GIS tools and techniques.
2. Data needs to be generated on extensive spatial data layers i.e. cropping pattern, crop residue availability. Area under fodder cultivation, potential grazing land, water resources, livestock population and production pertaining to small administrative level like blocks/sub-division.
3. The policy decision will be based on scientific information for natural resources management on sustainable basis rather than institutional abstract information.

Livestock should be fed with food rich in nutritive contents. This feed should contain carbohydrates, proteins, fats, minerals and vitamins. There are two kinds of feed-roughages and concentrates. Roughages consist of hay or the grassy material of paddy, wheat and maize. This is fibrous and nutritious. Concentrates include the seeds of Livestock Feed Recommendations, groundnuts, pulses and bran. These products consist of contents that are more nutritive than roughages. Compound Feed refers to animal feed that has nutrients in balanced quantities. Such Feed is made in analytical laboratories that are supervised by trained nutritionists. A significant number of small- scale feed mixers are also involved

in turning out feed for local consumption. Such feed is also known as ‘self-mixed feed’ or ‘home-mixed feed’.

Inter-departmental co-ordination between different departments like Department of Animal Husbandry, Department of Agriculture, Department of health, HPPCB, NGOs, CSOs is needed for effective planning, implementation & monitoring of livestock intervention programmes.

Animal Health monitoring data should be compiled & updated regularly by Animal Health Department. It should be linked to district level veterinary system, so that area specific plans, programmes & projects can be monitored and information on animal health can be accessed.

Focused attention needs to be given to curative aspects of Animal health care, where the share of the private sector in the number of illness episodes treated is almost negligible. Strengthening the existing veterinary services and widening their network through the involvement of private practitioners, voluntary non-government organisations and research institutions will improve the health care services in the State.

Livestock service delivery is necessary to facilitate establishment of need based livestock service delivery systems for the small holder livestock farmers, so that they get benefits from livestock easily.

Evaluate the veterinary and animal husbandry education to review and reorientation of veterinary and animal husbandry education to effectively equip veterinary and paraveterinary professionals to shoulder emerging responsibilities.

Increase Knowledge Networking & Research Partnerships to knit together the rich knowledge base that exists through effective linkages and communication platforms.

Give attention to livestock products marketing, which support small holder livestock producers in improving their income through better market access. This will improve the economy of the farmer as well as State economy.

Slaughter waste should be disposed off as per biomedical handling rules. Promote implementation of biogas plant in Himachal Pradesh.

All the sectoral recommendations related to project and programmes implementation for overgrazing, waste management and transportation, air pollution, inadequate animal health infrastructure, all the proposed actions related to response in terms of projects, programmes and plans identified & highlighted in Table 10 should be implemented.



Prepared By

IRG Systems South Asia Pvt. Ltd.

For

Department of Environment, Science & Technology (DEST)

Narayan Villa, Shimla, Himachal Pradesh, India - 171002

Web Site: www.himachal.gov.in/environment E-mail: dbt-hp@nic.in

Tel. : +91-177-2620559, +91-177-2627608 Fax.: +91-177-2627609