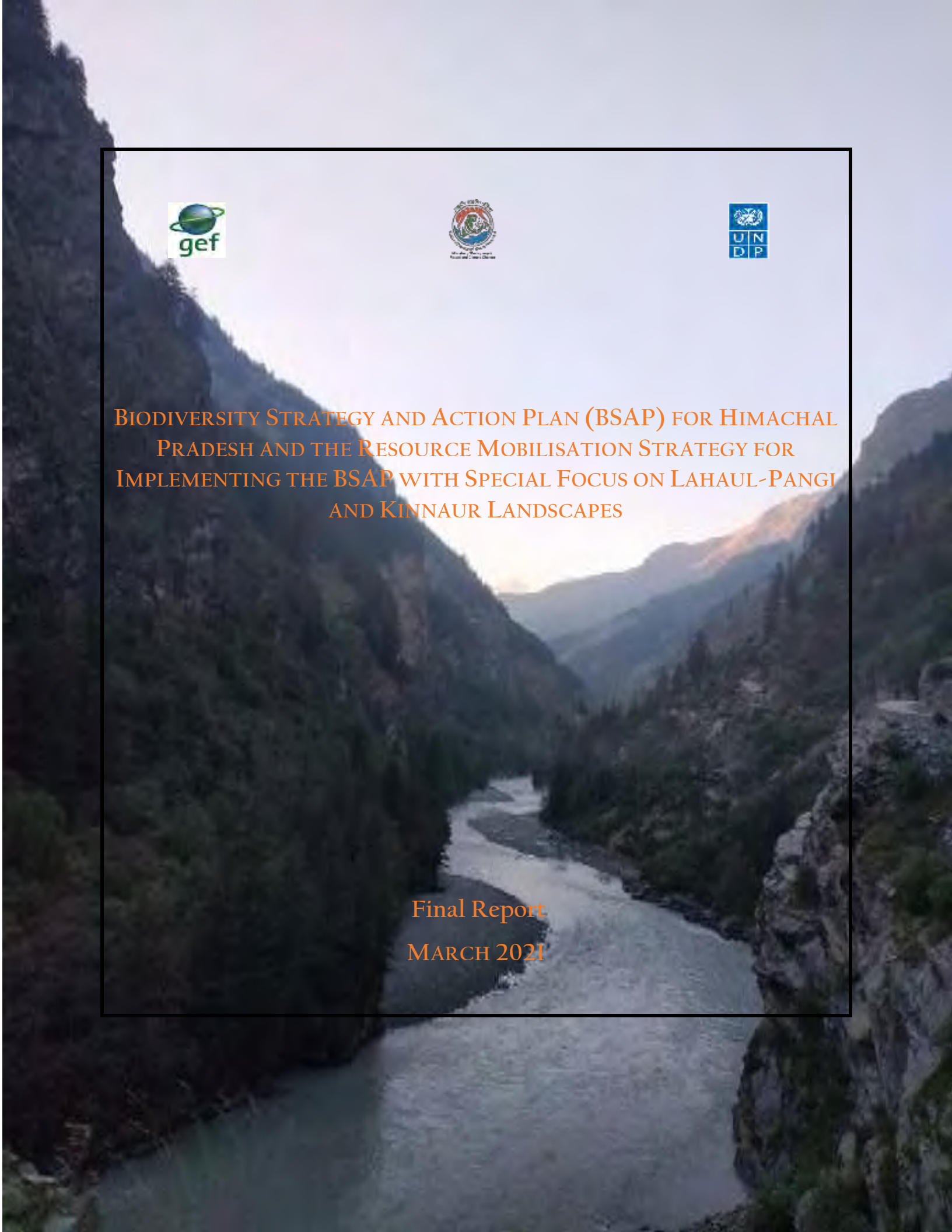

Biodiversity Strategy and Action Plan (BSAP) for Himachal Pradesh and the Resource Mobilisation Strategy for Implementing the BSAP with Special Focus on Lahaul-Pangi and Kinnaur Landscapes

Final Report

March 2021

This publication has been developed by the National Institute of Public Finance and Policy, New Delhi, under the assignment, Biodiversity Strategy and Action Plan (BSAP) for Himachal Pradesh and the Resource Mobilisation Strategy for Implementing the BSAP with Special Focus on Lahaul-Pangi and Kinnaur Landscapes in Himachal Pradesh under the GEF-GoI-UNDP SECURE Himalaya Project.

Biodiversity Strategy and Action Plan (BSAP) for Himachal Pradesh and the Resource Mobilisation Strategy for Implementing the BSAP with Special Focus on Lahaul-Pangi and Kinnaur Landscapes

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List of Abbreviations

ABS	Access and Benefit Sharing
ABT	Aichi Biodiversity Targets
ACF	Adaptation Coalition Framework
ADB	Asian Development Bank
APCCF	Additional Principal Chief Conservator of Forests
BBMB	Bhakra Beas Management Board
BDA	Biological Diversity Act
BER	Biodiversity Expenditure Review
BFP	Biodiversity Finance Plan
BHS	Biodiversity Heritage Sites
BIOFIN	Biodiversity Finance Initiative
BMC	Biodiversity Management Committees
BSAP	Biodiversity Strategy and Action Plan
BSI	Botanical Survey of India
CA	Compensatory Afforestation
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CAT	Catchment Area Treatment
CBD	Convention on Biological Diversity
CFC	Chlorofluorocarbons
CoP	Conference of Parties
CPCB	Central Pollution Control Board
CR	Critically Endangered
CRGGS	Climate Resilient Green Growth Strategies
CSKHPKV	Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya
CSR	Corporate Social Responsibility
CSS	Centrally Sponsored Scheme
DFO	District Forest Officer
DMF	District Mineral Foundation
DoA	Department of Agriculture
DoAH	Department of Animal Husbandry
DoEE	Department of Elementary Education
DoEST	Department of Environment, Science and Technology
DoF	Department of Fisheries
DoH	Department of Horticulture
DoI	Department of Industries
DoTD	Department of Tribal Development

EEA	European Environment Agency
EN	Endangered
ENVIS	Environmental Information System
FSI	Forest Survey of India
FTC	Forest and Tree Cover
GBPIHED	GB Pant Institute of Himalayan Environment & Development
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GoHP	Government of Himachal Pradesh
GSB	Govansh Samverdhan Board
GSDP	Gross State Domestic Product
HCFC	Hydro chlorofluorocarbon
HEP	Hydro Electric Projects
HIMCOSTE	Himachal Pradesh Council for Science Technology and Environment
HP	Himachal Pradesh
HPAB	Himachal Pradesh Ayush Board
HPAU	Himachal Pradesh Agriculture University
HPBOSE	Himachal Pradesh Board of School Education
HPFD	Himachal Pradesh Forest Department
HPKCCC	Himachal Pradesh Knowledge Cell on Climate Change
HPPCL	Himachal Pradesh Power Corporation Ltd.
HPSAMB	Himachal Pradesh State Agriculture Marketing Board
HPSBB	Himachal Pradesh State Biodiversity Board
HPSBSAP	Himachal Pradesh State Biodiversity Strategy and Action Plan
HPSMPB	Himachal Pradesh State medicinal Plant Board
HPSPCB	Himachal Pradesh State Pollution Control Board
HPSSAPCC	Himachal Pradesh State Strategy and Action Plan on Climate Change
HPSVC	Himachal Pradesh State Veterinary Council
HWC	Human-Wildlife Conflict
HYV	High Yielding Variety
IA	Implementation Agreement
IBBI	India Business and Biodiversity Initiative
ICAR	Indian Council of Agricultural Research
IHBT	Institute of Himalayan Bio-resource Technology
IGFRI	Indian Grassland and Fodder Research Institute
INDC	Intended Nationally Determined Contributions
IUCN	International Union for Conservation of Nature
JFMC	Joint Forest Management Committee

KUSUM	Pradhan Mantri Kisan Urja Suraksha Utthan Mahabhiyan
LADF	Local Area Development Fund
MAP	Medicinal and Aromatic Plants
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MoEF&CC	Ministry of Environment and Climate Change
MT	Metric Tonne
MW	Mega Watt
NAP	National Afforestation Programme
NAPCC	National Action Plan on Climate Change
NBA	National Biodiversity Authority
NBAGR	National Bureau of Animal Genetic Resources
NBAP	National Biodiversity Action Plan
NBT	National Biodiversity Targets
NDC	Nationally Determined Contributions
NEP	National Environment Policy
NIPFP	National Institute of Public Finance and Policy
NITI	National Institute for Transforming India
NLM	National Livestock Mission
NMAET	National Mission on Agricultural Extension and Technology
NMSA	National Mission on Sustainable Agriculture
NPV	Net Present Value
NRSC	National Remote Sensing Centre
NT	Near Threat
NTFP	Non-timber Forest Produce
OBC	Other Backward Classes
OECD	The Organisation for Economic Cooperation and Development
PA	Protected Area
PBR	People's Biodiversity Register
PES	Payment to Ecosystem Services
PGP‹	Plant Growth Promoting Microbes
PKVY	Paramparagat Krishi Vikas Yojana
PMKKKY	Pradhan Mantri Khanij Kshetra Kalyan Yojana
PRI	Panchayati Raj Institutions
RKVY	Rashtriya Krishi Vikas Yojana
RO	Range Officer
ROAM	Restoration Opportunities Assessment Methodology
SADA	Special Area Development Authority
SAWB	State Animal Welfare Board
SBB	State Biodiversity Board
SBSAP	State Biodiversity Strategy and Action Plan
SC	Scheduled Classes
SDG	Sustainable Development Goals

SECURE	Securing Livelihoods, Conservation, Sustainable Use and Restoration of High Range Himalayan Ecosystems
SHM	Soil Health Mission
STP	Sewage Treatment Plant
SVSY	Samudaik Van Samvardhan Yojana
SVY	Sanjhi Van Yojana
TCAD	Tourism and Civil Aviation Department
TDC	Tourism Development Council
TERI	The Energy and Resource Institue
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	US Dollars
VFDC	Village Forest Development Committee
VU	Vulnerable
WCCB	Wildlife Crime Control Bureau
WRI	World Resource Institute
WWF	World Wide Fund for Nature
YSSD	Youth Services and Sports Department
ZSI	Zoological Survey of India

Preface

SECURE Himalaya (Securing livelihoods, conservation, sustainable use and restoration of high range Himalayan ecosystems) is a GEF funded project being implemented by the Ministry of Environment, Forest and Climate Change, Government of India along with the UNDP, in the states of Himachal Pradesh, Uttarakhand, and Sikkim and Union Territories of Jammu and Kashmir and Ladakh. The project aims to support the Government of India to effectively promote sustainable land and forest management in alpine pastures and forests in high range Indian Himalayan ecosystems that secure sustainable livelihoods and community resilience and ensures conservation of globally significant biodiversity and threatened species.

The National Institute of Public Finance and Policy was commissioned to undertake this study as part of the SECURE Himalaya Project by the United Nations Development Program, New Delhi at the behest of the Ministry of Environment and Forest & Climate Change, Government of India. The present report "Biodiversity Strategy and Action Plan (BSAP) for Himachal Pradesh and the Resource Mobilisation Strategy for Implementing the BSAP with Special Focus on Lahaul-Pangi and Kinnaur Landscapes" covers important issues around conservation of biodiversity in Himachal Pradesh and India on which the authors have done exhaustive research through field visits and stakeholder consultations. The empirical analysis and investigations have enabled authors to make a number of policy recommendations which I am confident will be extremely useful to the central government and the government of Himachal Pradesh in their efforts to improve the status of biodiversity, natural resources and ecosystem services in the state and the identified landscapes.

This study was designed, managed and carried out by a team led by Professor Rita Pandey. Other key members of the team are Priya, Anuja Malhotra, and Garima Jasuja. The views expressed in the report are that of the authors and the Governing Body of the institute are in no way responsible for them.

(Pinaki Chakraborty)

Director

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Acknowledgement is also due to the Department of Forest, HP, especially to Dr. Archna Sharma, IFS, PCCF (WL), Shri Anil Thakur, IFS, CCF and Shri Ajay Srivastav, IFS, Addl. PCCF (WL) cum State Nodal Officer of the SECURE Himalaya Project in Himachal Pradesh for their guidance, technical support and insights. The support received during the initial Stage of the study from Shri G. S. Goraya, former PCCF (HoFF), Shri Kunal Satyarthi, IFS and former Member Secretary, HP State Biodiversity Board, and Shri N.P.S. Dhaulta, DFO (WL), Shimla is gratefully acknowledged.

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We wish to put on record the excellent support extended by Gayatri Mahar, State Coordination Officer at UNDP Delhi, and Parth Joshi, National Livelihoods Specialist, SECURE Himalaya at UNDP Delhi, Amit Mehta, Socioeconomic and Livelihoods Associate, Abhishek Kumar, Project Associate, UNDP and Ms. Neha Tomar, Administrative and Finance Assistant, UNDP.

The authors received support from Shri Nishant Thakur, HPAS, Joint Member Secretary, Himachal Pradesh State Biodiversity Board (HPSBB), also sought considerable inputs from Dr. M. L. Thakur, State Project Coordinator, Ms. Shubra Banerjee, Senior Scientific Officer, HPSBB. The inputs and insights received from various line departments of Government of Himachal Pradesh is highly appreciated. The authors sought considerable amount of information from Gram Pradhans, members of Praja, Mahila Mandal and other members of communities through field visits and in-person meetings. We appreciate and acknowledge their time and efforts. Our heartfelt thanks to all individuals and their institutions who contributed their time and expertise in various consultation meetings organized as part of the study.

During the course of the study, the team has received overall guidance and immense support from Dr. Rathin Roy, former Director, NIPFP for which we are grateful to him. Prof. Pinaki Chakravorty, Director, NIPFP provided useful support during the last ohase of the study. Wasim Ahmad and Promila Rajvanshi provided excellent secretarial support during the project cycle.

This report would not be possible without the financial support from UNDP, New Delhi which is immensely appreciated.

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Executive Summary

India is a mega diverse country, harbouring 7-8 per cent of all recorded species in the world with only 2.4 per cent of the world's land. Of the 34 global biodiversity hotspots, four are present in India, represented by the Himalaya, the Western Ghats, the North-east, and the Nicobar Islands.

The threats to biodiversity – not only in India, but throughout the world has culminated into The Convention on Biological Diversity (CBD) – which was one of the three Conventions of the Rio Earth Summit in 1992.

It has been increasingly recognised by both the member countries and the CBD that the Sub-national BSAPs are necessary for effective conservation and management of biodiversity as each state may have a different connect of biodiversity with human well-being as well as states' developmental priorities. Further, unique features of the state, land use patterns and practices, and institutional and policy arrangements for governance of biodiversity and natural resources may require a state specific BSAP.

In HP, the BSAP was prepared in 2002. However, with the introduction of new guidelines for National and sub-national BSAPs at Nagoya 10th CoP Summit, and India's commitment to CBD during 2011-20; the need to refine and update the BSAP, 2002 has been felt.

In this context, the National Institute of Public Finance and Policy (NIPFP) was commissioned to undertake the study "Updating the Biodiversity Strategy and Action Plan (BSAP) of Himachal Pradesh and a Resource Mobilisation Strategy for Implementing the BSAP with special focus on Lahaul-Pangi and Kinnaur Landscapes".

The key objectives of the study are:

1. To update the existing Biodiversity Strategy and Action Plan (BSAP) of Himachal Pradesh based on current state priorities and in alignment with national and global priorities of biodiversity conservation and wildlife protection.
2. To develop a resource mobilization strategy for implementing BSAP in Himachal Pradesh.
3. Prepare process document for implementation of two financial solutions for conservation of snow leopard landscape; namely Lahaul – Pangi and Kinnaur Landscape[1].

The present report focuses on identifying the threats to biodiversity in the State and makes policy recommendations for improving the status of biodiversity, natural resources and ecosystem services in the state. The preparation of this document has undertaken an exhaustive research through field visits and stakeholders' consultations. A review of the existing SBSAP and rapid assessment of the gaps in implementation was done. In addition, a review was carried out for:

- Status and trends of biodiversity and biological resources in the state.
- Threats to biodiversity.

[1] Analysis and results pertaining to this objective and a BSAP for Lahaul – Pangi and Kinnaur Landscapes are put together in a separate report (Pandey Rita et al, 2021) as per the advice of the Project Management Unit.

- Review of the biodiversity relevant schemes and expenditure in the landscape.
- Literature and statistical surveys through secondary literature.

Consultative meetings were conducted with the officials of HP Forest Department, State Biodiversity Board, key line departments in Shimla as well as the district level officials in the landscape. Field trips were organised for holding public meetings, discussions were carried out with local experts and subject experts.

Himachal Pradesh is a mountainous state that lies in the Western Himalayas, extending over a geographical area of 55, 673 sq. km (FSI, 2019). The state is characterised by fragile landscapes, rich biodiversity and ecosystems supporting livelihood of local communities and providing a source of revenue to the State Government. The state has elevation ranges from 350 m to 6816 m (Jaswal and Bhan, 2015) and is divided in three regions, topographically, namely Shiwalik (outer Himalayas), the lesser Himalayas (middle Himalayas) and the greater Himalayas. Due to altitudinal variations, the State is divided into 4 agro-ecological zones which differ in terms of their area, temperature, elevation, rainfall as well as important crops sown. These are: Sub-tropical, low hill zone, sub-tropical mid-hill zone, temperate wet high hill zone, and temperate dry high hill zone (Table 3.10). Due to varied geological formations, topography, climatic conditions and altitudinal changes, Himachal Pradesh has a vast repository of floral and faunal species. As many as 3,256 floral species are found in Himachal Pradesh, consisting of ferns, higher plants, fungi, mosses and lichens (out of the total of 47,000 species found in India). In addition, the State also harbours rich and unique fauna with 5,721 species of fauna (out of a total of 89,451 species found in India). The state has the largest population of Chir pheasants in the world. (Table 3.7).

The state is endowed with a variety of medicinal and aromatic plants (MAPs) which are used by local communities, and in other parts and regions in many ways. There are approximately 187 species of MAPs in Himachal Pradesh. The altitudinal variations also influence the agricultural and horticultural crops found in the State (Table 3.13 and Table 3.18). The State also has an abundance of fish (Table 3.24).

The biodiversity of the State faces a number of direct and indirect threats. According to the Himachal Pradesh Forest Department, 57 species of MAPs have gone threatened due to unscientific extraction.[2]. In addition, HPSBB has also released a list of 16 threatened faunal species[3]. A number of floral and faunal species have been included in IUCN Red List (Table 3.8).

Key direct threats faced by the biodiversity in the State:

i. **Human-wildlife conflict:** In Himachal Pradesh, the threats due to HWC revolve around livestock predation, crop raiding, attack on humans, and wildlife strolling in human settlements. There have been reported attacks by monkeys, wild bears and leopards on agro-pastoralists, agricultural fields, and livestock (Table 3.28).
ii. **Unscientific extraction of medicinal and aromatic plants:** Illegal and unsustainable collection and marketing have been seen as a major threat to MAPs in Himachal Pradesh. The unscientific extraction of medicinal plants has led to failure of regeneration of plants

[2] https://hpforest.nic.in/files/ANNEXURE%20-%20I.pdf
[3] http://www.hpbiodiversity.gov.in/BMC/Proceeding%20Threatened%20Animal.pdf

in their natural habitat. Over-extraction of plants also leads to soil erosion and landslides (Table 3.29).

iii. **Climate Change:** According to CRGGS (2015), there has been an increase in annual mean temperature in HP by 0.02 °C/year and a decrease in annual average rainfall by 3.26 mm/year. There has also been a decrease in snowfall received in the State. These fluctuations in temperature and precipitation have had an impact on agricultural productivity, flowering period and decline in the area of traditional crops (Table 3.30).

iv. **Forest Fires:** The peak fire season in the State is in the months of March to June. MoEF&CC and the World Bank (2018) estimated that reported monetary losses due to forest fires in the state was Rs. 134.78 lakhs in the year 2016 and Rs. 113.27 lakhs in 2015. Forest fires result in reduced density as well as basal area of Chir Pine trees in fire affected areas. The fires are also a major source of carbon emissions leading to changes such as reduced photosynthesis activities (Table 3.31).

v. **Illegal Hunting and Wildlife Trade:** There are several routes for illegal wildlife trade which are reported to be operating in HP, the main exit points of which are: Border areas of Leh-Ladakh, Chamba and Pathankot as well as Tiuni-Vikasnagar in Uttarakhand (Chauhan, 2018). Poaching disrupts the population of species which further disturbs the food chain as the population of immediate next wild animal would increase. Hunting of animals impacts nature-based tourism negatively. This impacts livelihood of locals (Table 3.32).

Key indirect threats to biodiversity in Himachal Pradesh:

i. **Climate Change:** The Himachal Pradesh Strategy and Action Plan on Climate Change (2012) notes that the State is highly vulnerable to climate change. Climate change leaves farmers vulnerable to crop losses due to fluctuations in temperature and precipitation. Similarly, change in climate encourages growth of invasive species which ultimately affects the biodiversity composition of an area. Climate change and forest fires also have a vicious circle which is difficult to disrupt. Climate change causes forest fires; forest fires increase carbon emissions and reduce the carbon storage capacity of an area, thereby worsening the climate change (WWF, 2020).

ii. **Pressure on Pastureland due to overgrazing:** Overgrazing is not only impacting the native grass species but also habitat of wild animal species in HP: ibex (*Capra ibex sibirica*), brown bear (*Ursus arctos*), himalayan tahr (*Hemitragus jemlabicus*), and musk deer (*Moschus moschiferus*) (Greentumble, 2017; Saberwal, 1996). Continuous grazing has also given rise to a number of invasive species such as *Rumex nepalensis* is found in Dharampur area due to overgrazing by sheep and goat (Saberwal, 1996). The Restoration Opportunities Atlas by WRI (2018) has identified grazing as one of the potential risks to land degradation in HP.

iii. **Mass Tourism:** Tourism sector provides more than 4 lakh jobs and generates 8 to 10 per cent of the GSDP in HP (Shukla, 2017). The high dependence on tourism has led to issues like water scarcity and traffic congestion in the State. Apart from this, there are negative

impacts on biodiversity due to improper disposal of waste, increased construction in the fragile landscapes, land clearing for construction, excessive fuel wood collection.

Keeping in view the status, trends and threats to biodiversity in the landscape, the Biodiversity Strategy and Action Plan (BSAP) has been presented in nine themes (Table 4.1):

1. Wild Flora and Fauna
2. Agriculture and Biodiversity
3. Animal Husbandry
4. Aquatic Biodiversity
5. Microbial Diversity
6. Tourism
7. Economic valuation and Natural Capital Accounting
8. Education, Awareness, and Training
9. Policies, Laws, and Institutions

A thematic summary of recommendations and action points:

1. Wild Flora and Fauna:

i. **Protected Areas:** There is a need for re-strategizing of PAs through spatial analysis for determining changes in forest cover of PAs using remote sensing applications. There is also a need to adopt participatory resource management strategy across all the PAs within the state. For this, the state needs to undertake training and awareness campaigns for the local governance bodies and community members to identify the opportunities for networking in the context of biodiversity conservation.

ii. **Human-wildlife conflict:** Developing a comprehensive database for HWC along with the nature and extent of conflicts in the State is crucial. This will involve conducting district-wise scientific investigation on richness of wild animals in relation to habitat characteristics, land-use pattern and availability of prey species. Other key interventions would be: to plant more fruiting trees in forests to avoid raiding by animals in agricultural lands in search of food, identify zones and mark them as grazing, revive degraded pasturelands in uphill to provide grazing lands for wild animals such as Ibex and blue sheep, periodic clearing of shrubs to provide free movements of animals.

iii. **Forest Fires:** There is a need to strengthen data on forest fire, especially to document causes of increasing incidents of forest fires. The State also needs to conduct the gap analysis of current capacity of forest fire management in terms of fire stations, improved fire equipment and manpower, explore devising a Fire Danger Rating System to assess the effect of factors such as fuel, weather, topography, etc. on daily fire potential of an area, and provide training to local communities for prescribed burning.

iv. **Restoration Potential:** To achieve the restoration potential of the State, it should explore the suitability of ROAM methodology developed by WRI, as well as identify

native tree species and associated value chain of key tree species for livelihood diversification and income generation of local communities.

v. **Preparation of PBRs:** Preparation of PBRs should be expedited as per the mandate of Biological Diversity Act, 2002 and supplement PBRs with regular scientific surveys to timely update key threatened, critical, endangered, vulnerable and rare species.

vi. **Wildlife Crime:** To tackle the issue of wildlife crime, there is a need to identify gap in staff training and funding based on security audits, and design training modules for the enforcement agencies.

vii. **Invasive Alien Species:** There is a need to involve cottage industries and incentivize them to utilize invasive species. For example, *Lantana Camara* can be used as bioethanol fuel, fresh root of *Ageratina Adenophora* have antibacterial qualities.

viii. **Biodiversity Heritage Sites:** Biodiversity Heritage Sites (BHS) should be identified in the state with active involvement of local institutions and communities. For this, use GIS mapping to delineate the boundaries of such sites.

ix. **Database:** Database on ENVIS HP portal should be strengthened to make it a repository of credible data and knowledge on biodiversity to include endangered, extinct, rare, threatened, vulnerable species along with trends in species composition.

x. **In-situ Conservation:** The state needs to identify sites for restoration in light of conservation of native species and plan for long-term environmental monitoring. The traditional knowledge regarding crop breeding, especially for the crops of economic importance to help farmers.

xi. **Ex-situ Conservation:** The State should conserve genetic diversity of threatened flora and fauna in the State by strengthening seed banks for seed and germplasm collection.

xii. **Cultivation of MAPs:** A comprehensive focused program should be introduced to create value chain through partnership between industry and local communities for commercially viable species of (MAPs) which are on the verge of extinction due to unscientific extraction.

2. Agriculture and Biodiversity:

i. **Organic Farming:** There is a need to introduce a program to provide support to identified niche organic products such as peas, kala jeera, wild garlic, kuth, kutki in terms of branding, labelling and marketing.

ii. **Community Seed Banks:** There is a need to establish community seed banks to make local variety of seeds available to farmers and monitor quality seed production response to threats posed to plant genetic resources due to climate change.

iii. **Fodder Management:** There is a need to revive degraded pasturelands on regular basis with native species. It is recommended that the State establish fodder banks in alpine areas to help local communities in winter months and reduce pressure on grazing lands.

iv. **Irrigation:** The State must promote khuls (a traditional irrigation practice), rainwater harvesting, solar energy and pumps. The State should also revise small Hydro power policy to consider the issue of divergence of water from micro irrigation systems such as Kuhls.

v. **Agro-forestry:** The State can explore rehabilitation of degraded land via agro-forestry system in lines with existing crops and livestock needs. For this, the State will need to set-up high-tech nurseries in higher altitude regions to provide viable varieties of planting material for agro-forestry.

vi. **Bio-control agents:** Use of bio-control agents should be promoted and on-farm training should be provided to the farmers to ensure proper adoption of Pesticide Application Technology for minimum residue and reduced pesticide risk.

vii. **Adaptation towards climate change:** The State should explore the option of mapping fragile ecosystems and demarcating them as "No-go zones". Provisions should also be made for ensuring availability of drought resilient seeds, public health measures for heat-waves, cold-waves, vector-borne diseases, disaster risk reduction, water management as well as climate smart agriculture.

3. Animal Husbandry and Biodiversity

i. **Promoting genetic diversity:** Conservation and promotion of genetic diversity of indigenous animal species should be strengthened.

ii. **Stray Cattle Management:** There is a need to involve local level institutions and communities to ensure effective stray cattle management, as well as designing a mechanism to identify and punish defaulters who abandon their unproductive cattle.

iii. **Diseases among livestock:** The State needs to conduct studies to identify diseases, causes, as well as etiological agents of diseases including the impact of these diseases on bovines across all the districts.

iv. **Diseases among migratory livestock:** The State needs to make provisions for compulsory vaccination of cattle before they are taken for grazing uphill by nomadic/semi-nomadic community to avoid the spread of diseases like Foot and Mouth Disease.

v. **Yak Population:** Provisions should be made for facilitating artificial insemination using yak semen in the remote regions of the State to increase yak population.

vi. **Fodder Management:** The farmers should be trained in the process of improving nutritive value and taste of crop residues as feedstock. A 21-day treatment process organized by ICRISAT in Karnataka is a success story in this context.

vii. **Grazing Policy:** Formulation of a Grazing Policy is critical for outlining the guidelines for management and development of pastureland in the State.

4. Aquatic Biodiversity

i. **Wetlands:** There is a need to identify wetlands facing environmental degradation and develop site-specific action plan for restoration.

ii. **Revival of fish species:** There is a need to strengthen fish brood bank, especially for native species such as mahseer. The State should also explore the option of designating deep pools in rivers as fish sanctuaries in consultation with Fisheries Department.

iii. **Construction of dams:** The report recommends E-flows assessment to determine river health regime, periodic check on hydropower projects for compliance with lean season

water flow mandate downstream, and small adjustments in flow regime in hydel project during hydro peaking to conserve shoreline river bed habitat.

iv. **Fish Movement:** The State should mandate appropriate channels to check obstruction of fish movement and facilitate easy fish movement through dams.

v. **Pollution:** CPCB has identified 7 polluted river stretches in HP. To address this, there is a need to conduct the study to estimate the gap between total sewage generation and treatment capacity of STPs in the state to plan effective sewage management, identify locations to lay down additional pipeline to treat effluents before disposal in river and involve public in reporting discharges by default industries.

5. Microbial Diversity

i. **Microbial diversity database:** There is a need to document microbial diversity (in both aquatic and terrestrial ecosystem) across the State by preparing web-based curated microbial diversity database.

ii. **Application of microbes in farming:** There is a need to identify and strengthen measures for utilization of plant growth promoting microbes (PGPM) which can be used as a substitute to agri-xenobiotics.

iii. **Conservation of aquatic microbial diversity:** Microbial biodiversity should be included in the impact assessment of projects and indicators should be developed to monitor microbial diversity of the State.

iv. **Direct-fed microbes:** The State should explore the application of microbes (called Direct-fed Microbes) to augment indigenous cattle performance.

6. Tourism

i. **Ecotourism:** The State should undertake capacity building programme for local communities for "high-value-low impact" tourism. There is also a need to converge 'Ecotourism Policy' of the Forest Department and 'Tourism Policy' of the Tourism Department.

ii. **Carrying Capacity:** The State should undertake carrying capacity studies to limit the maximum number of tourists in the ecological fragile areas of the State.

iii. **Payment for ecosystem services:** The state can also explore the PES model of tourism which provides a fair and equitable mechanism to incentivize communities for biodiversity conservation.

iv. **Impact Assessment:** There should be a study regarding the impact of activities like trekking and camping on habitat disturbances, solid waste accumulation, water pollution and air pollution.

7. Economic Valuation and Natural Capital Accounting:

i. **Economic Valuation of Biodiversity:** There is a need to focus on economic valuation of bio-resources for ABS mechanism. The state should support studies for measurement of economic valuation of bio-resources of the State for appropriate benefit-sharing.

ii. **Natural Capital Accounting:** The State should explore the application of Natural Capital Accounting to all the sectors in HP.

8. Education, Awareness and Training:

i. **Environmental Education:** The State should mainstream environmental studies in education to increase awareness about biodiversity conservation.
ii. **Awareness through communication media:** The State should promote awareness regarding topics related to biodiversity using short films, documentaries, besides stories in print media.
iii. **Community Based Natural Resource Management:** There is a need to promote collaboration between institutions such as self-governing bodies such as Praja Mandals, Panchayat, VDFCs, JFMCs, local administration, research institutes and NGOs.
iv. **Development of Portal:** A portal for documenting and sharing national and international best practices to relevant functionaries and stakeholders should be developed.

9. Policies, Laws and Institutions

i. **Procurement of green products:** The State should develop sustainable public procurement manuals for line departments to encourage procurement of green products based upon life-cycle costing.
ii. **Community Participation:** The State should explore the suitability of Adaptation Coalition Framework (ACF) to create community institutions with the mandate of increasing resilience to climate change over the long-term. This can be done by facilitating coalitions/alliances of local communities and mobilising local assets including human, social and financial.
iii. **Investment in Agricultural Research:** There is a need to increase investment in agricultural research, infrastructure and technology development as well as plant gene banks.
iv. **Regional Cooperation:** There is a need to promote regional cooperation between Himalayan States by strengthening existing mechanisms and explore possibility of new agreements.

The second objective of the study was to develop a resource mobilisation strategy for implementation of SBSAP in HP. The following figure gives a brief description of the elements of resource mobilisation strategy:

Source: Author's Construct

Biodiversity Expenditure Review (BER) is a standard tool used to map the sources and amount of funds flow towards biodiversity and ecosystem conservation and protection. Biodiversity expenditure can be direct (restoration, tree planting and other conservation and protection activities) or indirect (training awareness building of stakeholders, research, measuring and mapping of biodiversity etc.). Similarly, expenditure on biodiversity can be to achieve one or more goals of CBD or achieve one or more NBTs (Table 5.1).

Key results of BER (Table 5.3 to 5.5):

i. The BER analysis shows that in HP, while the number of biodiversity relevant schemes has increased from 77 in 2011-12 to 189 in 2016-17; biodiversity relevant expenditure has increased from Rs. 159.33 crore in 2011-12 to Rs. 457.35 crore in 2016-17 and is projected to increase to Rs. 741.87 crore in 2020-21.

ii. The detailed analysis shows that while some aspects of conservation have received the required policy and programmatic focus along with adequate funding, in some areas increase in both the policy focus and funding is necessary. For instance, while a significant share (over 31-68%) of the total biodiversity attributable expenditure is on 'protection' of biodiversity in the state; expenditure on restoration has been low (3.16-5.17%) especially when compared with restoration needs in the state. This calls for a greater policy focus and additional funding on restoration. Similarly, additional funding will be required in other key areas such as management of HWC, livelihood support, adequate compensation of farmers as an incentive for wild biodiversity conservation, training and awareness etc.

Mapping of current sources of revenues from biodiversity shows a lot of untapped potential. In this context the following suggestions are made:

i. **Effective Implementation of ABS**: Corporations utilizing bio resources of the State should be persuaded to share the benefits accrued with the State. There should also be a detailed assessment of ABS potential and the challenges in its implementation with the help of subject experts. State should encourage Bio prospecting proactively.

ii. **Environment Fund:** It was established in 2008 to be serviced mainly with donations. This fund needs to be revived and strengthened through mobilization of steady flow of funds. The following may be explored in this context.
    a. **Specific share of Compensatory Afforestation Fund:** The State should explore the possibility of earmarking a specific amount of CAMPA for conservation and restoration of biodiversity, specifically for restoration of endangered and threatened species. Earmarked amount could be transferred to the Environment Fund
    b. **Utilizing District Mineral Foundation Fund:** Currently the State has Rs 96.49 crore in DMF which, among others, can be used for control of pollution. The State should also explore the possibility of earmarking a part of DMF which could be transferred to the Environment Fund, to be utilized for conservation and restoration purposes.
    c. **Entry Fees:** The State already collects entry fees for ecologically fragile areas. Part of this fees could be earmarked for maintenance of biodiversity in the area.

iii. **Increasing the Involvement of Traditional Governance Systems:** Traditional systems like Praja Mahila Mandal should be encouraged and empowered to take actions for conservation of biodiversity like imposing ban on environmentally harmful activities, implementing fees and fines for behavioural changes among people towards sustainable practices.

Resource mobilisation: Details of finance needs assessment are outlined in Table 7.1. The total additional funds required for implementation of SBSAP in the state is estimated to be Rs. 51.795 crore per annum.

We suggest the following seven strategies in mobilising these additional funds:

1. Leveraging Existing Sources: The State should focus on mobilising resources through CAMPA, MGNREGA, PKVY, RKVY, KUSUM, NMSA and others (details in Chapter 7 of the report). SBB should build on the identified linkages and synergies between SBSAP and several programs and schemes currently being implemented in the state. Accordingly, the relevant line departments should be convinced to incorporate identified action points in their annual programs. An inter-departmental group set up for this purpose will be necessary in drawing up an annual or multi-year plan before the budgets of the line departments are finalised.

2. Rationalisation of User Charges of Protected Areas and CSR: There is a need to revise the entry fees commensurate with the demand for the PA and the pristine nature and services it offers and establish a Local Trust Fund for each PA. The state should explore levying a conservation cess on tourism activities in 4 to 5 sq km area around PAs for augmenting the receipts of the Local Trust Fund.

Long gestational period, poor awareness, and intangible results are reported to be partly responsible for poor mobilisation of CSR funds for conservation of biodiversity. SBB needs to strengthen awareness strategies and also develop a pipeline of projects in priority areas in collaboration with IBBI and other such associations and federations.

3. Levy a Charge on Identified Sectors: It is recommended that upto 50 per cent of the annual accruals in LADF and DMF be earmarked for biodiversity conservation which could be routed

through the existing Environment Fund. The State should also explore the option of levying a biodiversity cess @ 5 – 8 per cent on revenue from tourism activities (irrespective of the department involved).

4. ABS: This is a highly underutilised source of revenue in the country and HP is no different. There is a need for a detailed study on potential of ABS and challenges in implementing ABS in HP. It is an important tool for mobilising conservation funds at the same time ensuring its equitable distribution of benefits of conservation and sustainable use of resources. State should encourage Bio prospecting proactively.

5. Payment for Ecosystem Services: It is a market-based mechanism which has the potential to link up geographically disparate providers and beneficiaries as some ecosystem may be generated at one place, and benefits may be felt at considerable distances from their point of origin.

It provides an opportunity to put a price on un-priced ecosystem services like climate regulation, water quality regulation and the provision of habitat for wildlife and, in doing so, brings them into the wider economy.

In HP, under 'Policy to institutionalize Payments for Ecosystem Services' 2013, the ecosystem services eligible for PES include soil erosion control, sediment load reduction, fire control, discharge of water in streams and springs especially potable water, carbon sequestration, rehabilitation of weed infested areas, organic and conservation agriculture, conservation horticulture, pollination and biodiversity conservation.

Potential funders for PES: International donors, impact investment funds, private donors.

6. Carbon Credits: Carbon credits create a market for reducing greenhouse emissions by giving a monetary value to the cost of polluting the air. NITI Aayog has estimated that India can access USD 50 60 billion worth of carbon credits if it propagates natural farming and agroecology. Pangi in Chamba and part of SECURE Landscape practices natural farming, State may look for such environment friendly practices and initiatives register them. The restoration programme for landscape is potentially a good source for earning carbon credits for the State.

7. Fintech: These instruments have the potential to increase the breadth and depth of conservation finance. Fintech reduce transaction cost and improve economic efficiency. The use of technology reduces the cost of transaction, credit investigation, resources matching and help overcome the scale issues. These work well at the retail level and bring overall efficiency. There are several success stories available around these. SBB should explore this in addressing man-animal conflicts.

Chapter 1: Overview of International Conventions and Legislative and Policy Actions for Biodiversity Conservation in India

1.1 Background

India, a mega diverse country with only 2.4 percent of the world's land area, harbors 7-8 percent of all recorded species, including over 47,000 species of plants and 96,000 species of animals. Of the 34 global biodiversity hotspots, four are present in India, represented by the Himalaya, the Western Ghats, the North-east, and the Nicobar Islands.

India recognizes that human survival and well-being and millions of livelihoods in the country depend upon biodiversity and healthy ecosystems and the goods and services they provide. Therefore, protection, and conservation of biodiversity and ecosystems is of paramount importance in India.

However, the country's biodiversity faces a variety of threats — caused by various anthropogenic activities — ranging from land use changes in natural habitats to overexploitation of natural resources, proliferation of invasive species, and climate change. This calls for effective and urgent action to halt the loss of biodiversity in order to ensure that ecosystems are resilient and continue to provide essential services.

Threats to species and ecosystems are not unique to India but are prevalent in countries all over the world. This recognition culminated into The Convention on Biological Diversity (CBD) — which was one of the three Conventions of the Rio Earth Summit in 1992.

1.2 The Convention on Biological Diversity (CBD), Biological Diversity Act 2002 and National Biodiversity Action Plan (NBAP), 2008

The CBD is a multilateral treaty, entered into force on 29 December 1993. Its objective is to develop national strategies for the conservation and sustainable use of biological diversity. The 2050 Vision for Biodiversity was adopted as part of the Strategic Plan for Biodiversity 2011- 2020. The Strategic Plan for Biodiversity 2011-2020 consists of five strategic goals and twenty Aichi Biodiversity Targets (ABTs).

India, as a signatory party to the CBD, has proactively taken a range of legislative, policy, and institutional measures to fulfill its mandate and go beyond it in order to tackle the existing and emerging threats to biodiversity and the environment -- of which the following measures need to be emphasized:

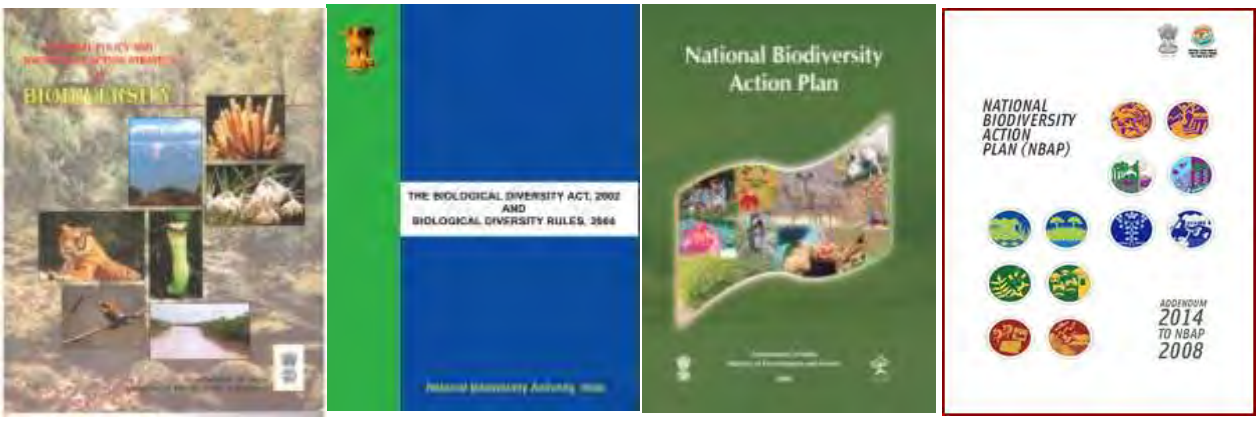
i. India developed a 'National Policy and Macro level Action Strategy on Biodiversity' in the year 1999. Subsequent to this, The National Environment Policy (NEP), 2006 which has been put in place to mainstream environment -- including biodiversity -- in development planning processes.
ii. India was one of the first countries to enact a comprehensive Biological Diversity Act in 2002 (BDA, 2002), to implement the provisions of the CBD. This is being implemented through a three-tier structure, National Biodiversity Authority (NBA) at the national level, State Biodiversity Boards (SBBs) at the provincial level, and Biodiversity Management Committees (BMCs) at the local level.

iii. India's NBAP, 2008, was developed prior to the formal release of CBD Strategic Plan for Biodiversity 2011-2020 and associated Aichi Biodiversity Targets. The NBAP was formulated through a comprehensive inter- ministerial process and approved by the Government of India in 2008. Subsequently, as part of the preparation of India's Fifth National Report to the CBD (NR5) and updating of NBAP 2008, India developed 12 National Biodiversity Targets (NBTs) in harmony with the Aichi Targets (Addendum 2014 to NBAP, 2008).

Table 1.1: CBD Strategic Goals, Aichi Targets and India's NBTs

	Strategic Goal				
	A	**B**	**C**	**D**	**E**
CBD Strategic Goal	Address underlying causes of biodiversity loss by mainstreaming biodiversity across government and society	Reduce direct pressures on biodiversity and promote sustainable use	Improve the status of biodiversity by safeguarding ecosystems species and genetic diversity	Enhance the benefits to all from biodiversity and ecosystem services	Enhance implementation through participatory Planning, knowledge management and capacity building
NBTs	(1,2,10)	(3,4,5,6)	(6 & 7)	(3,8,9)	(10,11,12)
Aichi Targets	1,2,3&4	5,6,7,8,9 & 10	11,12 & 13	14,15 & 16	17,18,19 & 20

Figure 1.1: Legislative and Policy Actions for Biodiversity Conservation



(1999) (2004) (2008) (2014)

1.3 Linkages of NBTs with Sustainable Development Goals

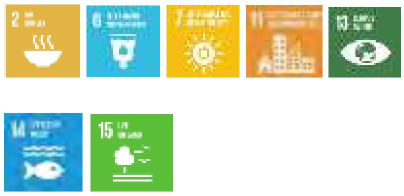
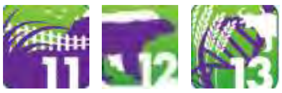
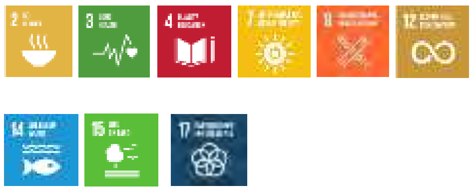
Under the 2030 Agenda, a series of 17 global Sustainable Development Goals (SDGs) have been agreed that are to be universally achieved. Although both NBTs and SDGs are not legally binding, governments are expected to establish national frameworks to achieve the goals and observe a reporting requirement. Biodiversity and ecosystems feature prominently in the 2030 agenda.

Almost all of the SDGs are relevant to biodiversity conservation although SDGs 13 (combating climate change) and 14 and 15 (marine and terrestrial biodiversity and ecosystems) have

stronger biodiversity conservation linkages. Linkages between NBTs, ABTs and SDGs are depicted in Table 1.2

A coordinated implementation of SDGs and NBAP and state level BSAPs will provide a tremendous opportunity to mainstream biodiversity in key national and sub-national development policies thereby setting up a robust policy, institutional and financial environment in achieving these interdependent goals and targets.

Table 1.2: Linkage of NBTs with ABTs and SDGs

India's National Biodiversity Targets	Aichi Biodiversity Targets	SDGs
		
		
		
		
		

Source: India's 6th National Report to the CBD (2018)

1.4 Linkages and Synergies between NBTs and NDCs

In 2015, 196 countries came together to sign the historic Paris Agreement, guided by the United Nations Framework Convention on Climate Change (UNFCCC), in order to deal with global warming impacts. Countries submitted their Intended Nationally Determined Contribution (INDC) to the UNFCCC which outlines their commitments to reduce greenhouse gas emissions and strengthen resilience to climate change.

India too signed the agreement and ratified through approval from the Union Cabinet on 2nd October 2016. NDCs committed and ratified by India are in Box 1.1. Almost all of the NDCs are relevant to biodiversity conservation although NDC 5, 6 and 7 have stronger biodiversity conservation linkages. Also, the National Action Plan on Climate Change (NAPCC) in India which is implemented through eight National Missions has strong focus on Biodiversity conservation.

Box 1.1: Biodiversity focus in NDCs Committed and Ratified by India

1. To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.
2. To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
3. To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.
4. To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030 with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF).
5. **To create an additional carbon sink of 2.5 to 3 billion tons of CO_2 equivalent through additional forest and tree cover by 2030.**
6. **To better adapt to climate change by enhancing investments in development programs in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management**
7. **To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.**
8. To build capacities, create domestic framework and international architecture for quick diffusion of cutting-edge climate technology in India and for joint collaborative R&D for such future technologies

1.5 Rationale for and Scope of Himachal Pradesh State Biodiversity Strategy and Action Plan (SBSAP)

It has been increasingly recognized by both the member countries and the CBD that the Sub-national BSAPs are necessary for effective conservation and management of biodiversity as each state may have a different connect of biodiversity with human well-being as well as states' developmental priorities. Further, unique features of the state, land use patterns and practices, and institutional and policy arrangements for governance of biodiversity and natural resources may require a state specific BSAP.

Thus HP BSAP (SBSAP) will ideally have elements of NBAP relevant for the Himachal Pradesh; and strategies and action plan necessary to address the pressures and resulting decline and loss of biodiversity unique to the state.

In HP, its first BSAP was prepared in 2002. This report had at least three key achievements: (i) it carried out extensive mapping of biological diversity in the state, both wild and cultivated/domesticated, found in the different eco-regions of the state, based on available scientific studies and knowledge, (ii) a thorough grass-root consultative process was followed in the form of meetings and interactions with different stakeholders, and (iii) it outlined strategies and an action plan for biodiversity conservation.

In 2010, new guidelines for regional and National BSAPs were framed at the Nagoya 10th CoP Summit. For achieving this, it was decided by the central Ministry of Environment and Climate Change (MoEF&CC) to prepare an addendum to India's NBAP and various states (state biodiversity boards) were asked to prepare state BSAPs to include the concerns of

various CBD CoP meetings, and to align the BSAP of the state according to the 2011-20 commitment of the country towards CBD.

Keeping in view recent data, knowledge, and experience, this study has been launched for refining and updating BSAP, 2002 under the GEF funded and UNDP managed SECURE Himalaya Project in the state.

The updated SBSAP will have the following new elements and components:

- Identification of regulatory, institutional, and finance gaps in implementation of existing SBSAPs
- Periodic monitoring and evaluation framework
- Suggestions for mainstreaming and coordination with other flagship programs
- Resource mobilization strategy for implementation of SBSAP

1.6 Key Objectives of the Study

1. To update the existing Biodiversity Strategy and Action Plan (BSAP) of Himachal Pradesh based on current state priorities and in alignment with national and global priorities of biodiversity conservation and wildlife protection.
2. To develop a resource mobilization strategy for implementing BSAP in Himachal Pradesh.
3. Prepare process document for implementation of two financial solutions for conservation of snow leopard landscape; namely Lahaul – Pangi and Kinnaur Landscape[4].

[4] Analysis and results pertaining to this objective and a BSAP for Lahaul – Pangi and Kinnaur Landscapes are put together in a separate report (Pandey Rita et al, 2021) as per the advice of the Project Management Unit.

Chapter 2: Overview and Process Documentation

2.1 Vision and Guiding Principles

The vision of SBSAP is same as the CBD strategic vision -- "Living in harmony with nature" where "By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people."

i. The SBSAP should address all three objectives of the Convention on Biodiversity (CBD) and the NBAP, namely:
   - Conservation of biodiversity
   - Sustainable use of the components of biodiversity
   - Fair and equitable sharing of the benefits deriving from the utilization of genetic resources.

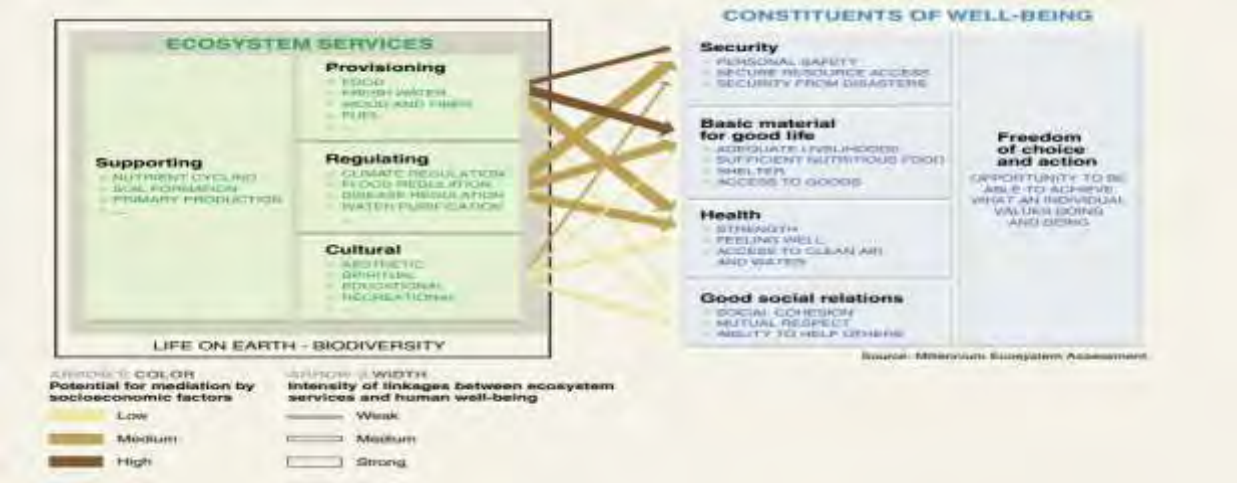
ii. SBSAP should recognize the contribution of biodiversity and ecosystem services for human well-being and poverty eradication, besides their valuable contribution to economic, social, and cultural development of people dependent on them. ***Therefore, BSAP should seek to maintain this fundamental connect with biodiversity and ecosystems*** (see Figure 2.1)**.**

iii. Only a participatory approach, where all stakeholders work together to support and conserve the wealth of biodiversity, can bring the desired success. In order to be effective, it is important that the SBSAP be jointly developed, adopted, and owned by the key stakeholders including those who may have stakes or rights with regard to biodiversity.

iv. SBSAP should emphasize the need for biodiversity conservation to be a significant consideration in socio-economic development strategy of the state and ***thus mainstreaming of biodiversity into sectoral and cross-sectoral decision-making at the policy and programmatic planning and budgeting level*** especially in the context of achieving the SDGs and NDCs.

v. The strategy ***should suggest and construct appropriate coordination and reporting arrangements as well as monitoring and evaluation frameworks.***

Figure 2.1: Linkages between Ecosystem Services & Human Well-being*



Source: Millennium Ecosystem Assessment, 2005.[5]

***** It depicts the strength of linkages between categories of ecosystem services (supporting, provisioning, regulating, and cultural) and components of well-being (security, basic material for good life, health, good social

[5] Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC.

relations, freedom of choice and action). In addition to the influence of ecosystem services on human well-being, it also shows how ecosystems are in turn affected by changes in human well-being.

2.2 Methodology and Process

In fulfilling the objectives of the study outlined in Chapter 1, and to encompass the vision and guiding principles of BSAP as above (Section 2.1), the following methodology and approaches have been adopted by the team.

2.2.1 Key process details

While detailed methodology for different components and themes of the study has been discussed in relevant chapters in the report, a snapshot of the process is given below:

1. Review of existing SBSAPs and rapid assessment of the gaps in implementation

Rapid assessment of BSAP, 2002 was undertaken with the following key objectives:

- Understanding the institutional, financial and programmatic arrangements put in place for implementation of the BSAPs and the barriers therein, and;
- The progress made so far with respect to achieving the listed actions/targets.
- Any gaps in coverage of issues, threats and practical solutions.

Information has also been elicited through questionnaires and detailed one-on-one and group discussions with the Himachal Pradesh State Biodiversity Board (HPSBB), relevant line departments, subject experts, research organizations, district and Panchayat level officials, civil society organizations and communities. Comparison of the existing BSAP action plans with the programs and schemes implemented in the state for biodiversity conservation and preservation in assessing the status of implementation of the same has also been carried out.

Box 2.1: Key Steps

1. Review of existing SBSAPs
2. Rapid assessment of gaps in existing SBSAPs
3. Review of key policies and programs relevant for the study
4. Identification of key stakeholders (government, private, research, specialized institutions, communities)
5. Mapping linkages with SDGs and NDCs
6. Review of existing literature relevant for the study
7. Field level one-on-one and group consultations with key stakeholders
8. Mapping budgetary fund flows for biodiversity
9. Mapping budgetary revenue receipts from biodiversity
10. Estimating gaps in funding
11. Resource mobilization strategies

2. Linking existing BSAP with NBTs, NDCs and SDGs

These linkages were mapped in order to identify the synergies and potential entry points for coordination and mainstreaming.

3. Desk-based assessments

We have also collected, compiled & reviewed state budgets of various years, annual reports, policies, peer-reviewed scientific publications and other literature relevant and important in this context. Desk assessments included the following:

i. A review of the status and trends of biodiversity and biological resources in the state;
ii. A review of the drivers of biodiversity loss. Both direct drivers (such as land use change, invasive species, over-exploitation of resources, pollution) and indirect drivers (such as changes in human population, livestock population, and climate change);

iii. A review of the framework of biodiversity relevant laws, policies, programs, and expenditures in the state and an assessment of any gaps;
iv. The relevant public institutions;
v. Literature and statistical surveys through secondary literature

4. Field level consultations and other assessments

i. Consultative meetings with representatives of Forest Departments, State Biodiversity Board, key government departments relevant for conservation of biodiversity, institutions associated with implementation of BSAP, state level institutions, universities, district and village level institutions and officials, and other stakeholders to get insights into any policy, institutional, capacity or technical gaps in current BSAP due to changing development and other priorities of the state as well as any new challenges and threats to biodiversity;
ii. Field trips for holding of public meetings;
iii. Discussions with local experts and knowledgeable individuals;
iv. The status, sources and potential sources of biodiversity financing in the country;
v. Gaps and unmet needs, and resource mobilization strategies.

A snapshot of the meetings held is given in Table 2.1. For details, see Annexure 1.

Table 2.1: Snapshot of meeting and consultative workshop in HP

S. No.	Particulars	Date	Participation
1.	Roundtable and small group meetings	December 2018	Department of Forest, HP State Biodiversity Board Department of Animal Husbandry, Department of Agriculture, Department of Horticulture, Himalayan Forest Research Institute
2.	Questionnaires sent to line departments via email, post and fax	Sent – April – May 2019 First round of follow-ups – May – July, 2019 Second round of follow-ups – August 2019	Department of Horticulture, Department of Agriculture, Department of Forest, Department of Health and Family Welfare, Department of Irrigation, Department of Rural Development, Department of Tribal Development, Department of Urban Development, Department of Tourism, HP State Biodiversity Board, Department of Animal Husbandry, Police, Department of Education, Directorate for empowerment of SCs, OBCs, Minorities Affairs and Specially Abled
3.	**Six** One on one meetings with Department Officials	16th May 2019	Department of Forest, SBB, Department of Irrigation and Public Health, Department of Agriculture, Department of Tribal Development, Department of Rural Management and Development
4.	Consultation Workshop at Kilar, Pangi	25th September 2019	53 participants from community, Representatives from local bodies like Panchayat, Mahila Mandal, Praja and line departments BMCs, Department of Animal Husbandry, Tribes Advisory Council
5.	**Nine** one to one meetings with Department officials and representatives from local bodies	24th September, 2019 and 26th September, 2019	Department of Forest, BMC Mindhal, Agriculture Development Officer, Block Development Officer, Panchayat Pradhan of Pangi, Karyas, Lujh, Naib Tehsildar, Kilar, Mahila Mandal Pradhan, Pangi.

Consultation workshop organized by NIPFP at Kilar, Pangi

(25th September, 2019)

Chapter 3: State Profile, Drivers of Change and Gaps in Biodiversity Conservation

3.1 State Profile

3.1.1 General Profile and Physiological Features

Himachal Pradesh is a mountainous state that lies in the Western Himalayas, extending over a geographical area of 55, 673 sq. km (FSI, 2019). The state is characterised by fragile landscapes, rich biodiversity and ecosystems supporting livelihood of local communities and providing a source of revenue to the State Government.

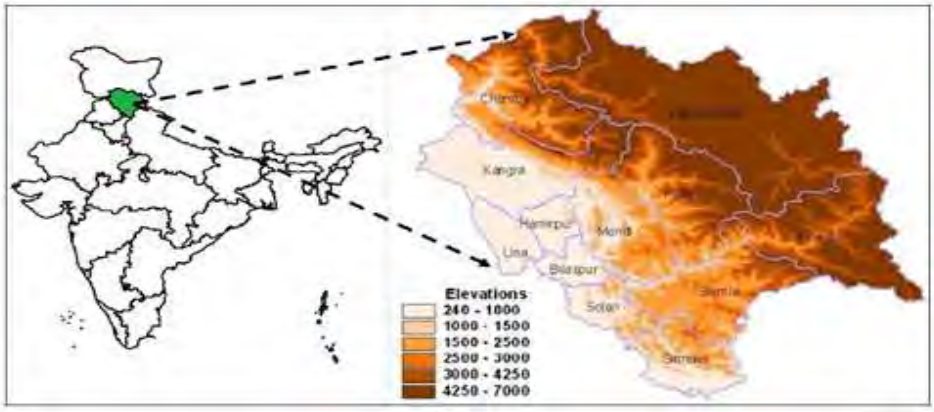
The state has elevation ranges from 350 m to 6816 m (Jaswal and Bhan, 2015) and is divided in three regions, topographically, namely Shiwalik (outer Himalayas), the lesser Himalayas (middle Himalayas) and the greater Himalayas. The elevation of the range is about 1000 m and stretches for about 70 Km. The middle or lesser Himalaya covers major part of the state and has high-altitude board-leaved and conifer forests, alpine meadows, major hill stations and covers major part of the state's land under horticulture. The Greater Himalaya constitutes trans-Himalayan cold desert areas of Himachal Pradesh and lies further north of the lesser Himalayas. This range has thin vegetation as well as human population density due to glaciated landscape. A glance of the state is presented in Box 3.1.

Box 3.1: Himachal Pradesh - Key Features

Geographical location: 30°22'40" N to 33°12'40" N Latitude and 75°47'55" to 79°02'20" E Longitude
Human population: 6,864,602 (89.97 Rural; 2011 Census)
Population Density: 123 per km^2
Sex Ratio: 972
Literacy Rate: 82.80 %
Livestock population: 48.44 Lakh
BPL households (rural): 25% of total rural households

Source: Compiled by NIPFP from various sources

Figure 3.1: Elevation Map of Himachal Pradesh



Source: Jaswal & Bhan (2015).

3.1.2 Other Physiological Features

1. Land Use

The total geographical area in the state is 5.5673 mha with 3.70 mha of land under forest. Of the total 6,20,700 ha of cultivable area, 5,38,412 ha is net sown area. Net irrigated area in the state is 1,09,452 ha (Table 3.1).

Table 3.1: Land-Use Pattern in Himachal Pradesh

Content	Area (ha.)
Total Geographical Area	55,67,300
Barren and Uncultivable Lands	7,83,404
Land Put to Non-Agriculture Use	3,48,649
Permanent Pastures and Other Grazing Lands	15,03,833
Land under Misc. Trees Crops not Included in Area Sown	68,391
Cultivable Waste Lands	1,28,224
Other Fallow Lands	22,109
Current Fallows	59,991
Net Area Sown	5,38,412
Total Cropped Area	9,40,597

Source: Department of Agriculture, Himachal Pradesh

2. Soil

In a mountainous state like Himachal Pradesh, soil type varies across different altitudes with different climatic conditions. The classification of soil in the state is done in two categories: Brown Hill soil and Sub-Montane soil. The brown soil is found in Shiwalik and the lesser Himalayan region covering 42.16% of the state's area. The sub-montane soil characterizes the Middle and Greater Himalayan zone covering 46.07% of the state's area whereas eternal snow and glacial types of snow cover an area of 11.77%.

The soil resource mapping has been done by NBSS & LUP in the Northern Region where 8 land capability classes have been developed with guiding principle as follows: cultivation should be restricted between capability classes I to IV, horticulture as well as grazing between V to VII, forestry to class VII whereas class VIII should be utilized for conservation and restoration. The soil in Himachal Pradesh is interpreted across 5 Land Capability Classes out of the 8 outlined (Table 3.2).

Table 3.2: Land Capability Classes of Himachal Pradesh

Land Capability Class	% of Total Geographical Area covered	Suitability of land
III	6.7	Fairly good land for cultivation of climatically suited crops
IV	14.7	Moderately good land for cultivation of climatically suited crops
VI	23.1	Grazing, Forestry plantation and limited cultivation
VII	14.7	Grazing and Forestry
VIII	40.6	Wildlife, Recreation and Permanent Snow Cover

Source: State of Environment Report, Himachal Pradesh (2009)

However, unscientific cultivation on the slope and deforestation is putting strain on the soil and is resulting in sheet[6] and gully erosion[7]. The soil erosion status of northern states has been prepared by NBSS & LUP. The study shows that around 7% of the total geographical area in the state is experiencing an annual soil loss within the range of 5-10 tonne per ha., around 5% area is recorded with soil loss ranging between 10-15 tonne per hectare and 27% area has soil loss in >15 tonne per ha. which is further categorized into severe, very severe and extremely severe.

3. Lakes and Rivers

Due to good precipitation during summer as well as winter season, Himachal Pradesh has rich water resources in the form of perennial streams draining into rivers, glaciers, man-made reservoirs, lakes, water springs as well as sub-soil.

There are nine major river systems in the state (Table 3.3), however five river systems i.e., Sutlej, Yamuna, Beas, Ravi and Chenab drain more than 95% of the total catchment area in the state.

Picture 1 and 2: Chenab River on way from Manali to Pangi

Table 3.3: Catchment Area of Major Rivers in Himachal Pradesh

S. No.	Name of the River System	Area of Catchment (in Km^2)	Area (in %)
1	Sutlej	20,398	30.69
2	Beas	13,663	24.50
3	Chenab	7,850	14.20
4	Yamuna	5,872	10.60
5	Ravi	5,528	09.90
6	Indus	1,450	02.60
7	Markanda	360	00.60
8	Ganga	290	00.50
9	Ghaggar	262	00.50
	Total	**55,673**	**100.00**

Source: State of Environment Report, Himachal Pradesh (2009)

Besides the river systems, there are numerous man-made reservoirs as well as natural lakes. Some of them are presented in the Table 3.4.

[6] Sheet erosion is uniform removal of soil in thin layers by the forces of raindrops and overland flow. It can go unnoticed covering large areas of sloping land.
[7] Gully erosion is the removal of soil along drainage lines by surface water runoff.

Table 3.4: Lakes and man-made Reservoirs in Himachal Pradesh

Water Body	Name
Lakes	Suketi (Sirmour), Ghadasaru, Renuka, Khajjiar, Nako(Kinnaur), Lama, Bradasar (Shimla), Manimahesh, Karali, Kalasar, Chandranahan, Mahakali (Chamba), Surajtal (Lahaul & Spiti), Chandertal, Dal, Kumservali, Kaveri (Kangra), Prashar, Sukhasar (Mandi), Rewalsar, Bharigu, Kuntbhyo, Sareolsar and Mantalai (Kullu)
Man-Made Reservoirs	Pongdam (Kangra), Pandoh (Mandi) and Govindsagar (Bilaspur)

Source: State of Environment Report, Himachal Pradesh (2009)

4. Climate

Due to altitudes varying between 350 m to 6816 m, there is a considerable variation in distribution of temperature as well as rainfall in the state. The precipitation in the form of rainfall (70% of the precipitation) is received during July to September. At elevations above 1800 m, precipitation is received in the form of snowfall. The areas above the elevations of 3000 m receive an average of 3 m of snowfall during December to March and the reaches which are above an elevation of 4500 m remain under perpetual snow.

Temperature decreases from West to East. The hottest month is June, whereas January records the lowest temperature in a year. Humidity is high during monsoon months of July to September (76-95%). Three marked seasons of the year are:

Figure 3.2: Seasons in Himachal Pradesh

Source: State of Environment Report, Himachal Pradesh (2009).

The state is divided into 4 agro-climatic zones. The elevation ranges between 350-2200 m and above are detailed in Table 3.5. Besides, agro-climatic Zone-I covers High Hill Temperate Sub-zone which is Western Himalayan region under which Himachal Pradesh falls. There are two distinct regions: The High Hill Temperate region comprises of Lahaul and Spiti and Kinnaur districts and the Hill Temperate region comprises of Chamba, Bilaspur, Kullu, Kangra, Hamirpur, Sirmaur, Shimla, Una and Solan districts.

Table 3.5: Agro-Climatic Zones in Himachal Pradesh

Zone	Elevation (in meters)	% of total geographical area	% of total cultivable area	Major crops
Shivalik Hill Zone	350-650	35	40	Wheat, maize, paddy, gram, sugarcane, mustard, potato vegetables
Mid Hill Zone	651-1800	32	37	Wheat, maize, barley, black gram, beans, paddy, cash crops like off-season vegetables, ginger, seeds of temperate vegetables like root crops, cauliflower

Zone	Elevation (in meters)	% of total geographical area	% of total cultivable area	Major crops
High Hill Zone	1801-2200	35	21	Wheat, barley, lesser millets, pseudo-cereals like amaranthus and buckwheat, potato, maize, seeds of temperate vegetables like root crops, cauliflower
Cold Dry Zone	Above 2200	8	2	Wheat, barley, pseudo-cereals like amaranthus, buck wheat, seed potato, peas as green as well as seed purposes

Source: ENVIS, Himachal Pradesh (2016)

According to the report State Level Climate Change Trends in India (2013) by India Meteorological Department, HP has recorded the highest increase in summer mean maximum temperature (+0.06% °C/year) as well as winter mean maximum temperature (+0.06% °C/year) during 1951-2010 due to climate change.

With increase in temperature, apple production has been declining at the rate of 9.1 units per year in the last 23 years. Besides, a damage of Rs. 366 crore was inflicted due to drought in the state; the damage was also inflicted on agrobiodiversity and livestock.

3.1.3 Biodiversity Profile including Threatened Ecosystems and Species

1. Range of biodiversity

Due to varied geological formations, topography, climatic conditions and altitudinal changes, Himachal Pradesh has a vast repository of floral and faunal species. The range of biodiversity in the state is extensive, as it ranges from Sub-tropical, temperate, dry temperate to alpine region, where 95 percent of species are endemic and rest 5% are exotic species. Table 3.6 shows the state symbols of Himachal Pradesh.

Table 3.6: State Symbols of Himachal Pradesh


Western Tragopan


Snow Leopard


Pink Rhododendron

Source: Himachal Pradesh State Biodiversity Board

A snapshot of biodiversity has been outlined in the Table 3.7 below. Floral biodiversity in the state constitutes of Medicinal and Aromatic Plants (MAPs), forest vegetation, agricultural crops as well as wild fruits and wild ornamental plants. As many as 3,256 floral species are found in Himachal Pradesh, consisting of ferns, higher plants, fungi, mosses and lichens (out of the total of 47,000 species found in India). The vegetation consists of Moist Temperate Deciduous Forest, Ban Oak Forest, Rhododendron Scrub Forest and Himalayan Alpine Pastures. The mid and high hills are dominated by coniferous forest with Sal and Chir Pine as predominant species in dry deciduous.

The state harbours rich and unique fauna with 5,721 species of fauna (out of a total of 89,451 species found in India). The state has the largest population of Chir pheasants in the world. Mammals mostly include long tailed Himalayan Marmots, Himalayan voles and squirrels whereas herbivores include blue sheep, ibex, serow, musk deer, tahr, the barking deer, ghoral. Carnivores are rare and include brown bear, black bear, yellow throated martin, himalayan

weasel, wolf and stone martin whereas the snow leopard and common leopard are representative of larger cats in the state.

(Floral and Faunal diversity of Pangi, Chamba)

Table 3.7: Snapshot of the Biodiversity in Himachal Pradesh

Species	Number	Species	Number
Angiosperms	3120	Crustaceans	73
Gymnosperms (Conifers)	12	Annelids	60
Pteridophytes (Ferns)	124	Molluscs	73
Mammals	77	Acanthocephala	2
Birds	447	Nematodes	132
Amphibians	44	Rotifers	16
Fishes	83	Platyhelminthes	90
Bryozoa	2	Cnidaria	2
Insects	4362	Porifera	3
Arachnids	195	Protozoans	34
Myriopods	11		

Source: HPSBB; Himachal Pradesh Forest Sector Review (2000)

The state is endowed with a variety of medicinal and aromatic plants (MAPs) which are used by local communities in many ways. There are approximately 187 species of MAPs in Himachal Pradesh. According to the Himachal Pradesh Forest Department, 57 species of MAPs have gone threatened due to unscientific extraction.[8] (Table A2.1 in Annexure 2). In addition, HPSBB has also released a list of 16 threatened faunal species[9] (Table A2.2 in Annexure 2). A number of floral and faunal species have been included in IUCN Red List (Table 3.8).

Table 3.8: Threatened Species in Himachal Pradesh as per IUCN Red list

IUCN Category	Name of Faunal Species	Name of Floral Species
Critically Endangered	Kashmir Catfish (*Glyptothorax kashmirensis)*	Indian Gentian *(Gentiana kurroo Royle),* Spikenard *(Nardostachys jatamansi (D. Don) DC,* Costus/ Kuth *(Saussurea costus (Falc.) Lipsch),* Indian Napellus/ Mori *(Aconitum chasmanthum Stapf ex Holmes), White Himalayan lily (Lilium polyphyllum D.Don) (5)*
Endangered	Himalayan Mahseer *(Tor putitora),* Kashmir Gray Langur (*Semnopithecus ajax*), Wagur	Liverwort *(Aitchisoniella himalayensis),* Doon Cheesewood *(Pittosporum eriocarpum Royle), Stephensoniella* brevipedunculata*, Dalbergia congesta,* Smooth Angelica/ Dogri *(Angelica glauca),* Atish *(*Aconitum heterophyllum Wall. ex Royle*) (6)*

[8] https://hpforest.nic.in/files/ANNEXURE%20-%20I.pdf

[9] http://www.hpbiodiversity.gov.in/BMC/Proceeding%20Threatened%20Animal.pdf

IUCN Category	Name of Faunal Species	Name of Floral Species
Vulnerable	Snow leopard (*Panthera uncia*), Asla, Asian small clawed otter (*Aonyx cinereus*)	*Sewardiella tuberifera, Eleiotis rottlerin,* Snoutbean *(Rhynchosia heynei),* Heart-shaped Slipper Orchid *(Cypripedium cordigerum D.Don),* Violet Monkshood *(Aconitum violaceum Jacquem. ex Stapf) (5)*
Near Threatened	Tarai grey langur (*Semnopithecus hector*), *Neallogaster ornata*, Gangetic ailia, Siberian Ibex (*Capra sibirica*)	*Carex kashmirensis,* Santapau/Ranmung *(Vigna khandalensis),* Haines/Maesen *Cajanus cajanifolius, Webb Fir (Abies spectabilis)* , Jungli pyaz *(5)*

Source: IUCN Red list (accessed in March 2021)
Note: The figures in the bracket indicate the total number of species in each IUCN category.

In addition to this, a list of threatened animal species as notified by Himachal Pradesh State Biodiversity Board has been presented in Table A2.1 in Annexure 2.

2. Cultural/Social Linkages with Biodiversity

Local-level systems which are based upon traditional knowledge for managing natural resources have potential to improve the status of mountain ecosystems given that a considerable amount of ecologically sensible indigenous practices exist (Berkes & Folke, 1994). Linkages develop due to existence of resource dependency which relates local communities to the environment (Adger, 2000). Such linkages give rise to problems which are complex in nature and therefore, cannot be addressed in isolation. Hence, both social as well as ecological systems are combined to ensure sustainable development keeping in view biodiversity conservation as shown in the Figure 3.3.

Figure 3.3: Superimposition of Socio-cultural System on Relationship of Ecological and Economic System

Source: Singh (2006).

There is a close linkage between local communities and biodiversity surrounding them. Forests are rich in native as well as exotic species and provide not only fuel wood but also wood for making houses, furniture, agricultural implements, fibre, fodder, MAPs as well as a variety of other food crops and aromatic plants such as Dhoop and Juniper. Therefore, acknowledgment of such multiple values of biodiversity need to be accounted for in the state policies such that actions necessary for biodiversity conservation can be identified.

3.1.4 Administrative set-up and Natural Resource Governance

The state consists of 12 Districts, 3 Divisions, 71 Sub-Divisions and 109 Tehsils. From the point of view of development, the state is divided into 59 Towns, 78 Blocks, 3,226 Gram Panchayats as well as 129 Police Stations[10].

Box 3.2: Administrative Structure

State Capital: Shimla
Districts: 12
Tehsil: 169
Divisions: 3
Sub-divisions: 71
Police Stations: 129
Blocks: 78
Urban Local Bodies*: 54
Gram Panchayats: 3226
Villages: 20690
Towns: 59
Parliamentary Constituencies

- **Lok Sabha**: 4
- **Rajya Sabha**: 3

Assembly constituencies: 68

Source: Government of Himachal Pradesh, 2020
*Urban Local Bodies include Municipal Corporation, Municipal Councils, Nagar Panchayat and Cantonment Boards

1. Forestry

Forests and other natural ecosystems constitute approximately two-third of the state's geographical area and therefore, recognizing these natural resources becomes important not only for ecological well-being but also for social well-being. Forests play an important role in preserving Himalayan ecosystem and is an important source of livelihood for local communities. The forest cover in HP is 15,433.52 sq. km constituting 27.72 percent of the total geographical area (Table 3.9). For a detailed district-wise assessment for forest cover see Table A2.3 in Annexure 2.

Table 3.9: Forest Cover in Himachal Pradesh

Category	Area (sq. km)	% of area
1) **Geographical Area**	55673	100
2) **Recorded Forest Area (RFA)**	37,033	66.51
3) **Area under Tree Cover**	15,433.52	27.72
i) **Very Dense Forest**	3,112.71	5.59
ii) **Moderate Dense Forest**	7,125.93	12.80
iii) **Open Forest**	5,194.88	9.33

Source: State of Forest Report, Forest Survey of India (2019).

Himachal Pradesh is divided into four agro-ecological zones which differ in terms of their area, temperature, elevation, rainfall as well as important crops sown. All the zones are associated with different herbs, scrubs and tress species as presented in Table 3.10.

Table 3.10: Classification of Forest on the basis of Agro-ecological Zone

Zone	Forest type	Tree Species
Sub-tropical zone, low hill (up to 1000m)	Tropical mixed deciduous and thorn scrub	**Tree:** *Acacia catechu* (Black Cutch), *Embelica officinalis* (Amla), *Dalbargia sissoo* (North Indian Rosewood), *Terminalia chebula* (Black Myrobalan), *Cassia fistula* (Golden Shower Tree), *Anogeissus latifolia* (Bakli), *Zizyphus jujube* (Jujube). **Scrub:** *Euphorbia royaleana* (Sullu spurge), *Adhatoda vasica* (Malabar nut), *Vitex negundo* (Chaste Tree), *Woodfordia fruticose* (Fire Flame Bush).
Sub-tropical zone, mid hill (1000m-1500m)	Sub-tropical pine forest	**Tree:** *Pinus roxburghii* (Chir Pine), *Quercus incana* (Upland Willow Oak), *Lannea sp.*, *Lyonia ovalifolia* (Fetterbush), *Rhododendron arboreum*

[10] https://himachal.nic.in/en-IN/at-a-glance.html#admst

Zone	Forest type	Tree Species
		(Rhododendron), *Indigofera sp.* (Indigo), *Myrsine sp.* (Colicwood), Rubus sp. **Scrub:** *Diospyros melanoxylon* (Black Ebony), *Embelica officinalis* (Amla), *Carrissa sp.*, *Dodonea viscosa* (Hop Bush), *Acacia catechu* (Black Cutch), *anogeissus sp.*, *Lannea sp.*, *Cassia Fistula* (Golden Shower Tree), *Olea cuspidata* (Wild Olive), *Punica granatum* (Pomegranate)
Temperate wet zone (1500m-3000m)	Himalayan moist temperate forest	**Tree:** *Quercus incana* (Bluejack oak), *Q. dilata*, *Cedrus deodara* (Deodar), *Picea smithiana* (Morinda Spruce), *Pinus wallichiana* (Himalayan Pine), *Abies pindrow* (West Himalayan Fir), *Quercus semicarpifolia* (Brown Oak), *Aesculus indica* (Indian Horse-chestnut), Acer caesium (Bluish Grey Maple), *Prunus padus* (Bird Cherry), *Populus ciliata* (Himalayan Poplar), *Corylus colurna* (Chinese Hazelnut), *Ulmus wallichiana* (Himalayan Elm), *Juglans regia* (Walnut), *Pyrus lanata* (Hairy Rowan), *Betula alnoides* (Himalayan Birch), *Fraxinus sp.* *Carpinus sp.*
Temperate dry zone (above 3000m)		**Scrub:** *Juniperus wallichiana* (Black Juniper), *J. communis* (Juniper) and *cargana sp.*, *Alpine steppe*

Source: State of Environment Report, Himachal Pradesh (2009)

Forests in HP have also been classified on the basis of criteria laid down by Champion and Seth (Table A2.4, Annexure 2). The Forest Department of Himachal Pradesh has been pro-active in conserving forests in the state. It also manages eco-tourism. Key institutions of Governance of Forest Department and their key functions are in (Table 3.11).

Table 3.11: Administrative Set-up of Department of Forest, Himachal Pradesh

Name of Institution	Functions and Focus Areas
HP State Forest Development Corporation Limited	Set up as an undertaking of the Government of HP in 1974. The Corporation deals primarily with sales & marketing of timber, fuel wood, pulp wood, bamboo, khair and resin.
H.P. Ecotourism Society	It is an autonomous and independent body. It aims to preserve and protect natural, historical and cultural heritage of Himachal Pradesh and provides opportunities to promote Community Based Ecotourism (CBET) using Participatory Forestry Management.
Forest Training Institute and Ranger's College	Set up in Sundernagar and Chail, the FTI conducts induction training as well as in-service training of forest personnel. The institute also conducts refresher courses for frontline staff Tailor made training courses for other departments/ projects/ HPSFDC/ agencies/ community members/ eco-tourism are also conducted in this Institute.
Natural Resource Management and Training & Development Society	The Society was set up in 2006 with the primary objective to organize capacity building trainings, study courses, exposure visits, conferences, workshops, seminars and lectures and all level trainings/activities of line departments over and above the mandate of Forest Training Centres/School at Sundernagar,

	Chail and Kuther and to assist and organize research programmes in 'Natural Resource Management'.
Joint Forest Management Committee (JFM) / Village Forest Development Committee (VFDCs)	These are village-level institutions involve people to participate for the protection, conservation and rehabilitation of forests whilst safeguarding the rights of forest dwellers.

Source: Compiled by Authors

2. Agriculture

Agriculture and its allied sectors contribute approximately 9% to the GSDP (Gross State Domestic Product) and provide direct employment to approximately 62% of the total workforce of the state (Economic Survey of HP, 2018-19). Operational holdings constitute of approximately 9.55 lakh ha area, operated by 9.61 lakh farmers. It is important to note that the agricultural land is highly fragmented in HP with 69.78 percent marginal and 18.17 percent small land holdings (Table 3.12) which has implications for implementation and desired impact of a number of programs and schemes in this sector.

Table 3.12: Distribution of Land Holding in Himachal Pradesh

Size holdings (hect.)	Category (Farmers)	No. of holdings (lakh)	Area (lakh hect.)	Avg. size of holdings (hect.)
Below 1.0	Marginal	6.70 (69.78%)	2.73 (28.63%)	0.41
1.0-2.0	Small	1.75 (18.17%)	2.44 (25.55%)	1.39
2.0-4.0	Semi medium	0.85 (8.84%)	2.31 (24.14%)	2.72
4.0-10.0	Medium	0.28 (2.87%)	1.57 (16.39%)	5.61
10.0-Above	Large	0.03 (0.34%)	0.51 (5.29%)	17.00
Total		**9.61**	**9.55**	**1.00**

Source: Economic Survey of Himachal Pradesh (2018-19)

The state is a repository of rich and wide variety of agricultural crop (For details see Tables A2.5 and A2.6, Annexure 2). The altitudinal variation in the state also impacts the diversity of the crops as the mean annual temperature, soil type and rainfall received differ across the zones. The different agro-ecological zones of Himachal Pradesh are associated with varied agricultural crops.

Table 3.13: Agro-ecological Zone-wise Important Crops

Zone		Area (in sq. km) % of total area	Elevation (M)	Mean Annual Temperature (C)	Soil type	Rainfall (mm)	Important crops
Sub-Tropical Sub Montane & Low Hills	Zone 1.1	8201 (14.73%)	240-1000	15 to 23	Sandy loams (Light textured, shallow)	≤1500	Wheat, maize, paddy, Pulses, Oilseeds, barley, Sugarcane, Potato, watermelon and vegetables
	Zone 1.2	2059 (3.70%)	240-1000	18.6-21.9	Loamy sand (medium in depth)	>1500	Wheat, Paddy, Maize, Seed pot, Pulses, oil seeds.

Zone		Area (in sq. km) % of total area	Elevation (M)	Mean Annual Temperature (C)	Soil type	Rainfall (mm)	Important crops
Sub humid Mid Hills	Zone 2.1	3770 (6.77%)	1001-1500	14.2-22.1	Sandy Loam-Clay Loam (Acidic)	≤1500	Wheat, Paddy, Barley, Pulses, Oil seed, Off season vegetables.
	Zone 2.2	894 (1.60%)	1001-1500	16.53-21.25	Silt Loam-Loam	> 1500	Wheat, Paddy, Barley, Pulses, Oil seed, Off season vegetables in some parts
Wet temperate high hills	Zone 3.1	8207 [14.74%]	1501-2500	9.1 - 20.6	Mainly Loamy shallow, acidic	≤ 1500	Wheat, Barley, Maize, Millets, Pulses, Oilseeds
	Zone 3.2	1010 [1.81%]	1501-3250	15.4 - 20.5	Sandy Loams shallow to Medium depth.	> 1500	Maize, Wheat, Pulses, Oilseeds
Dry temperate high hills	Zone 4.1	4616 [8.29%]	2501- 3250	9 - 20	Sandy Loams (Shallow in depth)	< 700 (Dry)	Wheat, Potato, Barley, Buckwheat, Peas Minor Millets, Kuth & Temperate Vegetables, Hops, Cumin & Saffron.
	Zone 4.2	7003 [12.58 %]	3251- 4250	8.8 – 19.9	Sandy Loams (Shallow)	Dry/ snow	Quality Potato seeds, Temperate & European type vegetables, Barley, Buckwheat.
	Zone 4.3	19890 [35.74%]	> 4250	8.7- 19.7	Sands & Pebbles (Loose Textured)	Dry/ Snow	Buck wheat, Barley, Minor millets & Kala Zeera.

Source: ENVIS, Himachal Pradesh, 2016

Food grain production in the state has increased from 200 thousand tonnes in year 1951-52 to 1745.1 thousand tonnes in year 2017-18. Maize is the major crop produced in the state the production of which has increased from 67.3 thousand tonnes in year 1951-52 to 644.44 thousand tonnes in year2017-18[11]. It is important to note two things here:

1. Even though there has been a significant increase in food grain production, the farmers are not able to get maximum yield from their fields. A study by TERI (2015) found a yield gap in farmer's field and their experimental research plot. (Table 3.14).
2. There has been a shift away from traditional crops *Setaria italica* (Koni), *Paspalum scrobiculatum* (Kodo), *Eleusine coracana* (Ragi), *Panicum miliaceum* (cheena), pseudocereals like grain amaranth, green chenopod and buckwheat. The reason for decline varies from the increased focus on HYV seeds to lower productivity of traditional variety as compared to high yielding seeds. There has been a deterioration

[11] http://www.hpagriculture.com/achivements.htm

of natural habitats due to man induced environmental changes and lack of scientific interests in the traditional crops, further leading to a decline in production of traditional crops (Maikhuri and Nautiyal, 1991).

Table 3.14: Yield gap in Agricultural Crops in Himachal Pradesh

Crop	Yield (in quintals)		
	Research Plots	Farmer's Plot	State Average
Maize	53.6	35.3	20.5
Wheat	35.9	33	14.7
Paddy	56.2	51	12.5
Black gram	10.5	7.8	3.7
Sesame	7.5	6.4	1.2
Rapeseed & Mustard	13	9.3	2.7
Linseed	11	9.5	3.2

Source: TERI (2015)

The state has taken steps to close the yield gap by providing improved seeds, fertilizers, and analysing soil samples to help the farmers maintain soil fertility (Table 3.15). There is a need to provide focused attention towards increasing area under traditional crops as these crops are adapted to high tolerance to the poorer soils, insects, pests, changing climate and require lesser fallow periods (Maikhuri et al, 1996).

Table 3.15: Progress in Respect of Programmes of Department of Agriculture during 2017-18

Development Programme	Unit	Quantity
Distribution of Improved Seeds	M.T.	10,210
i) Distribution of Plant Protection Material	M.T.	135.00
ii) Area Treated	000' ha	2.80
Distribution of Fertilizers (In Nutrients)		
i) Nitrogen (N)	M.T.	35,000
ii) Phosphorous (P)	M.T.	8,000
iii) Potassium (K)	M.T.	8,000
iv) TOTAL (N+P+K)	M.T.	51,000
Improved Agricultural Implements Distributed including Plant Protection Equipment	No.	1,20,000
Area covered under H.Y.V. Programme		
i) Wheat	000' ha	360.00
ii) Rice	000' ha	76.10
iii) Maize	000' ha	294.00
No. of Biogas Plants Installed	No.	100
Area to be Covered under Soil and Water Conservation Measures	ha	3,600
Number of Soil Samples Analysed	No.	50,000

Source: Department of Agriculture, Himachal Pradesh (2017-18)

There has been an increase in the use of pesticides with a progressive decrease in organic compost manures. Sub-standard pesticides sometimes act as a booster rather than killer where toxic residual effects are not paid attention to. The consumption of fertilizers is given in the Table A2.9 in Annexure 2.

The agricultural sector is governed by the Department of Agriculture. Agriculture research support if provided by Agriculture University, Palampur. Key institutions and features of Governance of Agriculture Department are given in Table 3.16.

Table 3.16: Administrative Set-up of Department of Agriculture, Himachal Pradesh

Name of the Institution	Functions and Focus Areas
HP State Agricultural Marketing Board	To facilitate the, Himachal Pradesh Agricultural Marketing Board overseas implementation of Himachal Pradesh Agricultural & Horticultural Produce Marketing (Development & Regulation) Act, 2005. The state has notified 10 marketing areas in the state
H.P. State Seed and Organic Produce Certification Agency	The main objective is to maintain, provide and make available to the public high-quality seeds of notified varieties and propagating materials and to ensure their genetic identity, known pedigree, high varietal purity and good seedling value.
State Agricultural Management and Extension Training Agency (SAMETI)	Capacity building and training at the State level

Source: Compiled by NIPFP

3. Horticulture

Himachal Pradesh is not only diverse in its agro-climatic conditions but also has variations in its topography and difference in its altitude with deep, well drained and fertile soil. Such climatic conditions are favourable for the cultivation of temperate to sub-tropical fruits in the state. In addition to this, the region is highly suitable for cultivating horticulture produce such as mushroom, honey, and flowers. Horti-forestry helps not only in providing inter-crops such as potato, sunflower, mango, peas, urad, etc. but also fodder, fuel, timber, etc. boosting the economy while maintaining the ecosystem. However, in Himachal Pradesh, farmers find it less paying to plant orchards than to cultivate cereal and other cash crops which is resulting in declining area under traditional crops. The varied climatic conditions offer scope for cultivation of off-season vegetables: tomato, capsicum, cabbage cauliflower, and pea. With the average productivity of 17 tonnes/ha which is low, there is a scope to bring more area under cultivation of off-season vegetables[12]. For a snapshot of status of horticulture in the state in the year 2017-19 and suitable fruit crops across different agro-climatic zones see Tables 3.17 and 3.18 respectively[13]:

Table 3.17: Status of Horticulture in Himachal Pradesh

Category	2017-18	2018-19	% change
Area under Horticulture	**2,30,852 ha**	**2,30,852 ha**	-
Total fruit production	5,65,307 M.T.	4,953,62 M.T.	(-) 14%
Gross value of the fruit production	Rs. 2,517.99	Rs. 3,313.68 Crore	24%
Area under floriculture	642.48 ha	705.77 ha	8%
Total production of mushroom	13,899 M.T.	14,206.70 M.T.	21%
Total production of honey	1,039.23 M.T.	1,591.3 M.T.	34%

Source: Department of Horticulture, Himachal Pradesh (2018-19)

[12] https://icar.org.in/files/state-specific/chapter/58.htm
[13] http://www.hpagrisnet.gov.in/hpagris/Horticulture/Default.aspx?SiteID=5&PageID=1219

Table 3.18: Suitable Fruit Crops Across different Agro-Climatic Zones in Himachal Pradesh

Description of Zone	Elevation range (m)	Rainfall (cm)	Suitable fruit crops
Low hill and valley areas near the plains	365-914	60-100	Mango, litchi, guava, loquat, citrus, fig, papaya, grapes, jackfruit, banana, low chilling varieties of plum, peach and pear and strawberry.
Mid hills (Sub-Temperate)	915-1523	90-100	Stone fruits (peach, plum, apricot, almond), persimmon, pear, pomegranate, pecan nut, walnut, kiwi fruit, strawberry.
High Hills and Valleys in the interiors (Temperate)	1524-2742	90-100	Apple, pear, cherry, almond, walnut, chestnut, hazelnut, strawberry.
Cold and dry zone (Dry Temperate)	2743-3656	24-40	Apple, grapes, prunes, drying type of apricot, almond, chilgoza, pistachio, walnut, hazelnut.

Source: State of Environment Report, Himachal Pradesh (2009)

The state is also endowed with a variety of honey bee species. There are four species of honey bees found in different agro-climatic zones as has been outlined in Table A2.10 in Annexure 2.

The sector of horticulture is governed by Department of Horticulture. The Department functions with the objective of building a prosperous Himachal through scientific development of horticulture by harnessing the natural resources for the development of a sustainable system of agriculture in the hilly areas.

4. Animal Husbandry

Rearing of livestock is an important component for a state where a large proportion of population is dependent on agriculture. Livestock not only provides material such as wool, milk, meat, etc. but is also a major source in agricultural operations on the hill slopes. There is a wide variety of domesticated animals in Himachal Pradesh consisting of cattle, buffaloes, yak, sheep and goats as well as a small proportion of ponies, horses, donkeys and pigs. Livestock population has been detailed in the Table 3.19. District-wise livestock population has been outlined in Table A2.11 in Annexure 2.

Table 3.19: Livestock Population (in thousands)

Category	1997	2003	2007	2012
Livestock:				
1. Cattle	2002	2196	2269	2149
2. Buffaloes	652	773	762	716
3. Sheep	909	906	901	805
4. Goats	947	1116	1241	1119
5. Horses and ponies	22	17	13	15
6. Mules and donkeys	31	33	26	31
7. Pigs	5	3	2	5
8. Other livestock	3	2	2	4
Total	**4571**	**5046**	**5216**	**4844**

Source: Statistical tables, Economic Survey (2018-19)

Livestock rearing is a profitable business if undertaken with utmost attention and care towards livestock. Therefore, data has been complied to outline the production of major livestock products in terms of milk, egg, meat and wool in Table 3.20.

Table 3.20: Year-wise Production by Livestock in Himachal Pradesh

	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Milk Production **('000 tonnes)**	1102	1120	1139	1151	1172	1283	1329	1392
Egg production **(in lakhs)**	1020.62	1049.66	1069.39	1075.48	1084.34	811.67	958.99	981.40
Meat Production **('000 tonnes)**	3.45	3.97	4.00	3.99	4	4.01	4.4	4.49
Wool Production **(000' kg)**	1642.15	1648.01	1649.33	1654.99	1663.07	1408.87	1475	1481.87

Source: Adapted from Ministry of Agriculture and Farmers Welfare.

In order to develop poultry sector in Himachal Pradesh and to minimize the difficulties of farmers, Department of Agriculture has taken a few initiatives to increase poultry production in the state as shown in Table A2.12 in Annexure 2.

For governance of this sector, Department of Animal Husbandry has been set up. The department works on the mandate to bring improvement of nutritional status of animals, training and demonstration in scientific livestock rearing, and extension and transfer of technology. Key institutions of Governance of Animal Husbandry Department are given in Table 3.21.

Table 3.21: Administrative Set-up of Department of Animal Husbandry

Name of the Institution	Functions and Focus Areas
Himachal Pradesh Govansh Samvardhan Board	The board was constituted for the purpose of the preservation, welfare and development of cow species in the state in 2016.[14]
State Animal Welfare Board	The board was constituted in 2015 to prevent infliction to cruelty to the animals. The Additional Chief Secretary -in-Charge of Animal Husbandry Department acts as the chairman of the board.
Himachal Pradesh Para Veterinary Council	The council was set up in 2011 with an objective to promote innovations, research and development in establishment of new Para veterinary subjects.[15]
HP Milk Producers' federation	Milk Fed was registered in 1980 with an objective to organise Milk Producers Cooperative Societies and provide remunerative market to milk producers.
Himachal Pradesh Govansh Samvardhan Board	The board was constituted for the purpose of the preservation, welfare and development of cow species in the state in 2016.[16]
State Animal Welfare Board	The board was constituted in 2015 to prevent infliction to cruelty to the animals. The Additional Chief Secretary -in-Charge of Animal Husbandry Department acts as the chairman of the board.
Himachal Pradesh Para Veterinary Council	The council was set up in 2011 with an objective to promote innovations, research and development in establishment of new Para veterinary subjects.[17]
HP Milk Producers' federation	Milk Fed was registered in 1980 with an objective to organise Milk Producers Cooperative Societies and provide remunerative market to milk producers.

Source: Compiled by Authors

5. Fisheries

Himachal Pradesh has been endowed with enormous rivers which are emanating from glaciers and traversing through hilly terrain. Major water bodies that have been created in Himachal include Pong, Gobind Sagar, Chamera including some parts of Ranjit Sagar Dam. Additionally, 1300 hectare of water body has emerged after the construction of Kol Dam on river Satluj. These reservoirs have resulted in the production of 1562.12 tonnes of fish valuing Rs.1449.65 lakhs during 2013-14[18]. Fish cooperative societies have been detailed in the Table 3.22.[19]

[14] http://www.hpagrisnet.gov.in/Agrisnet/AnimalHusbandry/pdf%20files/re-con.pdf
[15] http://hpagrisnet.gov.in/Agrisnet/AnimalHusbandry/pdf%20files/HPPVC%20ACT%202010.pdf
[16] http://www.hpagrisnet.gov.in/Agrisnet/AnimalHusbandry/pdf%20files/re-con.pdf
[17] http://hpagrisnet.gov.in/Agrisnet/AnimalHusbandry/pdf%20files/HPPVC%20ACT%202010.pdf
[18] https://himachal.nic.in/showfile.php?lang=1&dpt_id=4&level=1&sublinkid=6668&lid=6880
[19] https://himachal.nic.in/showfile.php?lang=1&dpt_id=4&level=1&sublinkid=128&lid=155

Table 3.22: Fish Cooperative Societies across different Reservoirs in Himachal Pradesh

Reservoir	No. of Fishermen	Active Fishermen	Participation of women	Participation of men	Total catch up to March 2019
Pong Reservoir	2674	2674	307	2367	2,65,703.9
Gobind Sagar Reservoir	2332	1799	581	1244	2,95,615.3
Chamera and Ranjeet Sagar Reservoir	173	110	10	100	32,539

Source: Department of Fisheries, Himachal Pradesh (2019).

There is a diversity of fish species in the state. The fish fauna of Himachal Pradesh principally belongs to 12 families (Table 3.23).

Table 3.23: Fish Fauna of Himachal Pradesh[20]

S. No	Family	Fish Species
1.	FAMILY NOTOPTERIDAE	Notopterus chitala (Hamilton), N. notopterus (Pallas), Oxygaster bacailia (Hamilton), Oclupeoides (Bloch), O. gora (Hamilton), Barilius barila (Hamilton), B.bendelisis chedra. (Hamilton), B.modestus(Day), B.vagra(Hamilton), B.shacra (Hamilton), Danio (danio) devario (Hamilton), D.(Brachydanio) rerio (Hamilton), Esomus danricus (Hamilton), Rasbora daniconius (Hamilton), Amblypharyngodon mola(Hamilton), Aspidoparia morar (Hamilton), Tor putitora (Hamilton) , Puntius chola (Hamilton), P.chrysopterus(MeClelland), P.chonchonius (Hamilton), P.sarana (Hamilton), P.tetrarupagus (MeClelland), P.terio(Hamilton), Catla catla (Hamilton), Cirrhina mrigala (Hamilton), C.reba (Hamilton), Garra gotyla (Gray), P.stigma(Hamilton), Labeo boga (Hamilton), L.calbasu(Hamilton), L.dero (Hamilton), L.dyocheilus(MeClelland), L.gonius (Hamilton), L.rohita (Hamilton), Oreinus plagiostomus(Heckel), O.sinuatus (Heckel), Crossocheilus latius punjabensis (Hamilton)
2.	FAMILY COBITIDAE	Noemacheilus botia (Hamilton), N. botia aeurus (Hamilton), N. corica (Hamilton), N. kangrae (Menon), Botia birdi (Chaudhuri), Lepidocephalus guntea balgara (Hamilton)
3.	FAMILY SILURIDAE	Ompak bimaculatus (Bloch), Wallago attu (Hamilton)
4.	FAMILY BAGRIDAE	Mystus (Mystus) bleekri (Day), M. (Mystus) vittatus (Bloch), M. (Osteobagrus) seenghala (Sykes), R*ita rita* (Hamilton)
5.	FAMILY AMBLYCIPITIDAE	Amblyceps mangois (Hamilton)

[20] https://himachal.nic.in/index1.php?lang=1&dpt_id=4&level=1&sublinkid=127&lid=149

S. No	Family	Fish Species
6.	FAMILY SISORIDAE	Glyptothorax conirostris (Steind), G. pectinopterus (Hamilton), G. stoliczkae (Steind)
7.	FAMILY SCHILBEIDAE	Clupisoma garua (Hamilton)
8.	FAMILY BELONIDAE	Xenentodon cancila (Hamilton)
9.	FAMILY MUGLIDAE	Mugil cascasia (Hamilton)
10.	FAMILY CHANNIDAE	Channa gachau (Hamilton), C. marulius (Hamilton), C. punctatus (Bloch)
11.	FAMILY ANABANTIDAE	Colisa fasciata (Bloch)
12.	FAMILY MASTOCEMBELIDAE	Mastacembalus armatus (Lacepede)

Source: Department of Fisheries, Himachal Pradesh (2014)

In addition to this, fish yield from the year 2012-13 to 2017-18 has been outlined in Table 3.24.

Table 3.24: Fish Yield

Fish Production (in 000 tonnes)	2012-13	2014-15	2016-17	2017-18
Marine	0	0	0	0
Inland	8.561	10.736	12.48	11.87
Total	8.561	10.736	12.48	11.87
Fish Seed Production (in Million Fry)	22.02	25.70	62.50	4.70

Source: Basic Animal Husbandry and Fishery Statistics, 2018.

5.1 Mahseer and Trout

In the uplands along the Himalayan belt, Tor Putitora or Golden Mahseer is the most sought-after species extending from north-west to north-east. Due to human interventions such as dam construction, barrages and over-extraction has resulted in threatening this species. Moreover, regardless of the height, dams act like barrier to breeding of the fish along with negative impacts of river valley projects such as morphological modifications. Indiscrimination dynamiting, hooking, and netting have also affected state's rivers as well as streams.

Trouts, which were introduced to encourage sport fisheries, are now being identified as a commercial venture for table fish production. Two major species available in Himachal Pradesh are rainbow trout (Salmo Gairdneri) and brown trout (Salmo Trutta fario). There has been a sharp decline in catches due to destruction of breeding grounds, illegal and destructive fishing, rapid urbanization, river-valley projects. However, the matter has received attention of the State Government[21]. Mahseer and Trout Major River stretches have been outlined in Table A2.13 and Table A2.14 in Annexure 2.

Streams in the state are categorized as either trout waters or general waters with approximately 600 kms and 2400 kms of length respectively. Fishes such as Nemacheilus spp, Mahseer, Trout, Schizothoraacids Crossocheilus sp. Glyptothorax spp., Barilus sp, etc. are found in the major streams flowing across the state such as Sutlej, Beas, Ravi, Tirthan, Giri, Nugal Gai, Sainj,

[21] https://himachal.nic.in/index1.php?lang=1&dpt_id=4&level=1&sublinkid=132&lid=153

rana, Uhl, Baspa, Lambadug, Pabar, Bata, etc[22]. Fishing across these streams is regulated by the state under Fisheries Act, 1976. For general water license rod, line as well as cast netting is allowed whereas for trout water only line and rod are allowed. Fishery Department has identified the fishing spots for trout and mahseer which are listed in Tables A2.15 and A2.16 in Annexure 2 respectively.

Department of Fisheries has been set up for conservation of riverine fisheries, production and protection of sport fisheries, issuing of licenses, breeding and production of trout seed, their plantation in rivers and streams for augmentation of riverine stocks. To acheive maximum sustainable fish production from state's reservoirs as well as fish farms by applying latest scientific technologies, HP Aqualculture, Fishing and Marketing Society was set up in 2001.

6. Environment, Science and Technology

The Department of Environment, Science and Technology works towards improving the effectiveness of environmental management, protection of vulnerable ecosystems and enhancement of sustainability of development.[23] Key institutions and features of Governance of Environment, Science and Technology Department are given in Table 3.25.

Table 3.25: Administrative Set-up of Department of Environment, Science and Technology

Name of the Institution	Functions and Focus Areas
Himachal Pradesh Council for Science, Technology & Environment	The council was set up on January 3, 1986 with an objective to advise the state on the issues and intervention related to science, technology & environment.
State Centre on Climate Change	It was set up under the aegis of the State Council for Science Technology & Environment to the objectives to coordinate amongst scientific, academic, NGOs and other research institutions in and outside the state for pursuing research in the field of climate change and its impact on the Himalayan Ecosystem
Himachal Pradesh State Biodiersity Board	Himachal Pradesh State Biodiversity Board has been constituted with an aim to conserve diversity, sustainable use of its components with fair and equitable distribution of benefits arising out of the use of biological resources knowledge and for matters connected herewith and incidental thereto in the State.
HP State Knowledge Cell on Climate Change	HP State Knowledge Cell on Climate Change (HPKCCC) under National Mission for Sustaining the Himalayan Ecosystem (NMSHE) has been setup in the Department of Environment, Science & Technology, Government of Himachal Pradesh after the approval of The Ministry of Science & Technology, Govt. of India. The objective of setting up this cell is to fill the knowledge gaps related to climate change.
Himachal Pradesh State Wetland Authority	The Himachal Pradesh State Wetland Authority (HPSWA) constituted in the year 2017 under the aegis of H.P. Council for Science, Technology & Environment (HIMCOSTE) is acting as a nodal agency to coordinate the Wetland Conservation Programme

[22] http://himachal.nic.in/index1.php?lang=1&dpt_id=4&level=1&lid=168&sublinkid=146
[23] https://desthp.nic.in/setup.html

Name of the Institution	Functions and Focus Areas
	with the active participation of all the stakeholders. The core objective is to conserve and restore wetlands with the active participation of the local community at the planning, implementation and monitoring level.[24]

Source: Compiled by NIPFP.

7. Other Agencies/Boards/Institutions/Committees

There are a number of Boards, Agencies, Institutions and local community groups, which are relevant in the context of biodiversity management and conservation, some of them have been identified below in Table 3.26.

Table 3.26: Other relevant Institutions in Himachal Pradesh

Name of the Institution	Functions and Focus Areas
HP State Board of Ayurvedic & Unani Systems of Medicine	The Board was formed in 1971 and is governed by Himachal Pradesh Ayurvedic and Unani Practitioners Act, 1968. The Board registers Ayurvedic and Unani Practitioners in the state and regulate the practice in such systems.
HP Khadi and Village Industries Board	This is a statutory body that came into existence in 1968. The Board functions to fulfil the objective of providing employment, producing saleable items with the help of local communities and building the strong rural community spirit.
HP State Pollution Control Board	It is a nodal agency in the administrative structure of the State Government, for the planning, promotion, co- ordination and overseeing the implementation of environmental programs.
HP Tourism Development Board	The Board was formed in 2003 for the promotion and development of tourism in the state.
HP State Council of Educational Research and Training	The Council is an apex body on school education which was formed in pursuance of the recommendations of National Policy on Education with an objective to improve quality of education in the state.
HP Panchayati Raj Training Institute	The Panchayati Raj Training Institute, Mashobra was established as a government institute, under the Panchayati Raj Department in the year 1978 and is recognised as an Extension Training Centre (E.T.C) under the Ministry of Rural Development.
HP State Wool Federation	The H.P. State Wool Procurement and Marketing Federation Ltd. commonly known as "Woolfed" was established on 7th November 1988 and registered with Registrar Cooperative Societies, Government of Himachal Pradesh for the upliftment of sheep breeders of the state by promoting the growth and development of wool industry in the state

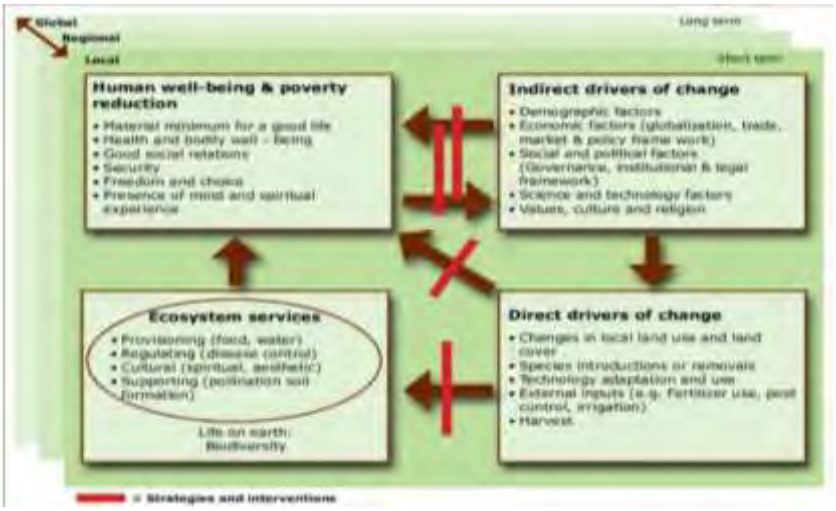
Source: Compiled by NIPFP

3.2 Drivers of Change: Key Factors Impacting Biodiversity

A conceptual framework for recognizing relationship between interaction of Biodiversity, Ecosystem Services, Human Well-Being and Drivers of Change[25] is important to put this in context. The framework assumes a dynamic interaction between human system and ecosystem due to direct and indirect drivers of change established by human actions (Figure 3.4), which, in turn, change ecosystems in different ways with profound impacts on human well-being[26].

[24] http://www.himcoste.hp.gov.in/Wetland%20Authority/Wetland_Home.aspx
[25] https://www.millenniumassessment.org/documents/document.356.aspx.pdf
[26] https://www.millenniumassessment.org/documents/document.765.aspx.pdf

Figure 3.4: Millennium Ecosystem Assessment Conceptual Framework



Source: Millennium Ecosystem Assessment (2005)

3.2.1 Direct Threats to Biodiversity in Himachal Pradesh

1. Human-Wildlife Conflict (HWC)

HWC has been on a rising trend in Himalayan region both due to anthropogenic pressure and due to climate change. In the notification dated May 20, 2020, the Ministry of Environment, Forest and Climate Change has declared the following areas in HP as monkey hotspots (Table 3.27):

Table 3.27: Identified Monkey Hotspots in Himachal Pradesh

S. No.	Name of District	No. of Tehsil/ Sub-tehsils	Name of Area/Tehsil/Sub-Tehsil
1.	Chamba	06	Churah, Bharmour, Dalhousie, Bhatiyat, Sihunta and Chamba
2.	Kangra	15	Kasba-Kotla, jaswan, DehrA-Gopipur, Khundiyan, Jaisinghpur, Baijnath, Dharamshala, Shahpur, Nurpur, Indora, Fatehpur, Jawali, Kangra, Palampur, and Baroh
3.	Bilaspur	06	Jhandutta, Bharari, Ghumarwin, Nainadevi, Bilaspur Sadar and Namhol
4.	Una	05	Bharwain, Amb, Una, Haroli, and Bangana
5.	Shimla	16	Sunni, Theog, Kotkhai, Kumarsain, Chopla, Rohroo, Jubbal, Chirgaon, Kupvi, Nankhari, Tikkar, Junga, Shimla Rural, Rampur, Nerwa and Shimla Municipal Corporation limits
6.	Sirmour	10	Paonta Sahib, Dadahu, Panjhota, Nohra, Pachhad, Rajgarh, Renuka, Shillai, Kamrau, Nahan Municipal Committee Area
7.	Solan	08	Arki, Kandaghat, Pamshahar, Krishangarh, Nalagarh, Kasauli, Solan and Daralaghat
8.	Mandi	10	Mandi, Chachiot, Thunag Karsog, Jagindernagar, Padhar, Ladbhadol, Sarkaghat, Dharampur, and Sundarnagar
9.	Kullu	06	Nirmand, Banjar, Ani, Manali, Kullu and Sainj
10.	Hamirpur	06	Hamirpur, Bhoranj, Nadaun, Sujanpur, Badsar and Bijhari
11.	Kinnaur	05	Nichar, Pooh, Kalpa, Sangla and Moorang

Source: MoEFCC, 2020.[27]

[27] https://hpforest.nic.in/files/WL%20notifiication.pdf

While more scientific data is needed, a review of available literature is in Table 3.28.

Table 3.28: Human-Wildlife Conflict: Threats, Drivers & Impact

Type of Threat	Drivers	Impact on environment, biodiversity and economic losses
In Himachal Pradesh, the threats due to HWC revolve around the following: • Livestock predation • Crop raiding • Attack on humans • Wildlife strolling in human settlements **188 cases of leopard attacks** killing more than 26 people have been recorded in HP during 2008-09 (Rattan, 2015) **Conflict among wildlife and agro-pastoralists** has been a major threat to livestock. Nearly 18% of the total livestock holding were killed by wild carnivores in HP in 1995 (Mardaraj & Sethy, 2015) **Monkey menace**- In 11 districts, 93 tehsils and sub-tehsils have been declared as monkey hotspots (Table 3.29). A total of 513 attacks by monkeys have been reported on humans in 2013-14 in HP. **Attacks by wild bears** on humans has been reported in Bharmaur and Jummhar regions of Chamba district and by leopard in Kinnaur and Una district (Bodh, 2017) **Crop depredation by Monkeys and wild pigs** has created a menace across five villages in Bilaspur District (Saraswat, Sinha, & Radhakrishna, 2015).	Interface of man and animal has escalated due to the following key drivers in HP: • Increasing human settlements • Degradation of wildlife habitat Degradation of pasture lands impacting wild animal habitat due to uphill movement of semi-nomadic communities like Gaddis for grazing their cattle Climate induced changes have impacted the habitat and food availability for wild animals in Himalayan region, causing them to wander around human habitations, leading to conflicts. Climate Change has also led to a dramatic increase in direct encounter incidents involving Himalayan black bears with stray incidents of leopards in HP. Depletion of natural prey base of wild animals has been shifting carnivores towards killing of livestock (Mardaraj & Sethy, 2015) In HP, there has been an increase in human settlement in urban, semi-urban and rural areas which is resulting in shrinking of wildlife habitat (Bodh, 2017)	The following impacts of HWC have been identified widely: A survey of crop damage by monkeys and langur in HP estimates the highest crop damage in Sirmor district (30%), followed by Bilaspur (25%), Mandi (18.8%), Solan (15.3%), Shimla (14.9%) and Chamba (11.4%) (Sahoo and Mohnot 2004). Crop damage by monkey raids left farmers grappling with an estimated loss of Rs. 19.16 crore in 2016, since farmers did not grow crops over 2864 ha land in Solan district (Sharma 2016). An annual estimated loss of Rs. 150.10 crore of horticulture crops has been reported in HP due to raiding of farmlands by monkeys and birds (Thakur 2019) Farmers are shifting away from growing sugarcane, maize, pulses and wheat in Una district due to crop destruction by nilgais (Narayanan 2015) During consultation workshop in Kilar, Pangi, local communities reported that crops (food and commercial) are damaged by monkeys and black bear[28]. An analysis of data collected from 26 migratory pastoralists from Kangra district reveals that 8-10% of their flocks were killed by wild animals impacting their only source of livelihood (Singh, Kaul, & Sivaramane, 2006)

[28] Consultation workshop organized by NIPFP on 25th September, 2019 in Kilar, Pangi Valley

2. Unscientific extraction of medicinal and aromatic plants (MAPs)

Illegal, and unsustainable and unscientific collection and marketing have been seen as a major threat to MAPs in Himachal Pradesh. A number of MAP species have already been listed as threatened in the state (Table A 2.1 in Annexure 2).

Table 3.29: Unscientific Extraction of Medicinal Plants: Threats, Drivers & Impact

Type of Threat	Drivers	Impact on MAPs
HP is rich in MAP species. With rising demand, MAPs are facing the following threats: • Unscientific methods of MAP extraction • Over-extraction of medicinal plants before maturation Local communities have less knowledge about biochemical, molecular and genetic characterization of existing medicinal plants which is resulting in unsustainable extraction of MAPs (Parkash & Aggarwal, 2010). Over-extraction of decoction of plants like *Crotolaria juncea* (Pataku) and *Eclipta alba* (Bringraj) by local communities to cure diseases as well as for livestock has been done by local communities (Parkash & Aggarwal, 2010) Tubers/rhizomes of *Picrorrhiza kurrooa, Saussurea lappa, Aconitum heterophyllum and Jurinea macrocepha*la are harvested every year as against the suggested optimal harvesting rate of 2-3 years (Singh G. S., 2011) Owing to over-extraction, *Paris polyphylla* has been listed as endangered in HP and other Himalayan regions (Paul, Gajurel, & Das, 2015)	The following drivers have been identified: • Unregulated use of permits for MAP collection • Illegal trading channels providing ready cash • Unemployment among youth Communities have been reported to dig 5 feet deep pits for illegal extraction of Kashmal in Kangra and Mandi districts fetching a price of Rs 100-500 per kg (Mohan, 2018) Collection of medicinal plants is done on right-holding basis. In this way, local people get free access to forest produce through license (Vinayak, 2012) Local communities reported in consultation workshop in Kilar, Pangi that illegal extraction is mostly done by the foreign intruders (mainly from Nepal) and Gaddis. In addition, the locals sell their permits (given to them by forest department for collection of NTFPs) to the traders, leading to over-extraction of MAPs through illegal channels	According to HP Forests for Prosperity Project Report (2018), productivity of MAP species is harmed since little or no grading is carried out by communities due to incorrect picking of plants. Regeneration failure of plants in their natural habitat is caused due to unscientific extraction such as removing of whole plant (without leaving any part of rhizome) (Paul, Gajurel, & Das, 2015) The extraction of species like *A. heterophyllum, A. glauca, H. spicatum* in HP at the flowering stage or before ripening of seeds has affected their high germination potential which is a constraint in their propagation (Butola and Badola 2008) Study conducted in Kullu district reveals that due to premature and frequent harvesting, the size of roots of *Jurinea macrocephala* has become smaller (Singh G. S., 2011) Over-extraction of plants leads to soil erosion which not only results in landslide but also declines productivity of MAPs (Bodh, 2016)

3. Climate Change

Climate change has emerged as a global issue which is not only impacting ecosystems but also human life. The phenomenon is much more complex than it looks since it alters the composition of atmosphere due to unsustainable extraction of natural resources. The threat has both direct (Table 3.30) as well as indirect impact on biodiversity.

Table 3.30: Climate Change as a Direct Threat: Threats, Drivers & Impact

Type of Threat	Drivers	Impact on environment, biodiversity and livelihood
According to a 2015 report "Climate Resilient Green Growth Strategies for Himachal Pradesh", changes in climate parameters have been observed in HP during 1951-2010: • **Increase in annual mean temperature by 0.02 °C/year** • **Decrease in annual average rainfall by 3.26 mm/year** There has been a decrease in the snowfall received in Shimla and Solan from 78 cm in 1986-1900 to mere 15 cm in 2009[29]. There has been an increased water stress for rain-fed crops in HP due to increasing temperature (1.7 °C to 2.2 °C) posing a threat to traditional crops (HPSSAPCC, 2012). HP has 98 IBIS grids for four-eco-sensitive regions, out of which 56% are projected to undergo change in vegetation type by 2030 due to climate change (HPSSAPCC, 2012).	The districts Una, Solan, Hamirpur, Sirmour and Bilaspur have been categorized as 'highly vulnerable' and exposed to climate change whereas districts Shimla and Kullu are 'moderately vulnerable' (HPSSAPCC, 2012). The stressors for climate change in HP are: • Anthropogenic pressure due to increasing population, mass tourism-based activities, and land degradation. • Inadequate infrastructure for solid waste management, and sewage treatment. • Diversion of water resources for hydropower.	Sen, et al. 2015 shows that apple productivity has decreased at the rate of 0.02 tonnes/ha per year in Kullu valley during 1985-2009. A declining apple productivity in other parts of HP has also been reported, due to erratic precipitaion and reduction in days of availability of effective chilling units adversely impacting the livelihood of farmers (CRGGS, 2015). Reduced annual snowfall and fluctuating temperatures during flowering period in Kullu has resulted in consistent decline in dry fruit production. A net decrease in productivity by 0.005 t/ha/yr has been recorded (HIMCOSTE, 2018) There has been an overall reduction in glacier area from 2,077 sq. km. to 1,628 sq. km. during 1962-2001 in Chenab, Parbati & Baspa Basins of HP (HPSSAPCC, 2012). Population of species like *Dalbergia sisoo*, commonly known as rosewood, has been declining in HP due to the prevalence of cold waves as well as non-availability of adequate light during winter, when new leaves emerge in the plant[30, 31]. The area under traditional crops like *Bunium persicum bioss.* (Kala zeera), Fagopyrum esculentum Moench. (Buckwheat), Amranthus candatus L. (amaranth), Saussurea costus Falc. (Kuth) and Crocus sativus L. (saffron) has decreased significantly in Lahaul valley (Rana et. al, 2013).

[29] http://www.hpenvis.nic.in/Database/Climate_Change_Scenario_4310.aspx
[30] http://www.hpenvis.nic.in/Database/Climate_Change_Scenario_4310.aspx
[31] https://hpforest.nic.in/files/20-11-2018%20EMF%20HPFPP%20FINAL.PDF

Type of Threat	Drivers	Impact on environment, biodiversity and livelihood
		Previously unknown pests are reported, for instance hopper burn in rice was reported in the Kangra valley in 2008 (ADB, 2010). Due to change in climatic factors, there has been an increase in invasive species which poses a threat to native biodiversity (Parikh et al, n.d.). The extent of major invasive species are as follows (FSI, 2019): • Lantana Camara: 654 sq. km • Ageratina adenophora: 39 sq. km • Ageratum conyzoides: 36 sq. km • Melochia corchorifolia: 30 sq. km • Dioscorea deltoidea: 29 sq. km

4. Forest Fire

Forest fire incidents cause economic losses as well as loss of non-monetised flora and fauna. Of the identified 14 major forest fire incidents during 1990-2011, two have been recorded in Himachal Pradesh (June 2007 in Shimla where 2000 ha of Reserve area was affected; and June 2010 in Solan which affected 19,109 ha of area) (Satendra & Kaushik, 2014). The report has outlined that the peak forest fire season in the state is March to June. A joint report by MoEF&CC and the World Bank (2018) estimated that reported monetary losses due to forest fires in the state was Rs. 134.78 lakhs in the year 2016 and Rs. 113.27 lakhs in 2015. Due to efforts by the State Government to fight the issue of forest fire, such as, satellite-based fire alerts there is improvement in situation. Besides, community participation in traditional forest fire management via forest line clearance, burning debris has proven useful. The impacts of forest fires have been summarized in the Table 3.31.

Table 3.31: Forest Fires: Threats, Drivers and Impact

Type of Threat	Drivers	Impact on environment and biodiversity
Districts like Bilaspur in HP consist of pine and broad-leaved forests which are highly inflammable in nature and are prone to forest fires. A Forest Fire Risk Map has been developed for Bilaspur district which depicts that the high terrain is more prone to forest fires given the unfavourable climatic conditions (Kanga, Kumar, & Singh, 2017). Forest fires cause indispensable loss to timber species like chir, teak, deodar, sal, sheesam, rosewood. The periodicity of forest fire in pine forest in Himalayas is 2 to 5 years which usually takes the form of crown	**Drivers of forest fires in HP:** **Natural drivers** • Natural factors such as extreme summer heat due to climate change (Parkash & Sharma, 2008). • Lightning, friction caused due to rolling stone from the slope, natural deposition of highly flammable forest produces such as Chir Pine cones (Satendra and Kaushik, 2014). • Ban on grazing leads to unchecked growth of shrubs which causes forest fires due to heat during summer season. **Man-made drivers** • Accidental fires due to unextinguished cigarette butts, matchsticks by local people who intrude forest area for fuel	Forest fires result in reduction of density as well as basal area of Chir Pine trees in fire affected forest areas (Kumar & Thakur, 2008) Forest fires are a major source of carbon emissions leading to biodiversity changes (such as reduced photosynthesis activities) and contributing to global warming. Burning of vegetation results in release of CO_2 stored in them. This increases global warming and contribute to climate change.

Type of Threat	Drivers	Impact on environment and biodiversity
fire when moving upward from the bottom of the hills. Most of the forests between the elevations of 1000-1800 m are dominated by oak and chir. The repeated fires in this region has resulted in spreading of chir pine forest (due to remaining seedlings after repeated forest fires) at the cost of indigenous oak forest causing an ecological imbalance (MoEF&CC and The World Bank, 2018) Wildlife habitat and species composition are disrupted by forest fires. Additionally, residual soot and charcoal increases insulation which results in rise in temperature making the habitat unfit for wild animals as well as microbes (Satendra and Kaushik, 2014).	wood collection (Kumar & Thakur, 2008). • Setting grasslands on fire by graziers for good pasture growth. • Collection of NTFP, shifting cultivation, burning farm residues, camp fires, uncontrolled prescribed burning (Satendra & Kaushik, 2014). According to Satendra and Kaushik (2014), one of the chief causes of forest fire in HP is 'negligence in use of fire', for instance: poor control of burning on adjacent croplands; and the second major cause is 'restriction on grazing in the forests.'	

5. Illegal Hunting and Wildlife Trade

India has been deeply impacted because of the trafficking operations in China and South East Asia. There are several trade routes operating in India that facilitate the successful trafficking; reported to be operating across Uttarakhand, Himachal Pradesh, Sikkim and into Tibet, and then China (Basu, 2018). Despite a ban on wildlife trade and NTFP collection, illegal collection and poaching is a serious threat to the biodiversity of HP. Based on a review of available studies a snapshot of key threats is in Table 3.32.

Table 3.32: Illegal Hunting and Wildlife Trade: Threats, Drivers and Impact

Type of Threat	Drivers	Impact on Environment, Biodiversity and livelihood
There are several routes for illegal wildlife trade which are reported to be operating in HP, the main exit points of which are: Border areas of Leh-Ladakh, Chamba and Pathankot as well as Tiuni-Vikasnagar in Uttarakhand (Chauhan, 2018). A trend analysis for Hamirpur district has found that during 2001-13, 58 out of 123 leopards were found dead due to illegal hunting (Kumar, Chandel, Kumar, & Sankhyan, 2015).	The following have been outlined as major drivers of illegal wildlife trade and poaching: • The illegal animal parts are not restricted to illegal markets, but also end up in legal markets. • These items fetch a huge amount of money in cash. Steep prices incentivize poachers to hunt more animals. • Diverse usage of animal parts such as making rug and carpet as well as traditional medicines implies various	Poaching disrupts the population of species which, in turn, disturbs the food chain as the population of immediate next wild animal would increase. Hunting of animals impacts nature-based tourism negatively. This impacts livelihood of locals. (Estrada, 2019)

Type of Threat	Drivers	Impact on Environment, Biodiversity and livelihood
Police arrested 2 locals and 2 Nepalese who were caught with leopard skin in Jabli area of HP. Meat filled with poison has become a trap for leopards for their skin which does not have bullet marks (Bisht, 2018). Panthers are killed for their jaws, claws and other body parts and traded in China and other South East Asian countries (Puri, 2018).	sources of demand fueling the wildlife trade (Ashwini, 2018). During the consultation workshop organised by NIPFP in Kilar, Pangi, local communities have reported that the existing frontline staff is inadequate in the forest area. It is easy for intruders to locate the forest guards and get away with the crime.	

3.2.2 Indirect Threats to Biodiversity in Himachal Pradesh

1. Climate Change

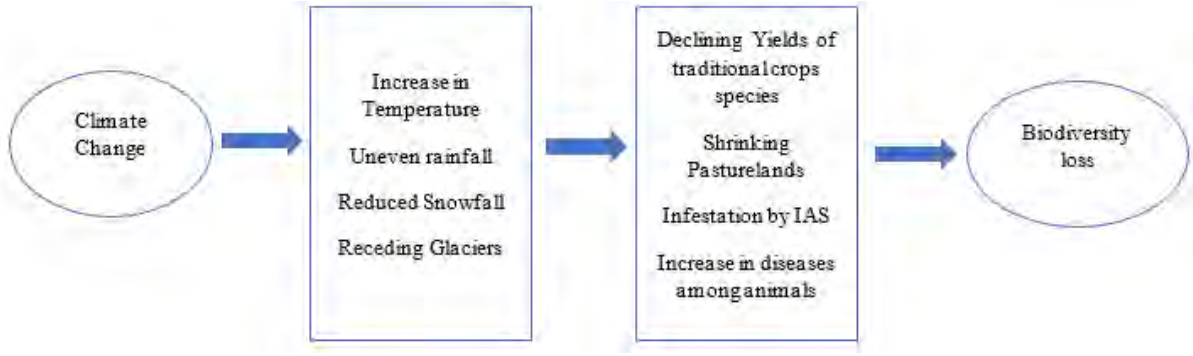
According to Himachal Pradesh Strategy and Action Plan on Climate Change (2012), the state is highly vulnerable to climate change. There are some indirect threats to biodiversity due to climate change such as increase in temperature which further increases the need for water and reduces agricultural productivity of traditional crops. Climate change leaves farmers vulnerable to crop losses due to two reasons: increasing temperatures, and excessive precipitation.. Similarly, changes in climatic parameters provide suitable conditions for invasive species to grow which affects the biodiversity composition. Besides, changing patterns of precipitation has resulted in shifting of apple line upwards.

In addition to this, an agro-climatic zone-wise study conducted on farmer's perception of climate change regarding shift in crops outlines that there has been a decline in basmati rice and maize crop production by 37% and 26% where the crop area has been diverted to paddy rice in Fatehpur Valley. There has been a shift in cultivation in Theog region from cereals and pulses to off-season and seasonal vegetables due to unfavourable weather conditions (Rana et. al, 2013).

Bajaura valley has also reported a shift in cultivation away from fruits like apples and plums to vegetables. A significant decline has been reported in area under *sarson* (mustard) oilseeds by 76 percent.

Also, the area under traditional crops like *Bunium persicum bioss.* (Kala zeera), *Fagopyrum esculentum Moench*. (buckwheat), *Amranthus candatus L*. (amaranth), *Saussurea costus Falc*.(Kuth) and *Crocus sativus L*. (saffron) has decreased significantly in Lahaul valley (Rana et. al, 2013)

Figure 3.5: Indirect Impacts of Climate Change

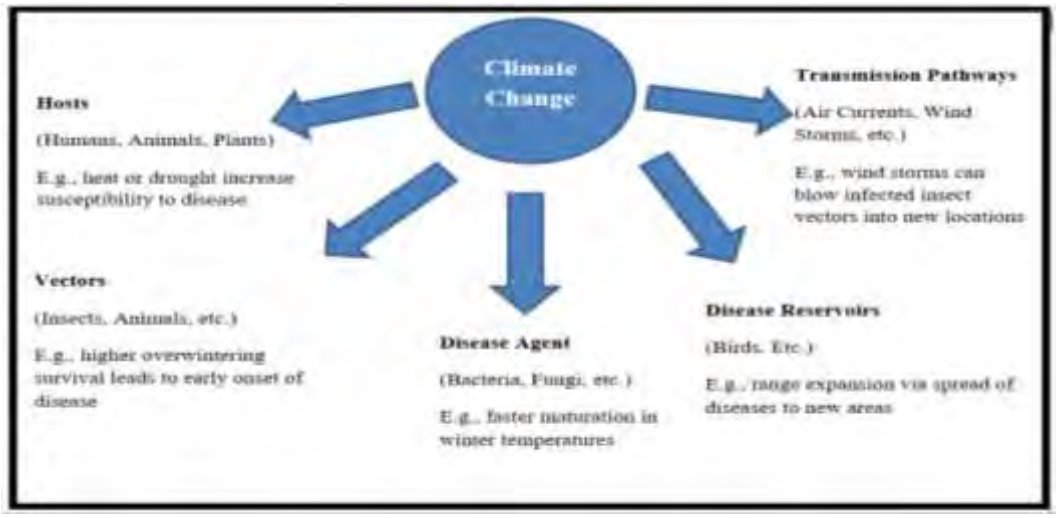


Source: Compiled by Authors

There are indirect impacts of climate change on diseases among animals as has been identified by State Centre on Climate Change in its report on 'Animal Diseases Influenced by Climate Variation in Himachal Pradesh'.

The complexity of indirect impacts of climate change on diseases among animals has been depicted in the Figure 3.6.

Figure 3.6: Indirect Effects of Climate Change on Animal Diseases



Source: State Centre on Climate Change

Climate change and forest fires also have a vicious circle that is difficult to disrupt. Fires release carbon trapped in vegetation and soils, and as their severity increases, they begin to damage deeper layers of soil, releasing centuries-old 'legacy carbon'. Moreover, when a forest regrows after burning, they are smaller, younger and drier than before, and, in some ecosystems, their carbon storage capacity is reduced. This results in a net increase in carbon emissions, thereby worsening climate change. Climate change causes forest fires, which further worsens climate change (WWF, 2020)

2. Pressure on pasture land due to overgrazing and shortage of fodder

According to Himachal Pradesh State of Environment Report (2009), cultivation of green fodder in the agricultural fields is virtually non-existent, leading to open grazing throughout the year. In addition, it is estimated that approximately 35-40% of the geographical area in HP is degraded. According to Desertification and Land Degradation Atlas of India (2016), there has been an increase in vegetation degradation on land with scrub by 1,12,990 ha during 2003-05 to 2011-13. WWF has also recognized overgrazing as a threat to the ecology of important wetlands such as Chandertal[32].

Gupta et al (1998) has estimated that in HP, there was an overall deficit of 32% of fodder requirement of which deficit was 13% in case of grasses, 14% in cases of tree fodder and 55% in case of straw. Some of the important species of fodder are: Beul (*Grewia oppositifolia*), *Grewia Optiva*, Poplar tree (*Populus spp*.), Willow (*Salix spp*.), Himalayan Birch (*Betula utilis*), Sea-buckthorn (*Hippophae*), Bichhu Booti (*Urtica dioica*).

There exists traditional agro pastoral Gaddi community in the state (approximately 100,000 Gaddis), who migrate the livestock semi-annually between the scrub forests of Shivalliks and the alpine meadows. The migration involves approximately 300 km each way over an elevation gradient of 13,000 feet. The shrinking pasturelands due to overgrazing as well as climate change have induced these communities to move upward in the wild animal habitat (Saberwal, 1996).

Overgrazing is not only impacting the native grass species but also habitat of wild animal species in HP: ibex (*Capra ibex sibirica*), brown bear (*Ursus arctos*), himalayan tahr (*Hemitragus jemlabicus*), and musk deer (*Moschus moschiferus*) (Greentumble, 2017; Saberwal, 1996).

Continuous grazing has also given rise to a number of invasive species such as *Rumex nepalensis* is found in Dharampur area due to overgrazing by sheep and goat (Saberwal, 1996). The Restoration Opportunities Atlas by WRI (2018) has identified grazing as one of the potential risks to land degradation in HP and has recorded the landscape restoration potential of 1.58 Mha in the state across three categories: Area of Protection[33] (0.52 Mha), Area of Wild-scale Restoration[34] (0.63 million ha), and Area of Mosaic Restoration[35] (0.43 million ha). Of the total restoration potential, 0.23 Mha potential has been calculated for Chamba and Lahaul & Spiti.

3. Mass Tourism

Being a popular tourist destination, the numbers of tourists in Himachal Pradesh have increased from 161.45 lakh tourists in 2012-2013, to 196.02 lakh in 2017-2018. Tourists enjoy a plethora of activities ranging from trekking and camping to adventure sports, visit to wildlife sanctuaries, lakes as well as fairs and festivals. The tourism sector provides more than 4 lakh jobs, and generating 8-10% of the GDP (Shukla, 2017). However, the implications of expansionary model of tourism on environment and biodiversity cannot be overlooked.

[32]Chandertal is a 'Wetland of International Importance' under the Ramsar Convention, due to the presence of rare plants and a wide variety of unique animal species.

[33] Atlas has defined forest cover with a density of more than 40% as protection areas which can be maintained through protection from risks such as fire, land diversion and fragmentation

[34] Existing forest and tree cover in this category of area is less than 40 % and population density is less than 200 persons per sq. km. This area also includes all plantations irrespective of tree cover density

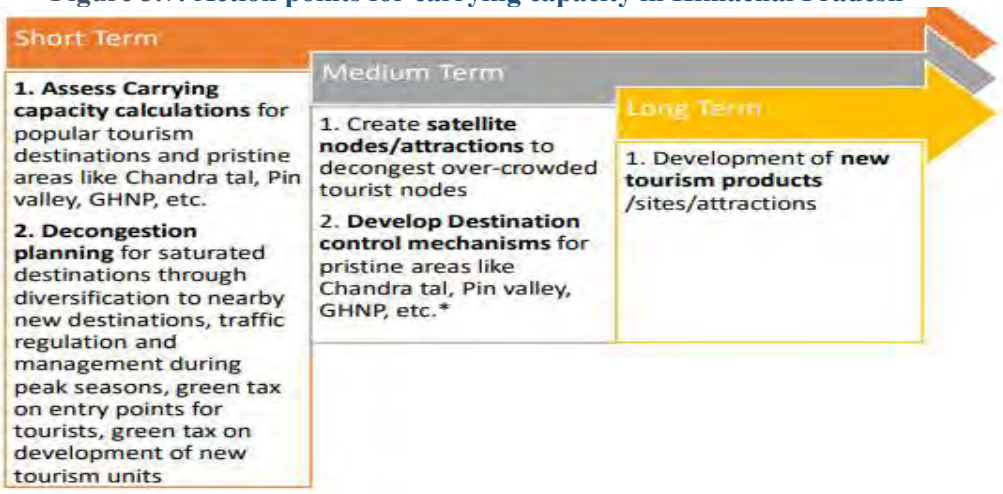
[35] This area has a tree cover density of less than 40 % and population density of less than 400 Persons per sq.km. The area includes agroforestry interventions, such as trees on boundaries, agri-horti-forestry, and farm forestry.

Problem related to water is often reported from the popular tourist places like Shimla and Kullu. A survey of 109 tourists conducted in Shimla reveals that scarcity of water is the major issue followed by traffic congestion during peak season (Das, 2012). Apart from this, negative impacts of nature and biodiversity are often subjected to tourism activities in HP such as waste generation in bulk and its improper disposal, increased construction in the fragile landscapes, land clearing for construction, excessive fuel wood collection.

Given that the state provides a wide scope for recreational activities-- promotion of community-based eco-tourism can be beneficial. With a participatory approach, the idea of promoting eco-tourism is not only restricted to ample employment opportunities for the locals but also contributes towards conserving the nature and biodiversity (Raj, 2017). Active participation of local communities along with building their capacities needs to be done especially in the remote tribal areas such as Pangi valley, Lahaul & Spiti. These places are emerging as a spot for bikers and trekkers.

This can be done in lines with restricting the number of tourists that can visit a destination at the same time based upon carrying capacity (Figure 3.7). An active participation from local communities can help meet the objectives of eco-tourism. Home stays need to be promoted in the remote regions of Chamba, Lahaul & Spiti districts. Home stay units (up to three rooms) are exempted from tax (Himachal Pradesh Home Stay Scheme, 2008). In addition to this, replacement of packed food with locally cooked food is an effective way to reduce solid waste generated during peak season. This along with defining the carrying capacity can help meet the objectives of eco-tourism in the state.

Figure 3.7: Action points for carrying capacity in Himachal Pradesh



Source: Himachal Pradesh Tourism Policy, 2019.

3.3 Gaps in Conservation and Management of Biodiversity

Himachal Pradesh scored 69[36] in SDG India Index 2.0 (NITI Aayog, 2019-20), which is the second highest score in ranking of all states. However, there exists scope for further improvements. Besides, there is a huge scope to strengthen research on microbial diversity to explore the unexplored habitats, specialized ecological niches, rhizospheres and phyllospheres of the plants, animals, traditional fermented foods and beverages of HP, as well as to characterize and report microbial diversity.

[36] This score doesn't include SDG target 13 which is Climate Action due to lack of data.

While a detailed sector-wise analysis is given in the Table A3.1 in Annexure 3 (which includes threats, components of policy, objectives, issues addressed, NBTs and SDGs achieved), a snapshot of gaps is in Table 3.33.

This has been accompanied with consulting Annual Action Plans, Schemes and other programmes, consultation workshops, as well as one-on-one interactions with line departments.

There are some gaps that prevail in conservation and management of biodiversity in the state which have been outlined in Table 3.33 below.

Table 3.33: Gaps in Conservation and Management of Biodiversity

S. No.	Theme	Gaps in current SBSAP and Conservation and Management of Biodiversity
1.	SBSAP 2002	• Harmonization of SBSAP with international conventions has not been made explicit. • A detailed Finance Plan for mobilization of resources has not been outlined. • Monitoring framework and indicators have not been developed.
2.	Implementation of SBSAP	Implementation is fragmented with no systematic institutional mechanism for tracking the progress on action points and targets outlined. No clear finance plan for implementation of BSAP.
3.	Synergy and Coordination among Line Departments	• Multiple agencies are involved with often overlapping functions. Currently, there are two tourism policies (Sustainable Tourism Policy, and Eco-tourism Policy) implemented by Tourism Department and Department of Forest respectively. • Convergence is needed between HP SSAPCC (Himachal Pradesh State Strategy and Action Plan on Climate Change) and HP SBSAP (State Biodiversity Strategy and Action Plan) by way of collaboration between HPFD and DoEST • A forum should be made for all the Himalayan States to exchange ideas, learn from each other and explore opportunities for cooperation. • Support should be provided to research centers/institutions to ensure coordination between Departments and researchers to share inputs.
4.	Priority Areas	Prioritisation of actions on critical threats is lacking • Human-wildlife conflict • Forest Fires • Climate Change • Unscientific extraction of medicinal plants • Shortage of fodder • Mass tourism
5.	Information and Research Gap	• Lack of periodic scientific mapping and monitoring of key resources. • Lack of alternatives to fuel wood to reduce dependence on forests. • Awareness building and training of local communities for sustainable extraction of medicinal plants. • Economic Valuation of ecosystem services to facilitate implementation of ABS and PES mechanism is required.
6.	Capacity Building and Strengthening of Institutions	• BMCs lack capacity for preparation of PBRs and implementation of ABS. Recruit more Forest Guards, provide them training and equipment[37]

[37] Kilar, Pangi Valley Workshop Discussion

Chapter 4: Biodiversity Strategy and Action Plan

4.1 Theme-wise Recommendations and Action Plan

This chapter presents the Biodiversity Strategy and Action Plan for Himachal Pradesh.

Table 4.1 presents BSAP for the whole state. The BSAP is organised under the following eight themes. Each theme is divided into key sub-themes which in our assessment would require focussed attention. The BSAP covers the *Issues, Recommendations, Action Points, Time Frame, Indicators and relevant Agencies*.

BSAP Themes

1. Wild Flora and Fauna
2. Agriculture and Biodiversity
3. Animal Husbandry
4. Aquatic Biodiversity
5. Microbial Diversity
6. Tourism
7. Economic valuation and Natural Capital Accounting
8. Education, Awareness, and Training
9. Policies, Laws, and Institutions

Table 4.1: Recommendations, Action Points, Time Frame, Indicators and relevant Agencies for Himachal Pradesh

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
1. WILD FLORA AND FAUNA						
1.1 Protected Areas						
1.	PAs as a conservation strategy should be re-strategized for effective biodiversity conservation. Re-strategizing does not necessarily mean an increase in net area under PAs, or significant impact on tenurial or access rights of communities or forest resources.	Conduct spatial analysis for determining changes in forest cover of PAs using remote sensing applications. This requires identifying pastureland and different migratory routes taken by herders within PAs to ensure appropriate distribution of livestock pressure in the landscape. Delineate boundaries of PAs in the state to create a systematic understanding of social, biological and physical components of the landscape	M	Scientific investigations conducted PA boundaries assessed Grazing zones identified within PAs	HPFD DoEST SBB NRSC GBPIHED	Reddy et al, 2017 **reveals a reduction of 7.3% in large core forests from 1930 to 2013 across 175 protected areas of India. It suggests application of high-resolution** satellite data to analyse degradation in PAs including grazing pressure, forest fires, invasive species as well as encroachments for better monitoring An assessment of status of biodiversity in relation to livestock grazing in The Great Himalayan National Park Conservation Area, Himachal Pradesh using GIS and remote sensing and have suggested the following (Mehra and Mathur, 2001): • A careful delineation of PA boundaries in the state • Allowing grazing in PAs based upon sound spatio-temporal use of grazing resources (pasture lands) instead of overburdening the landscape at a given point of time • Appropriate distribution of grazing pressure across the landscape
2.	Participatory resource management should be adopted across all 5	Identify the training needs of institutions (such as JFMCs, VFDCs, Yuvak Mandals, Mahila	S	Training modules designed	HPFD	In light of protected area management, Pretty & Pimbert (2009) have highlighted the idea of

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	National Parks, 26 Wildlife Sanctuaries and 3 Conservation Reserves in the state to involve local level institutions as well as communities dependent on PAs	Mandals, Praja Mandals) to create opportunities for networking in the context of biodiversity conservation in PAs Conduct awareness to educate communities about the impacts of anthropogenic pressures on biodiversity like illicit felling, unsustainable extraction of medicinal plants, overgrazing, etc.		Trainings conducted for institutions at the block level Awareness campaigns designed and conducted	DoEST SBB JFM and other local level institutions	community-based action through local institutions and user groups. The key premise here is that joint or co-management of protected areas will result in greater conservation. This would establish mutually agreed processes to achieve long-term conservation.
1.2 Human-Wildlife Conflict						
3.	Comprehensive database for Human-wildlife conflict along with nature and extent of conflicts in H.P should be prepared	Conduct district-wise scientific investigation on abundance of wild animals in relation to habitat characteristics, land-use pattern, and availability of prey species Establish a complete protocol of wild animals with types of species, sex, and individual identity of animals which may be involved in the human-wildlife conflict	M	Number of Human wildlife conflict related cases registered District-wise studies for scientific investigation on HWC conducted	HPFD SBB JFM PRI VFDC	188 cases of leopard attacks killing more than 26 people have been recorded in HP during 2008-09 (Rattan, 2015) Out of a total of 75 Tehsils, 39 Tehsils have been marked as monkey hotspots[38] Attacks by wild bears on humans has been reported in Bharmaur and Jummhar regions of Chamba district and by leopard in Kinnaur and Una district (Bodh, 2017) An annual estimated loss of Rs. 150.10 crore of horticulture crops has been reported in HP

[38] https://hpforest.nic.in/files/Proposal%20under%20Sec%2062%20for%20declaring%20Macaque%20as%20Vermin%20in.pdf

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		Evaluate the experience of ongoing projects/programs such as Insurance Scheme by National Conservation Foundation in Spiti (Bijoor, et al, nd) and identify effective approaches to strengthen such programs		A complete protocol of wild animals in conflict prone area established		due to raiding of farmlands by monkeys and birds (Thakur 2019) Pandey, et al. (2016) explains the importance of wildlife forensic genetics to provide significant information for the management of human-wildlife conflicts.
4.	Conduct studies to identify effective compensation and risk mitigation measures based upon extensive consultations with state officials, local-level institutions, local communities, and experts to reduce interface of man and animal	Ensure availability of food for animals in their habitat. Some of the suggestions[39] are listed below: **1.** Plant more fruiting trees in forests to avoid raiding by animals in agricultural lands in search of food **2.** Identify zones and mark them as grazing/ pasture lands **3.** Revive degraded pasturelands in uphill to provide grazing lands for wild animals such as Ibex & blue sheep **4.** Periodic cleaning of shrubs to provide free movement of animals **5.** Improving prey base for wild animals	M-L	Revival and demarcation of zones for grazing is done Convergence of economic instruments for compensation done More frontline staff deployed	HPFD SBB JFM PRI VFDC	Area specific measures such as identification of wild animals, plantation of fruiting trees, fencing should be explored and an effective compensation programme should be designed covering human, livestock as well as crop damage due to such conflicts Some of the reasons for HWC, based upon consultation workshop in Kilar, Pangi[40] are: • Depletion of natural prey base of wild animals (mainly due to shrinking of grazing pastures) is resulting in attacks on livestock by wild animals such as snow leopards • Encroaching habitat of wild animals • Uphill movement of semi-nomadic communities like Gaddis in search of pastures for grazing their cattle

[39] Consultation Workshop organized by NIPFP on 25th September 2019, Kilar, Pangi Valley
[40] Consultation Workshop organized by NIPFP on 25th September 2019, Kilar, Pangi Valley

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		6. Sterilization of animals like Monkeys				
		Explore gainful alternate livelihood for herders like Gaddis in uphill such as wool products as well as provide training to herders for sustainable pastoral practices				
		Explore implementation of insurance scheme and link it with already existing Rates of Relief (HP Forest Department, 2014) and Mukhya Mantri Khet Sanrakshan Yojana (Himachal Watcher, 2019)				
		Prevent poaching and illegal trade of wild animals by deploying more frontline staff and wildlife personnel and provide them adequate equipment				
1.3 Forest Fires						
5.	Data on forest fire should be strengthened to document causes of increasing incidents of forest fires (ANI, 2019)	Conduct a comprehensive study to document the causes as well as ecological, economic and social impacts of forest fire in the state	S	A detailed socio-economic analysis on impact of forest fire being conducted	HPFD DoEST SBB	Some of the causes that have been identified for forest fires are: 1. According to State Level Climate Change Trends in India report (2013) by India Meteorological Department, highest increase in both: summer mean maximum temperature

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	Regularly update information such as area burnt, economic loss, vegetation and wildlife affected due to forest fires	Conduct the gap analysis of current capacity of forest fire management in terms of forest fire stations, improved fire equipment, manpower, etc. and strengthen the same in the light of increasing forest fire incidents (MoEFCC & The World Bank, 2018).		Gap analysis to enhance forest fire management conducted		(+0.06% °C/year) and winter mean maximum temperature (+0.06% °C/year) in Himachal Pradesh has been noted during 1951-2010 due to climate change (Rathore, Attri and Jaiswal, 2013). 2. Setting grasslands afire by local communities to get softer grass after the rains in forest area vicinity (IANS, 2019 (i)). 3.Heaps of dry pine needle which are highly inflammable in nature (Goswami, 2018)
6.	Advanced technologies as well as suitable measures should be adopted to help detect, prevent and monitor the impact of forest fire Develop an active prevention strategy for the state. Shift the focus from suppression strategies to prevention strategies. Develop strategy to bring businesses on board by mobilising CSR activities to support local communities and create partnerships for fire	Explore devising a Fire Danger Rating System to assess the effect of factors such as fuel, weather, topography, etc. on daily fire potential of an area and consider local knowledge to identify solutions Explore the method of "prescribed burning" or "cool burn" and provide training for the same to local communities, where controlled, early dry-season burning is done intentionally to reduce the risk of serious fires Provision of LPG to reduce dependency on biomass-based stoves often used in open areas Strict vigilance of trespassers to not carry inflammable materials to trails	S-M	Fire Danger Rating System devised Percentage of households using clean cooking fuel	HPFD DoEST SBB	Fire Dander Rating System helps in assessing fire potential of an area. One Fire Danger Rating System has been designed by U.S. Department of Agriculture in collaboration with Pacific Southwest Forest and Range Experiment Station (NWCG (2002) & Cohen & Deeming (1985)) Explore the idea of cool burning, often referred to as prescribed burning, where intentional forest-fires are expected to reduce the risk of serious fires (Fernandes and Botelho, 2003). This has been emphasised by scientists worldwide as they have called for prevention-based action rather than suppression-based efforts.

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	prevention and suppression activities.	and meadows by deploying more forest staff in forests				
7.	Institutions such as Panchayat, JFM, VFDCs, VFDSs should be made an integral part of forest fire management Engage with communities through: Controlled, ecologically compatible and early dry-season burning protocols to reduce risk of serious fires Delegating responsibility to the community through sufficient policy and legislative safeguards Technical support and training to communities to enable them in assuming a central role in fire management.	Identify the training needs of communities for forest fire management as well as "prescribed burning" where early dry-season burning is done with an aim to reduce the risk of forest fires Distribute pamphlets as a part of awareness campaign containing information regarding Fire Alert Messaging System (FAMS) by FSI[41], and contact details of JFMs/VFDCs, Panchayats, Fire control rooms, DFOs, ROs, etc.	S	Trainings for forest fire management conducted Increase in number of local institutions that adopt and implement local risk reduction strategies Training conducted. Budget allocation to forest fire programs. Regulation of tourism activities. Awareness programs through audio and visual mediums. Awareness program in schools.	HPFD DoEST SBB	According to MoEF&CC and the World Bank (2018): The most important cause of forest fire in Himachal Pradesh is negligence in use of fire around forests, and The second most important cause is resource collection from forests especially grazing The most important challenge to forest fire management has been identified to be Public Management.

[41] http://fsi.nic.in/uploads/documents/technical-information-series-v2-22-4-19.pdf

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
1.4 Restoration Potential						
8.	Restoration Potential of 1.58 mha should be achieved across landscapes to ensure improvement in tree cover and carbon sequestration. Achieving the Restoration potential can provide direct benefits to the communities through food security, strengthened energy security, biodiversity conservation, and soil and moisture conservation. Therefore, a livelihood assessment is necessary to identify such value chains to support livelihood.	Design and implement a restoration program to regenerate degraded land by prioritizing areas based upon restoration potential. Explore the suitability of ROAM methodology developed by WRI to conduct pilots for landscape restoration including interventions such as identification of degraded landscapes, plantation of native species, assisted natural regeneration, mixed plantations, agri-horti-forestry, trees on boundaries as well as farmer managed natural regeneration Identify native tree species and associated value chain of key tree species for livelihood diversification and income generation of local communities	M	Proportion of land that is restored over total degraded land Increase in area of forest under tree cover Carbon Stock sequestrated	MoEF&CC NRSC HPFD DoEST SBB JFM VFDCs	The Restoration opportunities atlas for India has been launched by WRI. The Atlas can be used to prioritize areas/landscapes in Himachal Pradesh that have potential to be restored. The Restoration Potential (RP) for HP is 1.58 Mha and Carbon Sequestration (CS) Potential is 53.42-63.57 MT (Chaturvedi et al, 2018). The Restoration Opportunities Assessment Methodology (ROAM) has been developed by WRI where a case study of Sidhi in MP has been conducted. The highlights of the study are as follows (Sungh et al, 2018): **1.** Restoration can provide direct benefit of 3.75 million person-days of wage labour and INR 710.76 million in wage income **2.** 31,000 jobs for women, unemployed and landless can be generated by value chain development around six key tree species **3.** 7 million tonnes of CO2eq can be sequestered
1.5 Preparation of PBRs						
9.	Preparation of PBRs should be expedited as per the mandate in Biodiversity Act 2002, along with building capacity of BMCs	Facilitate preparation of PBRs in time bound manner by setting up a committee under HPSBB, and a dedicated fund to expedite this process. Conduct scientific surveys on a continuous basis using latest tools	S	Increase in Number of PBRs prepared Formation of Committee under SBB to facilitate preparation of PBRs	DoEST SBB NBA BMCs	

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	Supplement PBRs with regular scientific surveys to timely update key threatened, critical, endangered, vulnerable and rare species	and technology to timely update PBRs. This should appear as a separate budget line item on SBB budget. Commission a study for assessment of the total potential of ABS in Sikkim Commission a study for assessment of current use of natural resources which is liable for ABS and the key issues impacting ABS collection. A continuous dialogue with industrial users and traders on the importance and need for ABS for long term sustainability of resource is important.		PBRs utilized as key document in identifying targeted species as well as traditional knowledge for ABS contracts ABS mechanism starts to show results in terms of number of ABS contracts signed and revenue raised.		
1.6 Wildlife crime						
10.	Strengthen the existing mechanism to address wildlife crime as outlined below: **1.** A comprehensive database on wildlife crime to prevent illegal hunting and wildlife trade should be prepared	Develop database on wildlife crime in consultation with local communities, local level institutions such as Praja Mandal, Panchayat Raj, VFDCs, VFDSs as well as forest guards in the field, police and various other line departments Identify gaps in staff strength and funding based on security audits conducted by various agencies such as WTI, TRAFFIC	S-M	A state-level database on proportion of traded wildlife that was poached or illicitly trafficked Number of capacity building and anti-trafficking trainings conducted	HPFD Police department BMCs TRAFFIC WTI WCCB	There are several routes for illegal wildlife trade which are reported to be operating in HP, the main exit points of which are: Border areas of Leh-Ladakh, Chamba and Pathankot as well as Tiuni-Vikasnagar in Uttarakhand (Chauhan, 2019). A trend analysis for Hamirpur district has found that during 2001-13, 58 out of 123 leopards were found dead due to illegal hunting (Kumar, Chandel, Kumar, & Sankhyan, 2015)

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	2. Gap analysis in terms of frontline staff to be conducted **3.** Training to build capacity of government staff is important **4.** Local communities to be an integral part of fight against wildlife crime **5.** Identification of trade channels and coordination in trans-border (national and international) law to prevent illegal trading in skin and other body parts of wild animals	Design training modules and provide anti-trafficking training to all the enforcement agencies Organize awareness programs for farmers, herders, communities in uphill regions regarding the vulnerability of species like Panthera uncia (snow leopard) and need for their conservation Institutionalize community-based surveillance and patrolling systems especially in higher altitude landscapes Educate local communities regarding the need of wildlife crime prevention as well as ill-effects of retaliatory killing of wild animals using print media like posters, bill boards, pamphlets.		Number of awareness workshops organized Gap in number of incidents and cases reported is reduced Number of incidents show a decline	Local Community Groups NGOs	A state-level database needs to be prepared on: • Number of retaliatory killing • Cases of poaching for trade of animals' derivatives • Illegal Trade channels
1.7 Invasive alien species						
11.	Strengthen arrangements to identify Invasive Alien Species (IAS) and develop measures to eradicate them	Develop database via ecological assessment of invasive species and its impact on habitat in the state Document traditional knowledge via scientific surveys in PBRs to eradicate or put invasive species to alternate use	M	Database prepared Mapping and reporting of invasive species is included in PBRs	HPFD SBB BMCs Local Communities	Traditional knowledge can be very helpful in developing effective measures to eradicate invasive species: Lantana Camara (654 sq. km), Ageratina adenophora (39 sq. km), Ageratum conyzoides (36 sq. km), Melochia corchorifolia (30 sq. km) and Dioscorea deltoidea (29 sq. km) (FSI, 2019)

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		Develop Restoration Plan for area affected by invasive species. The plan should include regeneration of native species as well		PBRs are prepared and used as a key document in identifying IAS A list of targeted species is finalized	Rural Development Department	Currently, management of invasive species is being done under 'Policy for removal of Lantana Camara'. The scope of such policy can be expanded by identifying and including other invasive species
		Involve cottage industries and incentivize them to utilize invasive species. Some of the industrial uses of invasive species found in HP are: • Use of *Lantana Camara* as bioethanol fuel (Pasha et al, 2007) • Fresh roots of *Ageratina adenophora* have antibacterial qualities (Dong et al, 2017) • Parts of *Melochia corchorifolia* can be used as fodder and also have antioxidant and anti-bacterial qualities (Mamatha et al, 2018)				
1.8 Biodiversity Heritage Sites (BHS)						
12.	Biodiversity Heritage Sites (BHS) should be identified in the state with active involvement of local institutions and communities.	Identify and manage biodiversity rich areas based upon species, ecosystem services as well as livelihood benefits to local communities Identification of BHS can also be done as a part of eco-tourism programme	M	Delineation of boundaries of BHS being done Monitoring of BHS done regularly	HPFD SBB PRIs Rural Development Department	

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		Involve local communities as well as local level institutions (such as Panchayats, BMCs, VFDCs, JFMs) in the process of identification and management of BHS				
		Use GIS mapping to carefully delineate the boundaries of such sites				
		Conduct regular monitoring once sites have been identified in light of anthropogenic pressure				
1.9 Database						
13.	Database on ENVIS HP portal should be strengthened to make it a repository of credible data and knowledge on biodiversity Integrate data collection, collation and management efforts to enable easy access to data for policy analysis & minimize duplication of efforts.	Update existing database to include endangered, extinct, rare, threatened, vulnerable species along with trend in species composition in HP with the help of educational institutions	S Strengthening of ENVIS should be a continuous process	ENVIS HP Portal comes up as a comprehensive data and knowledge base ENVIS is made user friendly and interactive Policy research is produced using ENVIS Educational institutions registered and utilized ENVIS	MoEF&CC HPFD DoEST SBB ENVIS	This will be helpful in identifying further data needs and in keeping records of data usage and thus tracking usefulness of the portal
		Identify additional software and staff needs to strengthen ENVIS HP portal				
		Make arrangements with reputed institutions, experts and agencies that are working on biodiversity for sharing of information on ENVIS HP portal on a regular basis				

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
1.10 In-situ Conservation						
14.	Comprehensive strategies for threatened floral and faunal species for in-situ conservation are important Identify appropriate conservation strategies including mass multiplication protocols in their natural habitat	Prepare a plan for conservation of threatened indigenous species published by SBB. Identify sites for restoration in light of conservation of native species and plan for long-term environmental monitoring[42] Consider incorporating traditional knowledge in PBRs for crop breeding, especially for the crops of economic importance to help farmers[43] Organize workshops at village-level with help of BMCs to spread awareness regarding the importance of indigenous species and need of community-led conservation in the high-altitude areas	S-M	Species as well as sites for in-situ conservation prioritised Conservation protocols developed and standardised. Number of workshops organized to spread awareness regarding indigenous species Number of animal genetic species secured in medium or long -term conservation facilities	HPFD DoA SBB NBA NBAGR	Some of the threatned species in HP are: **Fauna:** Glyptothorax kashmirensis, Tor putitora, Kashmir Gray Langur, Wagur, Snow leopard, Asla, Asian small clawed otter, Tarai grey langur, Neallogaster ornata, Gangetic ailia, Siberian Ibex **Flora:** Gentiana kurroo Royle, Nardostachys jatamansi (D.Don) DC, Saussurea costus (Falc.) Lipsch, Aconitum chasmanthum Stapf ex Holmes, Lilium polyphyllum D.Don, Carex kashmirensis, Vigna khandalensis, Cajanus cajanifolius, Webb Fir, Jungli pyaz

[42] https://nmhs.org.in/fellowship_04_2015_16.php
[43] https://www.nap.edu/read/2116/chapter/7#119

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
1.11 Ex-situ conservation						
15.	Conserve genetic diversity of threatened flora and fauna in the state Identify species for Ex-situ conservation and provide economic and technical support for conservation	Develop database based upon morphological studies for chemical and molecular characterization of species for ex-situ conservation as well as standardize mass multiplication, breeding protocol of rare, threatened, vulnerable, endemic and endangered species Strengthen seed banks for seed conservation as well as plant breeding for further seed development Mass multiplication of threatened species through conventional and tissue culture techniques by selecting highest quality parents for breeding Germplasm collection to be strengthened to conserve animal genetic resources.	S-M	ENVIS HP database strengthened and updated for agro-climate zone-wise threatened indigenous species A priority list and action plan is prepared. Necessary protocols are developed, and relevant agencies identified. Proportion of faunal and floral species classified as being at risk, not at risk or at unknown level of risk of extinction Number of animal genetic species secured in medium or long -term conservation facilities Number of species cultivated through tissue culture	HPFD DoA SBB NBA NBAGR	Down to Earth (1997) finds that for long term preservation of endangered breeds, storage of DNA and RNA is a must. Scientific surveys can help in designing suitable propagation plan A fine example can be drawn from development of Community Reserve in Singchung Bugun Village, Arunachal Pradesh to conserve Buguns (Akhtar M. 2018; Dasgupta S., 2018). Here communities gave up approximately 17 km of land to make community reserve

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
1.12 Cultivation of MAPs						
16.	Create value chain through partnership between industry and local communities for commercially viable species of (MAPs) which are on the verge of extinction due to unscientific extraction MAP species extracted in huge quantities in HP are: *Aconitum heterophyllum, Angelica glauca, Berberis spp., Betula utilis, Centella asiatica, Ephedra gerardiiana, Picrorhiza kurrooa, Podophyllum hexandrum, Selinum tenuifolium, Valeriana spp.*	A comprehensive focused program should be introduced to provide support for identified medicinal and Aromatic plants. From field level consultations the following were identified: Patish (Aconitum heterophyllum) Wild Garlic (Allium ursinum) Kuth (Saussurea lappa) Kaala Jeera (Elwendia persica) Kutki (Picrorhiza kurrooa) Pushkarmool (Inula Recemosa) Assist entrepreneurship, business models as well as R&D keeping in view the market demand and adopt an inclusive approach to make scientific inputs available to local communities for cultivation of medicinal plant. The model should include quality specifications, bio-chemical compositions suitable for crops and a buy-back guarantee to farmers	M	A focused program introduced A business model for promotion of MAPs implemented	HPFD Rural Development Department HPAB HPSAMB HPSMPB	57 species of MAPs are threatened in HP[44]. Over-extraction of decoction of plants like *Crotolaria juncea* (Pataku) and *Eclipta alba* (Bringraj) by local communities to cure diseases as well as for livestock has been done by local communities (Parkash & Aggarwal, 2010) Study conducted in Kullu district reveals that due to premature and frequent harvesting, the size of roots of *Jurinea macrocephala* has become smaller (Singh G. S., 2011) The extraction of species like *A. heterophyllum, A. glauca, H. spicatum* in HP at the flowering stage or before ripening of seeds has affected their high germination potential which is a constraint in their propagation (Butola and Badola 2008) As a part of business model, start cultivation on a smaller scale and then scale-up the cultivation once farmers' trust is established. Funds can be procured from potential sources like AYUSH Mission, National Medicinal Plant Board for the same.

[44] https://hpforest.nic.in/files/ANNEXURE%20-%20I.pdf

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		Regulate enforcement of biodiversity related community-level rules (by-laws) such as penalties imposed by Praja Mandals for illegal extraction of MAPs.				
		Explore cultivation of carefully selected species as a mixed, inter or companion crop in agro and farm forestry (Karki et al, 2003)				
2. AGRICULTURE AND BIODIVERSITY						
2.1 Organic Farming						
1.	Scheme for branding, labelling and marketing, and value addition of organic produce of local varieties Selling these local varieties (mentioned in remarks column) as premium organic produce, supported with marketing can fetch a higher price and ensure synergy between commercialization and conservation	Introduce a comprehensive focused program to provide support to identified niche organic products such as peas, kala jeera, wild garlic, kuth, kutki[45]	S-M	Trainings on organic farming organized A comprehensive target-oriented program is introduced Area under organic shows an increase. Labelling and certification	DoA DoEST SBB HIMCOSTE	Some of the traditional varieties of crop in HP (HPSBB, 2018): Amaranthus hypochondriacus L. (Amaranth), Cajanus cajan (L.) Millsp. (Arhar daal), Chenopodium album L (Chenopod), Cicer arietinum L. (Chana), Echinochloa frumentacea Link (Shownk), Eleusine coracana Gaertn. (Koda), Fagopyrum esculentum Moench. (Buckwheat), Glycine max (L.) Merr. (Soybean) To enhance organic agricultural production, it is important to adopt and inclusive approach where farmers are incentivized to shift towards organic farming
		The program should involve branding, labelling, value added products, marketing, pricing as well as cold chains				
		Training to farmers regarding suitable organic crop combination, crop rotation, nutrient and residue management protocol, crop-livestock integration, post-harvest management and storage practices				

[45] Consultative workshop organized by NIPFP on 25th September 2019 in Kilar, Pangi Valley, Himachal Pradesh

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		Strengthen the facility of certification of organic produce Explore potential of PGS Certification of not for export varieties. [46]				
2.2 Community Seed Banks						
2.	Improve seed viability and storage technology to conserve Plant Genetic Resources for Food and Agriculture (PGFRA) through development of Community Seed Banks Collaborate with organizations like Navdanya which develop seed banks in various agro-climatic zones, & provide training to farmers.	Establish community seed banks to make local variety of seeds available to farmers. Monitor quality seed production response to threats posed to plant genetic resources due to climate change The following steps should be followed in setting up and maintaining a community seed bank: • Select villages and assess the needs through FGDs • Identify the farmers and plan seed production based upon needs assessment • Provide training to build capacity • Plan for renewal of diversity with focus on traditional and local varieties	S-M	Number of community banks established Local seeds classified as being at risk, not at risk or at unknown level of risk of extinction	DoA DoH HPSBB NBA GBPIHED	Cultivation has been shifting away from traditional crops which have tolerance to moisture stress and are adapted to poor fertile soils: Setaria italica (Koni), Paspalum scrobiculatum (Kodo), Eleusine coracana (Ragi), Panicum miliaceum (cheena), pseudocereals like grain amaranth, green chenopod and buckwheat (TERI, 2015). **Agro-climatic zone-wise analysis** shows shifting of farmers preferences away from traditional crops: **Lahaul-** *Bunium persicum bioss.* (kala zeera), Fagopyrum esculentum Moench. (buckwheat), Amranthus candatus L. (amaranth), Saussurea costus Falc. (Kuth) and Crocus sativus L. (saffron) **Kullu-** Plums, Apples**,** sarson oilseed **Kangra**- Basmati rice and maize crops **Shimla-** Cereals and pulses

[46] PGS *Certification* facilitates farmers to certify their organic produce, label and market their products domestically. It is a scheme under the Paramparagat Krishi Vikas Yojana (PKVY)

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		• Monitor to ensure quality seed production • Document the amount of seed available for local use and supply				(Rana et. al, 2013)
2.3 Fodder management						
3.	Fodder management needs to be done to check shortage of fodder, especially in winters. The following recommendations are outlined: **1.** Revive degraded pasture lands on regular basis with native species (native trees, grass, legumes) used as fodder **2.** Make Nomadic/ Semi-Nomadic herders such as Gaddis and other communities an integral part of VFDCs to address the problem of grazing conflicts	Prepare plans to grow species of grass, fodder trees and legumes which are high in protein & can be planted in high altitude regions of the state to feed livestock. Such as[47]: Poplar tree (Populus spp.) Willow (Salix spp.) Himalayan Birch (Betula utilis) Sea-buckthorn (Hippophae) Bichhu Booti (Urtica dioica) Awareness of farmers regarding efficient use of fodder, for e.g., adding of urea and mineral supplements to enrich crop residues and dry fodder Training of local communities in scientific production & management of fodder under Uttam Chaara Utpadan Yojana for higher productivity of livestock and less pressure on forests	S-M	Degradation of Grazing lands is halted. Fodder situation has improved and dependence on forests for fodder is reduced Development of fodder bank model at suitable sites established.	DoA DoAH Rural Development Department CSKHPKV IGFRI PRI Local communities	Gupta et al (1998) estimated that in HP, there was an overall deficit of 32% of fodder requirement of which deficit was 13% in case of grasses, 14% in cases of tree fodder and 55% in case of straw. The grasslands in HP are poor in respect of their productive potential and carrying capacity; and there is also an imbalance in human cattle population (1:1.25) indicating heavy pressure on natural forest for fodder, small pole, timber and fuel wood etc (Khanna, 2019) Dhyani, Maikhuri and Dhyani (2013) have developed a Fodder Bank Model in Kedarnath Wildlife Sanctuary, Uttarakhand. Fast growing, nutritious and high biomass yielding fodder species have been identified to include in the model. Women have been actively engaged in the model.

[47] Consultative workshop organized by NIPFP on 25th September 2019 in Kilar, Pangi Valley, Himachal Pradesh

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	3. Training of communities for fodder management	Develop a Fodder Bank with technical help from local institutions to enhance quantity and quality of fodder. This will help local communities in terms of increased milk output and less pressure on grazing lands.				
2.4 Irrigation						
4.	Need to revisit irrigation planning in HP to balance the need for small hydro power projects with traditional irrigation systems and practices. Due to small hydro power projects, there has been diversion of streams which is resulting in drying of traditional irrigation system called Kuhls. The following strategies may be considered. **1.** Promotion of Rain water harvesting	Promote Kuhls which is a traditional irrigation practice in the state[48] Revise small Hydro power policy to consider the issue of divergence of water from micro irrigation systems such as Kuhls[49] Explore **PES as a mode of compensation** to incentivize farmers to change irrigation practices and yield substantial water savings Increase the number as well as reach of solar pumping sets to farmers under Saur Sinchayee Yojana	S	Traditional irrigation systems supported and revived Increase in access to solar pumping sets	DoA DoH DoEST HPSBB HPAU ICAR Rural Development Department	The study conducted by Immerzeel, Stoorvogel, & Antle (2008) showcases the concept of PES to Incentivize farmers to save water in a small catchment on the Tibetan plateau.

[48] https://www.indiawaterportal.org/articles/kuhl-kohli-and-lost-tradition
[49] https://www.indiawaterportal.org/articles/kuhl-kohli-and-lost-tradition

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	2. Promotion of solar energy and pumps **3.** Promotion of traditional irrigation systems such as Kuhls					
2.5 Agro-forestry						
5.	Rehabilitate degraded land via agro-forestry system in lines with existing crop and livestock needs. Identify hotspots of agroforestry in HP Promote Silviculture	Incentivize farmers to grow local varieties by demonstrating and encouraging suitable farming practices such as Silvipastoral system done in Kandaghat block of Solan District Strengthen arrangements such as set-up high-tech nurseries in higher altitude regions as well as improved varieties of planting materials to the farmers for agro-forestry such as tall plants through already existing nurseries Sloping Land Conversion Program in China which provides subsidies to farmers who convert degraded and highly sloping cropland back into forests can be explored for its suitability in HP.	S-M	% of degraded area rehabilitated through agro-forestry A Plan is prepared on agro-forestry (agro-climatic zone-wise) Number of plants provided as planting material to farmers for agro-forestry A nodal agency for restoration is formed	DoA DoH HPFD DoAH SBB	Involving local communities in reviving degraded forests via agro-forestry can give them a sense of responsibility towards restoration of degraded forests (Matsvange, Sagonda and Kaundikiza 2016) Based on four case studies Adhikari and Taylor (2012) have outlined that communities should be involved in adaption efforts which are undertaken as a response towards climate change.
2.6 Bio-control agents						
6.		Strengthen State Bio control labs to provide suitable bio-control agents	M		DoA	

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	Use of bio-control agents should be promoted This should be accompanied with enabling safe use of pesticides on agricultural land	especially for higher altitude regions Provide on-farm training to farmers in order to ensure adoption of Pesticide Application Technology for minimum residue and reduced pesticide risk		Number of trainings provided to farmers for Pesticide Application Technology	DoH	There are currently 2 State Bio-control labs in the state[50]: • Holta, Palanpur, Distt. Kangra • Distt. Mandi, H.P. As per Himachal Pradesh Horticulture Development Project, most of the facilities have already been created in the laboratory to provide bio-control agents. However, with the addition of inputs, some more number of Bio-agents, Bio-pesticides and Bio fertilizers could be produced[51]
2.7 Adaptation towards climate change						
7.	Identify relevant tools and methods to assess the impact on and vulnerability of biodiversity due to climate change	Establish phenology monitoring units in the state as a continuous monitoring source of climate change. This should be in a program mode such that adequate monitoring is undertaken Map fragile ecosystems and demarcate them as "No-Go Zones". This needs to be accompanied with identifying critical species which are vulnerable to climate change for information and awareness of farmers, local communities,	M-L	A program for adequate monitoring of climate change being implemented No-Go Zones identified Integration of Climate Change adaptation measures	HPFD DoEST SBB IUCN BMC HPKCCC	Phenology is an important indicator for assessing climate change and should be made part of further research in the state Research published by IUCN has made repeated calls for identifying "No-Go Zones" in response to environmental threats

[50] http://ppqs.gov.in/divisions/integrated-pest-management/bio-control-labs
[51] http://documents.worldbank.org/curated/en/215321468252650728/pdf/HPHDP-ESMP-draftfinal.pdf

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		ecotourism activities and other development works Ensure availability of drought resilient seeds, public health measures for heat-waves, cold-waves, vector-borne diseases, disaster risk reduction, water management as well as climate smart agriculture Sensitize communities		in existing policies across relevant sectors		
8.	Strengthen measures to promote cultivation of local varieties as livelihood adaptation measure in the context of Climate Change This would require improving seed viability, storage technology, strengthening of market channels as well as awareness raising among communities	Demonstrate and encourage suitable agro-forestry systems such as Hortipastoral, Silvipastoral. Such systems have been explored by Kumar, et al. (2018) for Kandaghat block of Solan District Additionally, set-up high-tech nurseries to produce improved varieties of planting materials like tall plants that can be grown on farmlands	S-M	Community seed banks established Number of plant genetic resources for food and agriculture secured in either medium- or long-term conservation facilities	DoA DoH SBB HPSAMB HIMCOSTE NBA BMCs	The suitable crops suggested for Kandaghat block of Solan district are (Kumar et al., 2018): **Rabi crops**- wheat, pea, mustard, barley and cabbage, cauliflower **Kharif crops**- maize, colocassia, beans, capsicum, tomato, ginger and turmeric

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
3. ANIMAL HUSBANDRY AND BIODIVERSITY						
3.1 Promoting genetic diversity						
1.	Arrangements to conserve and promote genetic diversity of indigenous animal species should be strengthened	Propagation of indigenous breed of cow by using sex-sorted semen (SSS) as has been practiced in 10 states in India under Rashtriya Gokul Mission (Katiyar, 2019) Set-up more 'bovine stations' for animal preservation through germplasm collection where genetic material is stored in the form of semen, embroys as well as DNAs.	M-L	Bovine stations set-up Number of animal genetic species secured in medium or long -term conservation facilities	DoAH SBB NBA NBAGR	Sex-sorted semen (SSS) can help in controlling birth of bulls, reduce stray cattle, boost milk production, propagate indigenous species (KAtiyar, 2019) Sati and Singh (2010) and Koireng et al (2018) observe that indigenous species of livestock are more adaptable to the fragile hill environments than the crossbreed one and their potentials for economic enhancement of the region have yet to be utilized. Indigenous species are losing their economic viability due to which communities do not work towards preserving them. Local communities need to be incentivized towards preservation of such species.
3.2 Stray cattle management						
2.	Design effective measures for stray cattle management. This would require: 1. Strengthening arrangements to	Strengthen 'Gokul Grams/Gosadans' to increase the capacity to accommodate stray cattle[52] Make registration of animals compulsory with the help of local	M-L	Gokul Grams established Registration of cattle completed	DoAH SBB NBA	Currently, number of Gosadans and their capacity to accommodate stray cattle falls short due to increasing number of stray cattle

[52] According to 19th Livestock Census 2012, there are 32160 stray cattle in Himachal Pradesh. Stray cattle Policy 2014 mentions that there are 75 Gosadans with a capacity to house only 7451 cattle.

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	accommodate stray cattle (PTI, 2015; TNN, 2019) 2.Involving both local level institutions as well as local communities to ensure effective stray cattle management 3.Designing a mechanism to identify and punish defaulters who have abandon their unproductive cattle	level formal/informal institutions such as Panchayat, Yuvak Mandal, Mahila Mandal Conduct pilot for sex-sorted semen to ensure that female calves are born using the technology. This will increase productivity of cows, profitability of farmers as well as reduce the problem of stray cattle (Katiyar, 2019) Explore providing incentive to local communities as a possible strategy such as monthly remuneration to adopt stray cattle (Sharma, 2019)		A pilot for sex-sorted semen conducted		Gokul Grams have been established under Rashtriya Gokul Mission in 13 States so far
3.3 Diseases among livestock						
3.	Research on diseases among livestock should be strengthened (Jitendran, KP, 2000; Rana and Randhawa, n.d.)	Conduct studies to identify diseases, causing agents as well as etiological agents (Holden and Butler, 2018) of diseases including the impact of these diseases on bovines across all the districts Document traditional knowledge in PBRs related to ethno veterinary plants to cure animal diseases Similar documentation has been done for ethno veterinary practices in Jawalmukhi, as well as Hamirpur district (Bhatti et al, 2017)	S	Studies on diseases among livestock conducted PBRs being used as key document in recording traditional knowledge regarding ethno veterinary practices	DoAH DoEST SBB HPAB GSB SAWB HPSVC	Katoch, et al. (2017) has evaluated the impact of diseases among bovines along with the disease-causing agents across 7 districts of Himachal Pradesh. The existing preliminary research on diseases among livestock in the state require further follow up studies across all the districts on: Identification of etiological agents and their origin Impact evaluation of these diseases on animal health and production

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
						Appropriate management and veterinary practices to reduce incidence of such diseases
3.4 Diseases among migratory livestock						
4.	Focus needs to be put on diseases among migratory livestock**.** This requires: **1.** Identification of diseases like FMD[53], chlamydial strains **2.** Creating awareness among local communities **3.**Appropriate arrangements for vaccination of migratory livestock	Conduct regular serological surveys to calculate rate of titer[54] of disease antibody in the herd Make provisions for compulsory vaccination of cattle before they are taken for grazing uphill by nomadic/semi-nomadic community to avoid the spread of diseases like Foot and Mouth Disease (FMD)[55]	M	Surveys conducted Number of animal genetic species secured in medium or long -term conservation facilities Number of workshops organized for nomadic herders	DoAH DoEST SBB HPAB SAWB HPSVC	Pathogens to diseases need to be identified to avoid widespread epidemics. An early detection can be an effective controlling strategy. Diagnostic kits can be provided to herders to facilitate rapid diagnostic tests (Ding, et al. 2013).

[53] https://www.rufford.org/files/14311-1%20Detailed%20Final%20Report.pdf
[54] https://labtestsonline.org/glossary/titer
[55] https://www.rufford.org/files/14311-1%20Detailed%20Final%20Report.pdf

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		Organize workshops for semi-nomadic/nomadic communities to make them aware regarding preventive strategies such as timed sequences of treatments for livestock, evasive strategies such as anthelmintic treatment[56]				
3.5 Yak population						
5.	The issue of declining yak population due to climate change need to be curbed by strengthening arrangements for Yak breeding (Sharma, 2018)[57] Involve local communities in high altitude in the planning process to increase yak population	Document and disseminate indigenous knowledge of yak rearers in the state Increase the number of Yak breeding farms similar to the breeding farm (with 51 yaks) in Lari, Lahual and Spiti district Facilitate artificial insemination using yak semen in the remote regions of the state to increase yak population[58]	M	PBRs to be used as a document for traditional knowledge related to yak rearing in high altitude regions Yak Breeding unit established	DoAH SBB SAWB HPKCCC	All India level documentation has been done by National Research Centre on Yak for Indian Yak rearers (Ramesha, et al. 2009) There exists enormous knowledge among yak rearers in uphill that can be tapped in PBRs Himachal Prakriti, an NGO in Uttarakhand maintains a breeding herd of Yaks in the Ralam Valley and is currently exploring the option of putting in place a system of freezing yak semen for animal artificial insemination. Scope of such initiatives can be explored for Himachal Pradesh

[56] http://www.hpagrisnet.gov.in/Agrisnet/AnimalHusbandry/pdf%20files/DM.pdf
[57] There has been a decline in yak population in Himachal Pradesh from 5690 (Census 1997) to 2921 (Census 2012)
[58] http://www.himalprakriti.org/?q=content/yak-breeding

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
3.6 Fodder management						
6.	Provide training to farmers and other local communities for scientific production and management of fodder	Document methods to educate farmers to enrich crop residues and use it as fodder by adding urea, mineral supplements, etc. Demonstrate the process of improving nutritive value as well as taste of crop residues as feedstock to farmers, such as a 21-day treatment process organized by ICRISAT in Karnataka (ICRISAT, 2018)	S	A detailed training manual for scientific production of fodder being prepared Number of trainings provided to farmers for fodder management	DoA Rural Development Department DoAH SBB	Shortage of fodder is an issue particularly in winter season where cattle holders have to move uphill to graze their cattle or go the forest area to collect fodder. In such as case, process of improving crop residues in terms of its nutritive value can be explored
3.7 Grazing Policy						
7.	Grazing Policy needs to be formulated and implemented in the state	Formulate a grazing policy to outline guidelines for management and development of pasture lands by: • Defining zones for grazing in higher altitude regions of the state • Identify and revive pasture lands for natural prey base (such as ibex, blue sheep) of wild carnivores (such as snow leopards, black bear) • Organizing workshops at block level to make nomadic herders like Gaddis aware of the	M	Grazing Policy formulated Zones for grazing defined Workshops for nomadic herders conducted Suitable grass species and fodder trees planted	NBPGR HPFD DoA DoAH HPAU	Identification and plantation of species for high altitude regions (that can be used to stall feed livestock) can help in the following ways: • Pasture lands can be revived to maintain wild animal base in forests • Availability of fodder can help in preventing herders to enter wild animal habitat for grazing livestock **Some species have already been identified by the State Government (DoA, n.d.)**: **<u>Zone 1:</u>** Siratro (Macroptilium atropurium) Glycine (Neonotonia weightii) Dolichos (Macrotyloma axillara) **<u>Zone 2:</u>**

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		harmful impacts of overgrazing • Put a cap on number of livestock each herder takes up hill while issuing permits for grazing • Based upon routes taken by nomadic herders uphill, identify spots to establish check points and provide vaccination to migratory livestock • Identify species of grass, fodder trees and legumes which are high in protein & plant them across agro-climatic zones of the State to feed livestock[59]				Glycine (Neonotonia weightii) Dolichos (Macrotyloma axillare) White clover (Trifolium repense) Red clover (Trifolium pratense) **Zone 3:** Red clover (Trifolium pratense) White clover (Trifolium repens) **Zone 4:** Lucerne (Medicago sativa) White clover (Trifolium repens) Red clover (Trifolium pratense)
4. AQUATIC BIODIVERSITY						
4.1 Wetlands						
1.	Strengthen existing protocols to regulate overgrazing and mass tourism	Prepare wetland data-base including: • Biological diversity (plant and animal species and population, genetic	M	Database prepared	HPFD DoEST DoF	Wetland ecosystems and services have been under constant threat mainly due to increasing anthropogenic pressures: **Overgrazing and Mass tourism**

[59] Some of the species identified for high altitude during consultative workshop organized by NIPFP on 25th September, 2019, are Poplar tree (Populus spp.), Willow (Salix spp.), Himalayan Birch (Betula utilis), Sea-buckthorn (Hippophae), Bichhu Booti (Urtica dioica).

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		diversity, microbial diversity) • Socio-economic values and potential (and real) threats		Studies on the status of wetlands conducted	HPSBB HIMCOSTE HPSWA ZSI GBPIHED	Chemical-intensive agricultural practices are causing eutrophication of water bodies which has negative impacts on wetland ecosystem
		Identify wetlands facing environmental degradation and develop site-specific action plan for restoration		Proportion of water bodies with good ambient water quality		
		Strengthen the focus on wetland in agriculture sector's environmental commitments to develop cooperation between agricultural practices and environmental protection (ICRISAT, 2018)		Change in the extent of water-related ecosystems over time		
		Promote eco-tourism over Mass/expansionary model of tourism, especially for wetlands which are facing environmental degradation				
4.2 Revival of fish species						
2.	Rehabilitation of fish species needs to be done to revive the affected fish spawning grounds due to	To improve the quality of cultivable species and genetically improved strains in the supply chain, establish and strengthen fish brood bank, especially for native species such as mahseer (ICAR, 2018), [60,]	M Rehabilitation	Fish brood bank established	DoF DoEST HIMCOSTE	Hydraulic flushing can be explored as a possible solution to desilt the river bed

[60] http://www.dcfr.res.in/user_upload/90_noticerecommendations.pdf

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	silting of riverbeds and reservoirs (Sharma, 2013)	In light of increasing the population of native fish species and conserving their germplasm in HP, take initiatives such as 'rehabilitation programmes' for ranching fish seed of mahseer and snow trout[61]	should be an ongoing process	Rehabilitation programs designed and executed Designation of fish sanctuaries in rivers Desilting of riverbeds and reservoirs done on regular basis	HPSPCB	Rehabilitation of fish species can be developed by making fish eco-parks where angling as a sport can be encouraged with scientific catch and release method.
		Designate deep pools in rivers as fish sanctuaries in consultation with Fisheries Department, Universities and local communities (HP Environmental Master Plan, 2013)				
		Explore methods such as manual excavation and dredging of material for hydraulic flushing[62] to desilt the riverbeds and reservoirs (Draft Policy on Sediment Management, 2017)				
4.3 Construction of dams						
3.	Adequate 'water flow release pattern' from dams to maintain natural ecological functions of wetland ecosystem should be maintained	Conduct Environmental Flows Assessment (E-Flows) to determine River Health Regime, which describes the temporal and spatial variations in quantity and quality of water required for freshwater and estuarine systems to perform their natural ecological functions (Thakkar, 2015)	S	E-Flows assessment conducted	DoE DoF	Water abstraction for power generation is one of the biggest reasons to reduce appropriate water flow which disrupts aquatic life. Recommendations from report of three-member committee on assessment of environmental flows (E-flows) should be

[61] One such programme has been done at Pancheshwar, Uttarakhand: https://www.dcfr.res.in/user_upload/67_noticePancheshwar_Angling_Event_2016.pdf
[62] https://pdfs.semanticscholar.org/63ed/674b59e97b15bf4cc720fe44ca7c9396466b.pdf

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		Periodic check on hydropower projects for an already existing mandate of 15-20% lean season water flow downstream (Vijayakumar vs State of Himachal Pradesh, 2019; Kennedy et al, 2016)				considered in improving the health of rivers (Thakkar, 2015)
		Make small adjustments in flow regime in hydel projects during hydro peaking to conserve shoreline river bed habitat (Dandekar, 2012)				
4.4 Fish movement						
4.	Mandate appropriate channels to check obstruction of fish movement and facilitate easy fish movement through dams (Theophilus, 2014)	Dams to provide fish ladders/ fish pass for the movement of fishes compulsorily (Sharma, 2013)	S	Assessment of fish dams for fish ladder done	DoE DoEST DoF HIMCOSTE DoF	Fish population is affected due to obstruction in its movement. Moreover, Hydro Power Projects also impact breeding grounds for fishes. There is no study to document project-wise impact on fisheries in the state. Every project should have a mandatory fish pass/fish ladder. Such a requirement should be made compulsory for all the projects to get approved before their construction.
		Timely removal of fallen rocks and debris from fish pass channel in the dams				
		Assessment of design of fish ladder for both existing as well as upcoming dams. Physical and hydraulic characteristics of different fish ladders impact fish species movement differently				
4.5 Pollution						
5.	Urgent need for plan to address CPCB identified 7	Conduct study to estimate the gap between total sewage generation and treatment capacity of STPs in the state to plan effective sewage	M-L	Installed sewage treatment capacity as a proportion of	DoE DoI	Septic tanks that have been constructed around water bodies result in seepage of pollutants into these bodies. Analyzing current and future scenarios for capacity of

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	polluted river stretches in HP	management (IANS, 2014; CPCB, 2019; IANS, 2019 (ii))		sewage generated in urban areas Proportion of waste treated Percentage of industries complying with waste water treatment as per CPCB norms	HPSPCB	sewage treatment plants paves a way forward to enhance the capacity of such plants (Batliwala and Kania 2019). CPCB (2018) report has identified 351 polluted stretches across 323 rivers in India out of which 7 stretches in Himachal Pradesh have been identified as "Critically Polluted"[63] River Rejuvenation Committee should take recommendations of such reports.
		Identify locations to lay down additional pipelines to treat effluents before their disposal in river (Action Plan for Baddi Industrial Cluster, 2018)				
		Involve public in reporting discharges by default industries (CPCB, 2019)				
5. MICROBIAL DIVERSITY						
5.1 Microbial diversity database						
1.	Documentation of microbial diversity (in both aquatic and terrestrial ecosystem) across the state by preparing web-based curated microbial diversity database should be done (Dasgupta, 2014; Bhalla, 2015)	Identify locations using geo-based plotting (Bhattacharjee and Joshi, 2014) across a diverse range of temperature, altitudinal and soil gradients to collect soil samples and characterize biochemical[64], morphological[65] and molecular properties (Dasgupta, 2014)	S-M Strengthening of portal should be a continuous process	A comprehensive microbial diversity database prepared An interactive web portal designed where online user registration allows access and use of data with other institutions	HPFD DoEST SBB HIMCOSTE ENVIS BSI ZSI	Currently, HP ENVIS portal does not provide detailed data on microorganisms in the state Making a portal will help keeping a track of data usage and identifying data needs by researchers. Such an ongoing process will ensure timely updating of the portal
		Create a web portal to provide information, allow data download as well as answers to frequently asked queries by microbiologists				

[63] http://www.indiaenvironmentportal.org.in/files/file/Report%20on%20River%20Stretches%20For%20Restoration%20Of%20Water%20Quality.pdf
[64] Properties such as utilization of nutrients and products of metabolism
[65] Physical properties such as cell size, type, etc.

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		similar to North East India Microbial Database (NEMiD) (Dasgupta, 2014)				
		Documentation of traditional knowledge in PBRs related to use of microorganisms in fermented food, beverages, dyes, Ayurvedic medicines as well as in agricultural fields[66]				
5.2 Application of microbes in farming						
2.	Identify and strengthen measures for utilization of plant growth promoting microbes (PGPM) which can be used as a substitute to agri-xenobiotics (Juchau and Chen, 1998) This will result in reduction in use of chemicals on farmlands as well as utilization of bioremediation, bio control and bio fertilizer properties of microbes in agriculture	Conduct study to: 1. Identify response of soil microbial community to organic fertilizers to explore the applications of microbes in farming in the state 2. Identify bio control agents suitable for different agro-climatic zones such as pathogens to weed 3. Collect soil samples from each agro-climatic zone and test them to analyse the impact of chemicals used in agricultural lands on microorganisms	M	Studies to document applications of microbes in agriculture conducted Percentage use of nitrogen fertilizer out of total N,P,K, (Nitrogen, Phosphorous, Potassium) Awareness workshops conducted	DoEST DoAH HPAU IHBT	Kaushal, et al. 2011 have explored PGPM that includes mycorrhizal fungi and several genera of bacteria. Based upon the properties of these microbial species, the following applications have been suggested: Use of PGPM to improve capsicum productivity under mid-hill conditions in North-Western Himalayan region Enhancement of phosphorous and nitrogen content of shoot and root Treatment of tomato crop using bacteria B. subtilis CKS1strain to increase root and shoot length (Kaushal, et al. 2011)
		Facilitate availability of endosymbionts to farmers for				

[66] http://www.bdu.ac.in/schools/biotechnology-and-genetic-engineering/biotechnology/sekardb.htm

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		biological nitrogen fixation such as *Rhizobium* (Sly, 2010)				The recommendations can be utilized to explore the application of microbes in organic farming in the state
		To spread awareness among farmers for use of microbes on farmlands instead of chemicals, conduct awareness workshops based upon recommendations of scientific studies to explore the use of microbes in improving agricultural productivity This can also be done by including information on microbial diversity and related threats in workshops organized by HPSBB for local communities[67]				
5.3 Conservation of aquatic microbial diversity						
3.	Conservation measures for aquatic biodiversity should include microbes by: 1. Incorporating micro biodiversity in the impact assessments of projects 2. Developing indicators for microbial monitoring. One such application has	Explore the application of developing microbial indicators in Environmental Impact Assessment of developmental projects (such as dam construction) should consider impact on microorganisms as well (NBAP, 2008)	S	Studies conducted for micro-biodiversity inclusive environment impact assessment	DoE DOEST	Study done by Sims, et al. (2013) outlines the following: Assessment of wetland health conditions should include microbial indicators Effective restoration of wetlands can be done in lines with bacterial diversity Such recommendations can be referred to in assessing environmental health of natural resources
		Strengthen Microbial Germplasm Bank (MGB) in the state **to expand the scope of research** to include aquatic microbial diversity				

[67] http://www.hpbiodiversity.gov.in/Workshop_1.aspx

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	been explored in wetland assessment					Provide adequate resources to research institutes to hire experts and facilitate them with equipment The scope of research on microbial diversity should be expanded to include issues related to aquatic microbial diversity such as '**impact of quarrying river beds on microorganisms**'
5.4 Direct-fed microbes						
4.	Explore the application of microbes (called Direct-fed Microbes) to augment indigenous cattle performance	Expand the scope of research to identify DFM to improve health and productivity of livestock Methodology of the above-mentioned studies can be adopted to facilitate the research	S	Scientific studies conducted	DoAH HPSVC DoEST HPAU I HBT	A number of universities have Microbiology Department. Experts in these departments can be facilitated with appropriate funds to conduct research & explore the application of microbes in enhancing productivity of indigenous cows in the state
6. TOURISM						
6.1 Ecotourism						
1.	There is a need to shift from an Expansionary Model of Tourism/Mass Tourism to Eco-tourism	Undertake capacity building programme for local communities for "high value-low impact" tourism Promote community-based eco-tourism where local communities are involved such as impart training for home stays in rural areas under 'Home stay policy (2008)'	S-M	Capacity building program for local communities designed	TCAD HPFD PRI Local communities	Studies related to analyses of local residents' perception can be conducted such that they can be made an integral part of tourism planning to promote community-based tourism (Lee and Jan 2019)

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		Encourage high-value tourists such as international tourists				
		Establish convergence between 'Ecotourism policy' of Forest Department and 'Tourism policy' of Tourism Department				
	Seek Global Certification from organisations such as the Global Sustainable Tourism Council (GSTC). Being certified means that the state complies with the highest social and environmental standards on the market. Certification will provide credibility and enhance regulated tourism	The GGD standard has more than 400 indicators that provide hotel and tour operators a map that takes executives and entrepreneurs on a path to be more successful in their business while being responsible with employees and their families, the community, the cultural heritage and traditions including the environment.	**S-M**	Major tourist areas certified	TCAD HPFD	The GREAT Green Deal Sustainable Certification Program (GGD) represents a way of doing business while taking care of all stakeholders involved in the tourism operations
6.2 Carrying capacity						
2.	Conduct carrying capacity studies to limit the maximum number of tourists at a time	Develop indicators to establish links between use levels and impacts of tourism on environment	**S-M**	Carrying capacity studies conducted	TCAD HPFD	Lindberg, McCool, & Stankey (1997) outline that focusing only on the number of tourists can result in misguided simplicity. It has been recommended that indicators selected for conducting carrying capacity should stem out of desired social, economic as well as ecological conditions.
		Establish rationing system for tourists such as 'first come, first serve' to limit the access to ecologically fragile areas				
		Design programs to divert trekker influx to less ecologically fragile areas.				

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
6.3 Payment for ecosystem services						
3.	Explore PES model for tourism which provides a fair and equitable mechanism to incentivize communities for biodiversity conservation	Identify opportunities for PES. An "Opportunity assessment" should be conducted to develop PES scheme for tourism The following are the indicative ideas for the model: • Trekking trails with tourism influx should have a permit fee associated to the entrance such as Triund (Kangra), Kheerganga (Kullu) • Permit fees should be imposed for vehicles entering valleys/pass such as Sach Pass, Khajjiar (Chamba)	M	Opportunities assessment for PES conducted	TCAD HPFD SBB	Currently, the following fees is being charged in HP: • Permit fee for cars entering • Rohtang Pass, Kullu • Green Fees in Manali A best practice guide developed for PES outlines that PES should be clearly informed by opportunities assessment to identify the beneficiaries as well as the funding streams (Smith et.al, 2013) In order to generate funds in Philippines' National Park, for the continuous preservation of reefs, the Management Board placed user fees on recreational scuba divers. This user fees constitutes a fund, used for maintenance of the national park (Macandog, 2016)
6.4 Impact Assessment						
4.	There should be a study for assessing the impacts of specific tourism activities like trekking, off-road driving, camping The impact of these activities should be studied on habitat disturbances, solid waste	Conduct Environmental Impact Assessment of tourism activities in HP: • Trekking and camping • Adventure sports • Pilgrimage tourism • Off-road driving	S	Impact assessment for each tourist activity in HP conducted	TCAD DoEST HPFD	A case study has been done for Ladakh, using GIS modelling. The study assesses the impact of various tourism activities like trail-use, trekking, off-road driving, and camping. The stressor intensity, receptor vulnerability and value have been assessed. This study is suitable to support the drawing of tourism plans and policies[68]

[68] https://www.zobodat.at/pdf/IGF-Forschungsberichte_2_0062-0070.pdf

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	accumulation, water pollution, air pollution and soil health					
7. ECONOMIC VALUATION AND NATURAL CAPITAL ACCOUNTING						
7.1 Economic valuation of biodiversity						
1.	Assessment of biodiversity to be explored using economic valuation methods Need to focus on economic valuation of bio-resources for ABS mechanism	Develop institutional mechanism to facilitate ABS, incorporating the real values of bio-resources and ensure a stream of benefits to local communities who are 'providers' (Nelliyat, n.d.)	M	Studies on economic valuation of bio-resources	MoEF&CC HPFD HPSBB DoA DoH DoEST FSI	HP is rich in floral species with 3400 species in 1038 genera. Species of genera Asteraceae, Poaceae & Fabaceae, Carex, Polygonum, Poa are important bio-resources A number of plant species are used as traditional veterinary medicines in HP[69]: • Roost of *Thalictrum foliolosum* are used to treat boils and Foot and Mouth disease • Cell-sap of *Pyrus pashia* for Conjunctivitis • Leaves of *Leucas lanata* are used to cure Diarrhoea HP is rich in MAPs which are extracted in huge quantities: *Aconitum heterophyllum, Angelica glauca, Berberis spp., Betula utilis, Centella asiatica, Ephedra gerardiiana, Picrorhiza kurrooa, Podophyllum hexandrum, Selinum tenuifolium, Valeriana spp.*
		Support studies for measuring the economic valuation of bio-resources for appropriate benefit sharing, using revealed preference approaches: • Observed market value and related goods approach • The productivity approach • Cost-based methods				

[69] http://www.hillagric.ac.in/edu/covas/vpharma/winter%20school/lectures/38%20Herbal%20bioresources%20of%20HP.pdf

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		Based upon marginal willingness to pay by the pharmaceutical companies, the net bio-prospecting value/ha for Himachal Pradesh has been estimated to be Rs. 31,758 (Gundimeda et. al, 2006) Integrate recommendations of studies conducting sector-wise economic valuation of ecosystem services into various schemes/programmes The study conducted for forest sector in HP estimates 'the total value of goods/services in terms of area under tree cover and scrub forest' to be Rs. 7.45 lakh/hectare				The study to for economic valuation of forests in HP has found that the maximum per hectare value is generated by watershed function followed by carbon sink, biodiversity, ecotourism (all non-marketed values) and recommends the following (Verma, 2000): • The difference between estimated and actual market value to be interpreted to reflect true contribution of forests • To compensate forestry sector for indirect benefits to other sectors • Utilize the valuation studies to claim actual share in allocation of developmental funds
7.2 Natural Capital Accounting						
2.	Explore application of Natural Capital Accounting to all the sectors in HP	Prioritize ecosystem services in research conducted for valuation not only on the basis of higher economic benefits but also on the basis of sensitivity to environmental changes and their significance to environmental thresholds Measure the value of depletion and degradation of biodiversity and examine ways to conserve forests by linking with PES, REDD+, etc.	M	Number and coverage of ecosystem services in valuation studies Reflection of biodiversity and ecosystem studies in policy decisions, planning and reporting processes	MoEF&CC HPFD DoA DoH DoAH DoEST TCAD SBB FSI	Natural Capital Accounting has been explored by IIT Bombay for Forest Sector in Himachal Pradesh and recommends the following (WAVES, 2015): • Feasibility and planning study should be conducted for all the sectors • Population pressure and its impact on environment to be included in the policy planning • Modify training modules towards ecosystem approach to build capacity • Training of institutions like Panchayati Raj

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
						• Conduct analysis for various sectors
8. EDUCATION, AWARENESS AND TRAINING						
8.1 Environmental education						
1.	Mainstream environmental studies in education to increase awareness about biodiversity conservation	Revise curricula to incorporate subject areas such as integrated mitigation, adaptation, impact reduction and early warning for climate change Organize plantation drives to ensure plantation of shrubs as well as trees in accordance to different agro-climatic zones	Ongoing	Extent to which environmental education for sustainable development is mainstreamed in primary, secondary as well as tertiary curricula Plantation drives organized	CBSE ICSE HPBOSE DoEE HPFD SBB	There has been considerable progress in terms of trainings and workshops. Moving towards more innovative methods of awareness using electronic as well as print media can also be considered.
8.2 Awareness through communication media						
2.	Awareness regarding biodiversity conservation should be created through appropriate communication media	Promote communication media such as short films and documentaries, besides stories in print media such as weekly columns in local dailies. These can include topics ranging from conservation challenges, to HP's vast ecological wealth	S	Short films prepared	SBB	

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
8.3 Community-based natural resource management						
3.	Community-based natural resource management to strengthen biodiversity conservation	Regulate enforcement of biodiversity related community-level rules (by-laws) such as penalties imposed by Praja Mandals for illegal extraction of medicinal and aromatic plants Promote collaboration between institutions such as self-governing bodies like Praja Mandals, Panchayat, VFDCs, VFDSs, JFM, local administration, research institutes as well as NGOs Identify training needs that strengthen the role of institutions like Van Panchayats, Yuvak Mandals, Mahila Mandals, Praja Mandals	Ongoing	Community-level rules (by-laws) regulated Number of trainings organized for local-level institutions	MoEF&CC HPFD SBB DoTD YSSD	Resurgence and strengthening of such local-level institutions should be an ongoing process across all the districts
8.4 Development of portal						
4.	A portal for documenting and sharing national and international best practices to relevant functionaries and stakeholders should be developed	This may be included in the scope of work of ENVIS, covering global & national best practices, and spreading awareness about HP's achievements and conservation programmes.	S	Portal being developed	HPFD DOEST SBB ENVIS	

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
9. POLICIES, LAWS & INSTITUTIONS						
9.1 Procurement of green products						
1.	Public procurement practices should be revisited for green products	Develop sustainable public procurement manuals for line departments to encourage procurement of green products based upon life-cycle costing[70]	M	Material footprint per capita, or material footprint per GSDP[71, 72] Sustainable public procurement policy implemented	DoI	Procurement of green products includes: electrical appliances, paper, daily consumables, construction material, etc. can help in promoting sustainability in both consumption and production
9.2 Community participation						
2.	Adapting capacity[73] of local communities to adverse impacts of climate change should be focused in policy making	Explore the suitability of Adaptation Coalition Framework[74] (ACF) to create community institutions with the mandate of increasing resilience to climate change over the long-term This can be done by facilitating coalitions/alliances of local communities and mobilising local	M	Climate resilience incorporated in policy-making Pilot ACF conducted	DoEST PRI JFM VFDCs Local Communities	ACF has been outlined in a study by World Bank where suitability of this framework has been assessed for Latin America (Ashwill, Flora, & Flora, 2011). The four basic steps of ACF includes knowledge exchange, Training and Information Gathering, Feedback and Planning and Strengthening Coalitions.

[70] Life-cycle cost refers to the total cost over the life of an asset and can include costs before, during and after the usage of an asset

[71] The indicator developed with an aim to ensure resource efficiency in both consumption and production. This will include use of paper, plastic, water use, biomass use, fossil fuel minerals, non-fossil fuel minerals and metals (industry, agriculture, residential, commercial, transport, municipal levels), use of local materials in construction

[72] As per the report, "Going Green: Best Practices for Sustainable Procurement" published by OECD, the total volume of public procurement in India is estimated to constitute about 30% of gross domestic product (GDP). Accessible at: oecd.org/governance/ethics/Going_Green_Best_Practices_for_Sustainable_Procurement.pdf

[73] Adaptive capacity is the degree to which adjustments in practices, processes, or structures can moderate or offset the potential for damage or take advantage of opportunities created by a given change in climate

[74]The Study by World Bank, "Building Community Resilience to Climate Change Testing the Adaptation Coalition Framework in Latin America" defines Adaptation Coalition Framework as Derived from the Advocacy Coalition Framework, is a process through which local groups form coalitions or alliances with outside groups around climate change issues in order to achieve common desired futures. Accessible at: http://siteresources.worldbank.org/EXTSOCIALDEVELOPMENT/Resources/244362-1232059926563/5747581-1239131985528/Adaptation-Coalition-Framework-Latin-America_web.pdf

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
		assets including human, social and financial.				The feasibility of this framework has been analysed and presented as case studies for Argentina, Bolivia, Dominican Republic, Paraguay as well as Peru
9.3 Investment in agricultural research						
3.	Increase investment in agricultural research, infrastructure and technology development as well as plant gene banks	Develop Agriculture Orientation Index[75] to compare government spending on agriculture vis-à-vis its contribution to total economy	S Should be an ongoing exercise	The agriculture orientation index for government expenditures prepared	DoA DoH HPAU ICAR	Such an analysis throws light on the extent to which government expenditure is required for agriculture with an aim to improve food security, reduce inequalities, inclusive growth[76]
9.4 Regional cooperation						
4.	Promote regional cooperation between Himalayan States by strengthening existing mechanisms and explore possibility of new agreements	Agreements should increase access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms.	Exchange of knowledge should be an ongoing process	Cooperation agreements between Himalayan States signed	Himalayan State Regional Council	Himalayan State Regional Council has been constituted on the basis of the recommendation of Five thematic Working Group Reports of NITI Aayog. This council was constituted with an aim to promote sustainable development in the Indian Himalayan Region.
	The work on Post 2020 framework is in progress at the CBD. Once the new framework and targets are	A plan along with a budget should be made ready for necessary revision in this SBSAP Report.	Planning, Management and		SBB Subject experts	

[75] The Agriculture Orientation Index (AOI) for Government Expenditures is defined as the Agriculture Share of Government Expenditures, divided by the Agriculture Share of GDP, where Agriculture refers to the agriculture, forestry, fishing and hunting sector. The measure is a currency-free index, calculated as the ratio of these two shares. This indicator will measure progress towards SDG Target 2.a. Accessible at: http://www.fao.org/sustainable-development-goals/indicators/2a1/en/

[76] http://www.fao.org/sustainable-development-goals/indicators/2a1/en/

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	developed and notified, there will be a need to align the SBSAP of Sikkim with the new biodiversity framework.		Coordination			
	One District One Product (ODOP) is an initiative which is seen as a transformational step forward towards realizing the true potential of a district, fuel economic growth and generate employment and rural entrepreneurship, taking us to the goal of AtmaNirbhar Bharat.	All twelve districts of HP have been listed in the scheme. An inter-ministerial group or an expert group with representatives of the relevant departments should be formed to finalise the products under the scheme.			Relevant departments SBB Department of Planning	ODOP initiative is operationally merged with 'Districts as Export Hub' initiative being implemented by DGFT, Department of Commerce, with Department for Promotion of Industry and Internal Trade (DPIIT) as a major stakeholder.
	Seek support from the National Biodiversity Mission under their programmes related to building an inventory of India's Biodiversity, mapping key ecosystem services, developing various conservation actions while maximising benefits to local people, quantify the role of India's forests, and components under	Planning in this direction would include, among others, identification of sites for the pilots, and products to be promoted; and strengthening of BMC both in terms of capacity and finances.				The Mission will focus on 117 aspirational districts in the country; and in HP, Chamba has been identified as an aspirational district. The Mission proposes a national effort that aims to transform biodiversity science by linking it to the peoples' economic prosperity. It further aims to help India realize the United Nation's Sustainable Development Goals by using India's rich biodiversity to create solutions for challenges in agriculture, health, and climate change.

S. No	Recommendations/Strategies	Action Points	Time Frame	Indicators	Agencies	Remarks
	Biodiversity and Agriculture, and Biodiversity and Health Programmes.					As part of the preparatory phase, the mission's programs will be implemented in two pilot districts - west Sikkim and Raichur in Karnataka. The Panchayat-level biodiversity management committees will create a "people's biodiversity register", which will document the flora, fauna and traditional knowledge of people about them. Before launching the full-fledged project, pilot will be carried out in these two districts. The objective of the pilot will be to test the interest and involvement of local communities. NBA will be the nodal agency of the mission.

Source: Authors

Chapter 5: Biodiversity Expenditure Review

5.1 What is a Biodiversity Expenditure Review (BER)

Biodiversity Expenditure Review (BER) is a standard tool used to map the sources and amount of funds flow towards biodiversity and ecosystem conservation and protection. It is a useful instrument in assessing the alignment of an economy's concerns and priorities in respect of biodiversity loss with its expenditure on conservation of biodiversity[77]. In this report the purpose of BER is to map and estimate the current expenditure on biodiversity through various schemes and programmes of the central, state and district plans. The BER is in turn used to estimate the additional funding required for implementing the proposed SBSAP in HP.

Biodiversity expenditure can be direct (restoration, tree planting and other conservation and protection activities) or indirect (training awareness building of stakeholders, research, measuring and mapping of biodiversity etc.). Similarly, expenditure on biodiversity can be to achieve one or more goals of CBD or achieve one or more NBTs. Therefore, it is important to have a framework (Table 5.1) for the analysis of BER results to examine which aspects of biodiversity conservation have been addressed adequately and where gaps remain.

Table 5.1: Framework Used in Analysis of BER

	Strategic Goal A	Strategic Goal B	Strategic Goal C	Strategic Goal D		Strategic Goal E
CBD Strategic Goal	Address underlying causes of biodiversity loss by mainstreaming biodiversity across	Reduce direct pressures on biodiversity and promote sustainable use	Improve the status of biodiversity by safeguarding ecosystems species and genetic diversity	Enhance the benefits to all from biodiversity and ecosystem services		Enhance implementation through participatory Planning, knowledge management and Capacity building
NBTs	NBTs (1,2,10)	NBTs (3,4,5, 6)	NBTs (6 & 7)	NBTs (3,8, 9)		NBTs (10,11, 12)
Aichi Targets	1,2,3&4	5,6,7,8,9 & 10	11,12 & 13	14,15 & 16		17,18,19 & 20
BIOFIN Taxonomy	Biodiversity Mainstreaming	Sustainable use of Resources except Prevention & Control of invasive species (Aichi Target 9 & NBT4)	Protection Strategies include Aichi Target 9 and NBT 4	Restoration strategies	ABS (Aichi Target 16 & NBT 9)	Implementation Strategies
Impact on Biodiversity	**Indirect**	**Indirect** In most cases except	**Direct**	**Direct** **In** most cases except when it is a	**Direct**	**Indirect** Direct only when implemented by

[77] In this report the term biodiversity conservation has been used as a generic term although in our analysis it corresponds CBD definition in this context.

	Strategic Goal A	Strategic Goal B	Strategic Goal C	Strategic Goal D		Strategic Goal E
		Aichi Target 9 & NBT4		very small component		MOEF&CC; There can be some deviations

Source: Authors' Construct

5.2 Mapping Public Expenditure for Biodiversity in Himachal Pradesh

The BER in Himachal Pradesh considers only budgetary flows of funds during the period 2011-12 to 2016-17 comprising:

i. **Central government funds** in the form of Centrally Sponsored Schemes (CSS), Central Sector Schemes (CS), and Additional Central Assistance (ACA). Some of these schemes could be fully funded by the Centre while others would require the state government to contribute its share. For Himachal Pradesh, funds for all CSS are contributed in the ratio 90:10, where the Centre contributes 90% of the share and the state contributes 10% of the share.

ii. **Consolidated fund of the State** funding a number of state schemes.

iii. **Union Finance Commission of India:** The Thirteenth Finance Commission**,** (which covered a period April 2010 to March 2015) provided a forest grant of Rs. 5000 crore to the states based on the criteria of standing forest (stock) in each state.

iv. **External Aid:** During the study period the following key projects having components and activities relevant for biodiversity have been identified.

a. **World Bank Aided Mid Himalayan Watershed Development Project –** The overall objective of this component was to promote value addition in crop, livestock, and non-timber forest produce in the project area. It also involves implementation of Bio-Carbon Project focused on reforestation to protect watersheds, improve rural livelihoods, and generate additional income through carbon credits. Implemented in 11 watershed divisions falling in 10 districts, a total of 140 GPs was prioritized to sequester greenhouse gas (GHG) emissions through reforestation, mitigate climate change risks, generate additional income through carbon credits, and enable an environment for additional employment opportunities.

b. **Himachal Pradesh Forest Eco-System Climate Proofing Project –** It aims at minimizing and mitigating the negative impact of climate change, resulting in an increase in biodiversity and sustained income in rural areas through sustainable management of forest resources and making the forests resilient to climate change. The project has been launched with German collaboration, with funding from KfW bank.

c. **Himachal Pradesh Forests for Prosperity Project:** The objective of the project is to improve the governance, management, and community use of forests and pastures at selected sites in HP, by strengthening the institutional capacity of the state, strengthening value chain of select NTFPs and increasing the value of eco-tourism in select areas. The project is being assisted by the World Bank, and is being implemented by the Department of Forest, HP.

d. **Himachal Pradesh Forest Ecosystems Management and Livelihoods Improvement Project:** The objective is to manage and enhance forest area ecosystems in the project area by sustainable forest ecosystem management, biodiversity conservation, livelihoods improvement support and strengthening institutional capacity, thereby contributing to environmental conservation and sustainable socio-economic development in the project area in the state of Himachal Pradesh. The project is being implemented by HP Forest Department and JICA.

Using the Budget documents of Government of Himachal Pradesh and the specific guidelines of schemes, which were obtained from various sources, we reviewed the entire list of schemes and identified schemes which have activities/components directly or indirectly relevant for biodiversity conservation. For each scheme, budget codes for the major head, sub-major head, and minor head along with the scheme code have been recorded for easy tracking of the scheme as well as sectoral and department-wise analysis of expenditure. For the identified schemes data on actual expenditure was collated for further analysis.

5.3 Methodology for Determining Expenditure Attributable to Biodiversity Conservation in Himachal Pradesh

Having collected the data pertaining to funds released for various biodiversity relevant schemes, the next step is to determine the proportion of expenditure under each of the identified scheme which would be attributed to biodiversity conservation. This involves the following steps:

i. The relevance or significance of the identified schemes with respect to their impact on biodiversity is not same; and may vary significantly. Some schemes may have a direct bearing on biodiversity while others may indirectly influence it. Conceptualization on schemes' relevance (in terms of impact on biodiversity conservation) in this study is guided by the Rio markers, OECD[78] methodology and a study of BER conducted for Maharashtra by the authors of this report[79].

ii. We approach the biodiversity attribution issue by defining 'tiers' of relevance into direct (where 'primary' purpose of the scheme/activity is biodiversity conservation) and indirect (when conservation of biodiversity is not primary but a 'significant' objective)[80]. The tier 'Indirect' comprises activities that are relevant for biodiversity but not as a primary purpose. A range of activities can be listed in this tier e.g. promotion of organic farming, sustainable fisheries, data management, pollution control, watershed management (Table 5.1). However, contribution of all these activities to biodiversity is not the same. To reflect their varied levels of contribution the 'indirect' tier has been classified into: indirect high; indirect medium; and indirect low (see Table 5.2)

While expenditure on schemes/activities classified as 'direct' is conceptualized to be fully attributed to biodiversity, a system for attribution (coefficients/ proportion of expenditure attributable to biodiversity conservation) of expenditure of schemes/activities under the tier 'indirect' has been developed (Table 5.2).

[78] https://www.oecd.org/dac/environment-development/Revised%20climate%20marker%20handbook_FINAL.pdf
[79] Pandey et al (2020); available at: https://www.nipfp.org.in/media/medialibrary/2020/07/WP_311_2020.pdf
[80] This is consistent with the approach used in existing methodologies.

Table 5.2: Determining Attribution for Biodiversity Expenditures

Biodiversity Relevance	Broad Thematic Areas	Expenditure Attributable to Biodiversity Conservation
Direct (Range: 90 – 100%)	Where primary purpose of the scheme is biodiversity conservation. Example: Wildlife conservation, Afforestation and Regeneration of forest, Research on ecology.	95 Percent
Indirect Very High (Range: 75 – 90%)	Where conservation of biodiversity is a significant objective. Ex. Promotion of organic farming, Ecosystem restoration - River conservation/rejuvenation, conservation of wetlands (lakes, ponds, tanks, etc), preventing pollution of water bodies by treating sewage, etc.	82.5 percent
Indirect High (Range: 50 – 75%)	Where the emphasis is on strengthening the grassroot level institutions (considering role of Panchayats in BMCs, etc)	62.5 Percent
Indirect Medium (Range 25-50%)	Where biodiversity is not the main but significant biodiversity relevant outcomes are expected. Ex. Sustainable Agriculture, Integrated Watershed Development, Programs of animal husbandry, fisheries and poultry which include promoting on-farm diversity	37.5 percent
Indirect Low (Range: 5 – 25%)	Example: River management including flood management and erosion control, Developing water resources information system	15 percent
Indirect Marginal (Range: 0 – 5%)	Example: renewable energy, general awareness and training, climate mitigation activities	2.5 percent
Major Scheme	Where some components are highly related to biodiversity, some are related as medium, some as marginal, a weighted attribution coefficient is calculated. For example: In case of RKVY, about 11.5% (10/87) of the permissible activities are in the nature of IWSM, which come under indirect medium (37.5%); about 5.7% (5/87) of activities are organic farming related and fall under indirect very high (82.5%); overall attribution = 0.375 × 0.115 + 0.825 × 0.057 = 0.0901	Calculated for each scheme individually
Large Multi-purpose Scheme	Example: MGNREGA, AMRUT	Calculated for each scheme individually

Apart from classifying schemes into Direct and Indirect Biodiversity relevance, the identified schemes are also classified into six CBD themes using the framework developed by us in Table 6.1. These six themes are: (i) Sectoral Mainstreaming, (ii) Natural Resource Uses, (iii) Biodiversity Protection, (iv) Biodiversity Restoration, (v) Access and Benefit Sharing, and (vi) Enhancing Implementation. This framework can be used to align thematic classification with

NBAP targets, Aichi targets and CBD goals for tracking which aspects are being adequately provided for and where more focus may be required.

5.4. Analysis of Findings and Results

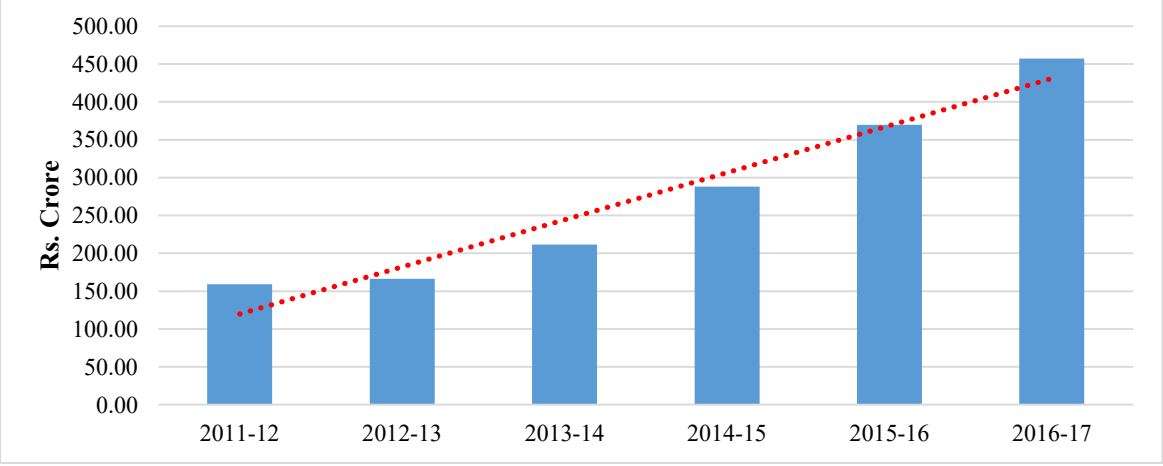
A snapshot of flow of scheme based central and state funds during 2011-12 to 2016-17 to Himachal Pradesh is presented in Table 5.3. The number of biodiversity relevant schemes has been increasing over the period of study, from 77 in 2011-12 to 189 in 2016-17. The share of biodiversity attributable expenditure in the total expenditure of the state and GSDP compares well with the number estimated through a similar exercise for the states of Sikkim and Maharashtra. As noted earlier, significance of the biodiversity relevant schemes with respect to their impact on biodiversity is not the same and varies significantly across schemes. Applying the coefficients (Table 5.2), we have found that the total expenditure attributable to biodiversity in Himachal Pradesh ranges from Rs. 159.33 crore to Rs. 457.35 crore.

Table 5.3: Biodiversity Related Expenditure in Himachal Pradesh (Summary)

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
No. of Biodiversity Relevant Schemes	77	89	143	171	178	189
Biodiversity Attributable Expenditure (Rs. Crores)	159.33	166.25	211.51	288.01	369.75	457.35
Attributable Expenditure as % of Total Expenditure of the State	0.91	0.83	1.00	1.17	1.34	1.45
Biodiversity Attributable Expenditure as % of GSDP of the State	0.22	0.20	0.22	0.28	0.32	0.37

Source: Authors' calculation

Figure 5.1: Total Biodiversity Attributable Expenditure



Source: Authors' Construct

Figure 5.1 shows that the total expenditure attributable to biodiversity over the study period has been increasing. (The red dotted line shows the increasing trend of the biodiversity related expenditure.)

The schemes relevant to biodiversity have been classified according to the BIOFIN thematic classification (see Table 5.4). The figures in brackets show the number of schemes for a particular category in that year, and the figure outside the brackets show the expenditure incurred within a particular category in a given year. Most of the biodiversity relevant schemes are for Natural Resource Use (ranging from 29 in 2011-12 to 82 in 2016-17) and Protection (ranging from 29 in 2011-12 to 66 in 2016-17). However, the schemes for Protection have the highest expenditure attributable to biodiversity over the years, ranging from Rs. 108.90 crore in 2011-12 to Rs. 143.69 crore in 2016-17. In later years, 2015-16 and 2016-17, the expenditure of schemes under the category Natural Resource Use is maximum (Rs. 157.52 crore and Rs. 157.09 crore respectively). Although the number of schemes for Sectoral Mainstreaming is lower in the earlier years, it increases steadily after 2014. The expenditure in this category follows the same trend.

A study by the WRI in 2019 puts forest and landscape restoration potential in HP at 1.58 MHa. However, the number of schemes focusing on restoration and the expenditure incurred within them is low indicating a lower focus on restoration.

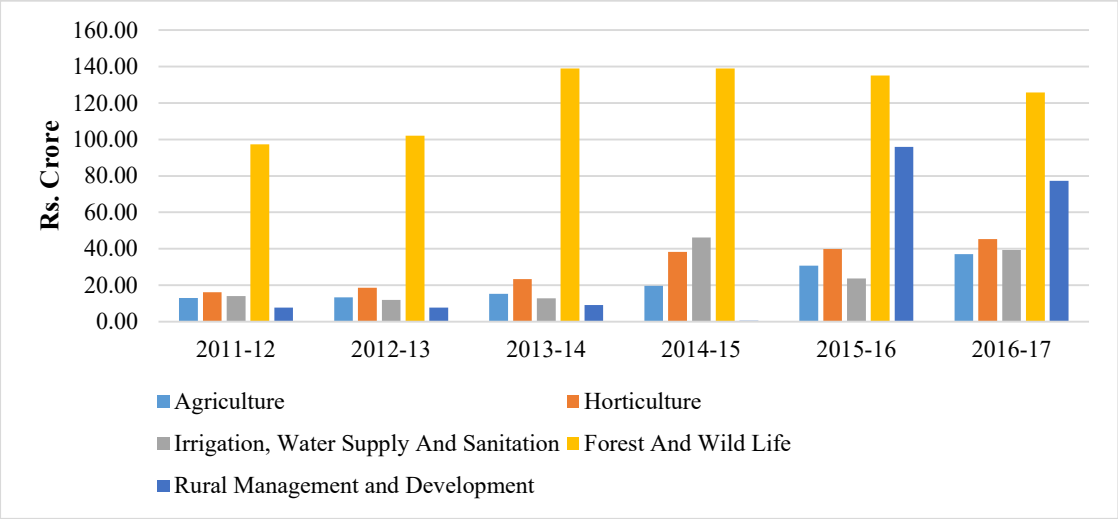
Table 5.4: Attributable Expenditure under CBD (BIOFIN) Classification (Rs. Crore)

Type of Expenditure (BIOFIN Classification)	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Enhancing Implementation	14.40 (6)	15.69 (7)	19.81 (10)	19.22 (10)	29.61 (10)	28.23 (10)
Natural Resource Use	29.34 (29)	26.51 (33)	28.89 (64)	45.84 (77)	157.52 (81)	157.09 (82)
Protection	108.90 (29)	105.95 (35)	146.98 (52)	198.92 (57)	143.46 (56)	143.69 (66)
Restoration	5.05 (6)	15.22 (6)	13.22 (9)	15.60 (9)	18.97 (11)	23.67 (13)
Sectoral Mainstreaming	1.64 (7)	2.88 (8)	2.61 (8)	8.43 (18)	20.20 (20)	104.66 (17)
Total Biodiversity Attributable Expenditure	**159.33**	**166.25**	**211.51**	**288.01**	**369.75**	**457.35**

Source: Authors' Calculation. Note: Figures in brackes are number of schemes

Figure 5.2 shows the departments incurring significant expenditure in biodiversity. As expected, the Department of Forest incurs the highest expenditure on biodiversity over the study period (Rs. 97.38 crore in 2011-12 to Rs. 125.69 crore in 2016-17). The expenditure of Department of Agriculture, Department of Horticulture and Department of Irrigation, water supply and sanitation rise steadily over the years. The expenditure incurred by the Department of Rural Management and Development (RMDD) has shown a sudden increase in the last tow years of study. In 2011-12 the expenditure of the RMDD is Rs. 7.71 crore, while in 2016-17 the expenditure rises almost 11 times to Rs. 77.24 crore. The reason for this sudden jump is because of sudden surge in the expenditure undertaken through MGNREGA in 2015-16 and 2016-17.

Figure 5.2: Attributable Expenditure to Biodiversity by Key Departments



Source: Authors' Construct

Table 5.5 shows the department wise expenditure classified as per the themes of BIOFIN.

Table 5.5: Department-wise Expenditure on Biodiversity (Rs. Crore)

	Departments	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Enhancing Implementation	Agriculture	7.81	7.92	9.55	8.87	17.30	16.20
	Forest and Wildlife	0.06	0.06	0.07	0.07	0.06	0.04
	Horticulture	6.50	7.68	10.16	10.16	10.16	10.16
	Police	0.00	0.00	0.00	0.00	0.00	0.32
	Planning and Backward Area Sub-Plan	0.03	0.03	0.03	0.03	0.04	0.04
	Scheduled Castes Sub Plan.	0.00	0.00	0.00	0.09	1.77	1.33
	Tribal Development	0.00	0.00	0.00	0.00	0.28	0.13
Natural Resource Use	Agriculture	0	0	0	5	8	8
	Forest and Wildlife	0.56	0.82	1.13	1.50	1.88	1.75
	Horticulture	3.63	4.02	3.55	19.30	21.46	27.66
	Irrigation, Water Supply and Sanitation	12.45	9.78	10.93	10.63	16.44	26.77
	Miscellaneous General Services	0.32	0.41	0.07	0.00	0.00	0.00
	Planning and Backward Area Sub-Plan	0.17	0.22	0.42	0.30	0.16	0.05
	Rural Development	7.71	7.83	9.20	0.58	95.81	77.24
	Scheduled Castes Sub Plan	4.04	2.80	3.08	7.50	12.21	12.73
	Tribal Development	0.46	0.64	0.52	0.93	1.69	2.79
Protection	General Administration	0.00	0.00	0.00	0.00	0.00	0.00
	Agriculture	5.17	5.48	5.71	5.72	5.53	12.75
	Animal Husbandry, Dairy Development and Fisheries	0.00	0.00	0.00	7.21	0.00	1.58

	Departments	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
	Forest And Wild Life	96.38	92.01	130.40	127.37	120.46	110.63
	Horticulture	6.04	6.86	9.67	8.81	8.28	7.44
	Irrigation, Water Supply and Sanitation	0.00	0.00	0.00	34.09	5.16	6.29
	Planning and Backward Area Sub-Plan	0.30	0.17	0.15	0.13	0.14	0.13
	Scheduled Castes Sub Plan.	0.00	0.00	0.00	13.65	3.17	3.24
	Tribal Development	1.00	1.43	1.05	1.93	0.71	1.63
Restoration	Forest And Wild Life	0.38	9.19	7.29	9.99	12.67	13.27
	Irrigation, Water Supply and Sanitation	1.65	2.09	1.92	1.49	2.18	6.27
	Planning and Backward Area Sub-Plan	3.02	3.93	4.01	4.07	4.12	4.13
	Tribal Development	0.00	0.00	0.00	0.00	0.00	0.00
	Scheduled Castes Sub Plan.	0.00	0.00	0.00	0.05	0.00	0.00
Sectoral Mainstreaming	Education	0.00	0.00	0.00	0.00	0.00	0.00
	Health and Family Welfare	1.57	2.19	1.97	0.67	1.23	1.77
	Animal Husbandry, Dairy Development and Fisheries	0.08	0.13	0.06	0.02	0.03	3.69
	Urban Development, Town and Country Planning and Housing	0.00	0.00	0.00	0.00	12.60	82.19
	Tribal Development	0.00	0.14	0.13	0.97	0.92	1.71
	Scheduled Castes Sub Plan.	0.00	0.42	0.46	6.77	5.42	15.30
	Total	**159.33**	**166.25**	**211.51**	**288.01**	**369.75**	**457.35**

Source: Authors' Calculation

5.5 BER for Landscapes under SECURE Project

The SECURE project is situated in two snow leopard landscapes of Himachal Pradesh – Lahual-Pangi Landscape and Kinnaur Landscape. In what follows an attempt is made to examine expenditure on biodiversity in detail in these landscapes.

The project landscapes are spread over the districts of Kinnaur, Lahaul-Spiti, and Chamba (Pangi is a sub-district of Chamba). These areas are covered under the Scheduled Areas under the Fifth Schedule of the Constitution as these areas fulfil the minimum criterion of 50 percent of the ST population concentration in a community development block.[81] These areas are vast in size characterised by snow glaciers, high altitudes, highly rugged terrain, fast-flowing rivers,

[81] Community development block is a rural area administratively earmarked for development. The area is administered by the Block Development Officer, supported by several technical specialists and village level workers.

and small and dispersed population and thus very high per unit cost of infrastructure development.

5.5.1 Fund Flow Arrangements to the Landscapes

Before launching the Fifth Five Year Plan, the Planning Commission of India made a decision of incorporating a Tribal Sub-plan in the Annual Plan of the state, so that the Government can focus on the welfare of the tribal population.

Till 1995-96, State Planning Department used to allocate plan outlays to different sectoral departments in consultation with Tribal Development Department. The departments concerned then used to carve out outlays for Tribal Sub-plan as per their own discretion and priorities, and to decide as to which of the schemes, programmes and development works are to be taken up from the funds provided under Tribal Sub-Plan. There was, therefore, a feeling that the Tribal Sub-Plan was merely agglomeration of the State Plan schemes taken-up in the Tribal Area and emphasis given to mainly arithmetical figures rather than the scheme really benefiting tribal families.

To address this short coming of the policy, the state government had decided to introduce fundamental change in the process of formulation of Tribal Sub-Plan at the directions of Ministry of Welfare, (now Tribal Affairs) Government of India since 1996-97. Under this new system, the State Planning department shall communicate 9 percent ceiling of the total State Plan outlays to the Tribal Development Department who in turn shall allocate the divisible outlays to each of the Integrated Tribal Development Project (ITDP) viz. Kinnaur, Lahaul, Spiti, Pangi and Bharmour. The indivisible outlays in the nature of grant-in-aid etc. shall be conveyed to the Administrative departments. Each ITDP has its own needs and requirements as such each ITDP shall be free to determine its own priorities and allocate funds only to those schemes which are relevant to the area.

5.5.2 A snapshot of number of biodiversity relevant schemes implemented

The number of schemes implemented in Kinnaur, Lahaul-Spiti, and Pangi landscapes (Tables 5.6 and 5.7) ranged from (64 – 72) during 2014-15 to 2016-17. It would be seen from these tables that in terms of number there is an upward trend which is encouraging.

Table 5.6: Number of Biodiversity Relevant Scheme by Type of Impact

Classification by Impact	2014-15	2015-16	2016-17
Direct	20	20	23
Indirect Very High	6	6	7
Indirect Medium	13	13	14
Indirect Low	13	13	15
Indirect Marginal	3	3	3
Large Multipurpose scheme	1	1	1
Major Scheme	8	9	9
Total	**64**	**65**	**72**

Source: Authors' Calculation

Table 5.7: Number of Biodiversity Relevant Schemes (CBD Classification)

Type of Expenditure	2014-15	2015-16	2016-17
Enhancing Implementation	8	8	8
Natural Resource Use	25	26	29
Protection	18	18	22
Restoration	7	7	7
Sectoral Mainstreaming	6	6	6
Total	**64**	**65**	**72**

Source: Authors' Calculation

Analysis of funds flow under these schemes shows a significant variation in terms of both the amounts as well as type of expenditure across SECURE districts/sub-districts. Therefore, we present the analysis and results separately for these areas.

A. PANGI *(Sub-district of Chamba)*

The biodiversity related expenditure shows a gradual increase during the period under study (Table 5.8). The focus of these schemes is on promoting protection and sustainable use of natural resources. However, it is encouraging to note that the restoration related activities and those contributing to enhancing implementation of schemes and programs are showing an upward trend (Figure 5.3).

Table 5.9 shows that maximum expenditure has been incurred in the schemes having direct and indirect very high impact on biodiversity, which is encouraging.

Table 5.7: Biodiversity Attributable Expenditure

	2014-15	2015-16	2016-17
Biodiversity Attributable Expenditure (Rs. Crore)	2.46	2.38	3.25
Attributable Expenditure as % of Total Biodiversity Attributable Expenditure of State	0.85	0.64	0.71
Attributable Expenditure as % of Total Expenditure of the State	0.010	0.009	0.010
Biodiversity Attributable Expenditure as % of GSDP of the State	0.0024	0.0021	0.0026

Source: Authors' Calculation

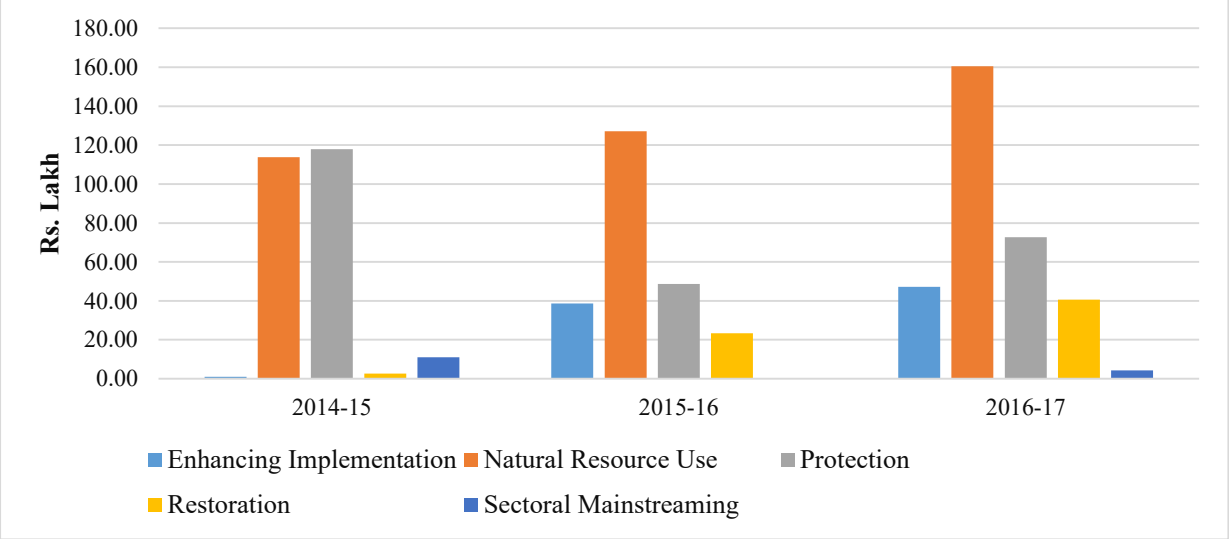
Table 5.8: Expenditure of Biodiversity Relevant Scheme by Type of Impact (Rs. Lakh)

Classification of Impact	2014-15	2015-16	2016-17
Direct	116.37	66.65	107.87
Indirect Very High	91.13	95.33	118.37
Indirect Medium	1.8	44.80	49.56

Indirect Low	17.15	21.41	28.16
Indirect Marginal	0.25	0.35	1.04
Large Multi-purpose Scheme	4.58	6.74	17.91
Major Scheme	15.10	2.88	2.40
Total	**246.38**	**238.16**	**325.31**

Source: Authors' Calculation

Figure 5.3: Biodiversity Related Expenditure (CBD Classification)



Source: Authors' construct

Table 5.9 presents department-wise expenditure on biodiversity conservation. As expected, the Departments of Agriculture and Forest are key departments in terms of total expenditure on biodiversity in Pangi. Department of Horticulture, irrigation and rural development show an increasing trend in expenditure which is a good sign as these expenditures support livelihood opportunities. Animal husbandry is pretty steady, while tourism, transport and Ayurveda are non-existent which can potentially contribute to livelihood opportunities and reduce pressure on forest resources and conflict with wild animals.

Table 5.9: Department-wise Biodiversity Attributable Expenditure (Rs. Lakh)

Departments	2014-15	2015-16	2016-17	Departments	2014-15	2015-16	2016-17
Agriculture	97.53	104.16	117.42	Irrigation	11.56	19.75	27.11
Animal Husbandry	4.18	4.18	4.37	Renewable Energy	0.26	0.35	1.04
Ayurveda	0	0.00	1.33	Rural Development	15.29	7.46	20.99

Fisheries	1.93	2.09	3.46	Tourism	0.00	0.00	0
Forest	109.73	59.76	99.02	Transport	0	0	0
Horticulture	5.72	40.29	50.56	Water & Sewerage	0.01	0.01	0.01
				Youth and Sports	0.19	0.11	0

Source: Authors' Calculation

B. LAHAUL

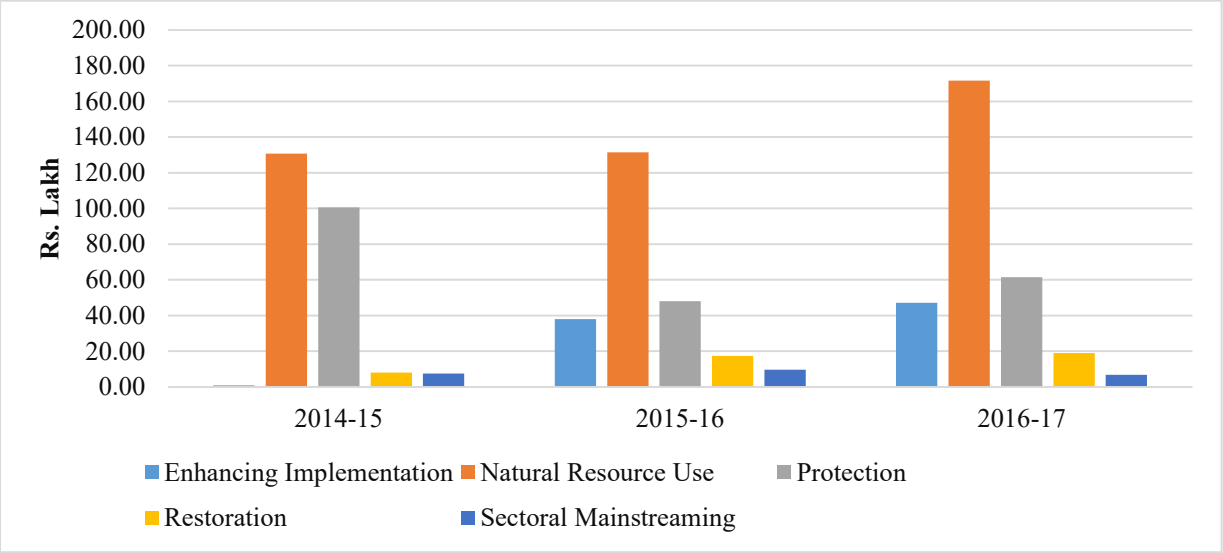
Biodiversity attributable expenditure in Lahaul shows gradual increase during 2014-15 to 2016-17 (Table 5.10). Sustainable use of natural resource is the top focus followed by activities contributing to enhancing implementation of biodiversity conservation. As in the case of Pangi, expenditure on restoration activities shows a positive trend which is a good sign (Figure 5.4).

Table 5.10: Biodiversity Attributable Expenditure in Lahaul

	2014-15	2015-16	2016-17
Biodiversity Attributable Expenditure (Rs. Crore)	2.47	2.44	3.06
Attributable Expenditure as % of Total Biodiversity Attributable Expenditure of State	1.33	1.23	1.40
Attributable Expenditure as % of Total Expenditure of the State	0.010	0.009	0.010
Biodiversity Attributable Expenditure as % of GSDP of the State	0.0024	0.0021	0.0024

Source: Author's Calculation.

Figure 5.4: Biodiversity Related Expenditure (CBD Classification)



Source: Authors' Construct

Table 5.11: Direct and Indirect Impact-wise Biodiversity Attributable Expenditure (Rs. Lakh)

Classification of Impact	2014-15	2015-16	2016-17
Direct	98.99	57.82	74.57
Indirect Very High	95.16	98.94	132.68
Indirect Medium	1.9	45.57	49.60
Indirect Low	35.14	23.00	25.51
Indirect Marginal	0.26	0.35	1.04
Large Multi-purpose Scheme	4.58	6.74	17.91
Major Scheme	11.59	12.14	4.97
Total	**247.62**	**244.56**	**306.28**

Source: Authors' Calculations.

Table 5.12 shows the contribution of schemes of different departments of the District during the period 2014-15 to 2016-17 on various activities which support biodiversity conservation. As expected, the Departments of Agriculture and Forest are key departments in terms of total expenditure on biodiversity. Department of Horticulture, and especially rural development show a sharp increase in expenditure which is a good sign as these expenditures support livelihood opportunities. As in Pangi, expenditure by the Animal husbandry is steady, while tourism, transport and Ayurveda are non-existent which can potentially contribute to livelihood opportunities and reduce pressure on forest resources and conflict with wild animals.

Table 5.12: Department-wise Biodiversity Attributable Expenditure (Rs. Lakh)

Departments	2014-15	2015-16	2016-17	Departments	2014-15	2015-16	2016-17
Agriculture	103.23	105.1	131.29	Irrigation	25.05	21.34	22.96
Animal Husbandry	4.18	4.18	4.37	Renewable Energy	0.26	0.35	1.04
Ayurveda	0	0.00	1.33	Rural Development	9.73	13.85	20.99
Fisheries	5.55	4.42	3.63	Tourism	0.00	0.00	0
Forest	85.5	47.41	65.05	Transport	0	0	0
Horticulture	11.88	44.92	53.04	Water & Sewerage	2.06	2.88	2.58
				Youth and Sports	0.19	0.11	0

Source: Authors' Calculation

C. KINNAUR

The biodiversity related expenditure has increased gradually over the study period of 2014-15 to 2016-17 (Table 5.13). Sustainable use of natural resource is the top focus followed by activities contributing to enhancing implementation of biodiversity conservation. However, during 2016-17, there is a sudden increase in the expenditure incurred in the schemes related to restoration. This is due to the expenditure incurred by the Transport department under the head "Land Compensation including NPV" (Figure 5.5).

Table 5.13 Biodiversity Attributable Expenditure

	2014-15	2015-16	2016-17
Biodiversity Attributable Expenditure (Rs. Crore)	2.23	2.49	5.39
Attributable Expenditure as % of Total Biodiversity Attributable Expenditure of State	0.77	0.67	1.18
Attributable Expenditure as % of Total Expenditure of the State	0.009	0.009	0.017
Biodiversity Attributable Expenditure as % of GSDP of the State	0.0021	0.0022	0.0043

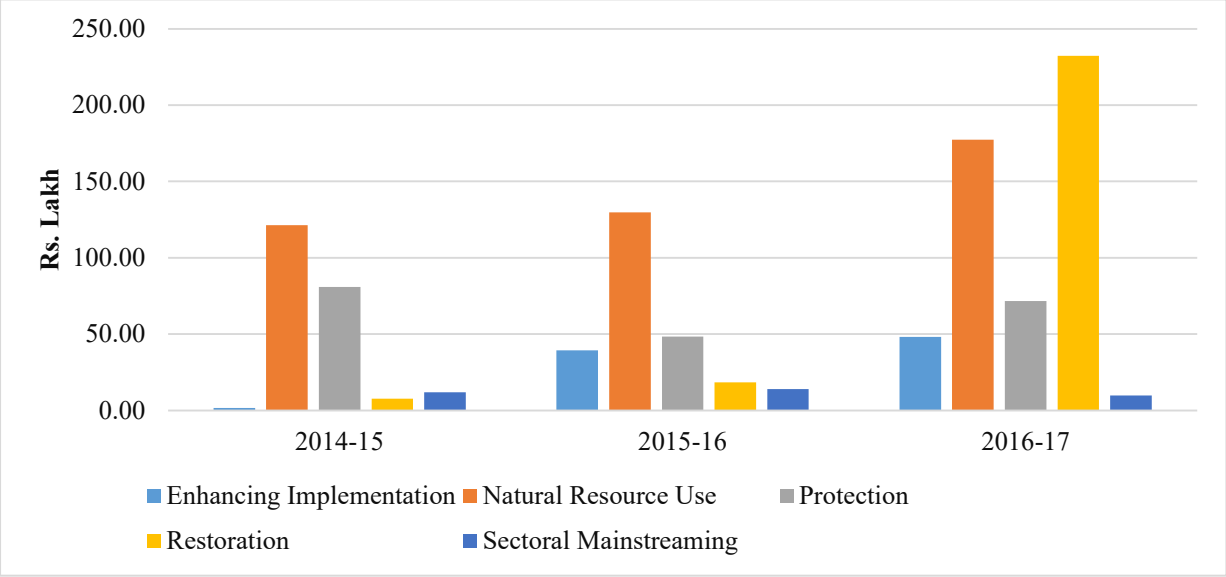
Source: Authors' Calculation

Table 5.14 Expenditure of Biodiversity Relevant Scheme by Type of Impact (Rs. Lakh)

	2014-15	2015-16	2016-17
Direct	74.26	56.97	287.11
Indirect Very High	98.99	99.91	143.39
Indirect Medium	2.976	46.44	51.79
Indirect Low	26.26	23.05	30.14
Indirect Marginal	0.32	0.41	1.04
Large Multi-purpose Scheme	4.58	6.74	17.91
Major Scheme	15.86	16.45	7.96
Total	**223.25**	**249.96**	**539.32**

Source: Authors' Calculation

Figure 5.5: Biodiversity Related Expenditure (CBD Classification)



Source: Authors' construct

Table 5.15 shows the contribution of schemes of different departments of the District during the period 2014-15 to 2016-17 on various activities which support biodiversity conservation. As expected, the Departments of Agriculture and Forest are key departments in terms of total expenditure on biodiversity. Department of Horticulture show a sharp increase in expenditure which is a good sign as these expenditures support livelihood opportunities. As in Pangi, expenditure by the Animal husbandry is steady, while tourism and Ayurveda are non-existent which can potentially contribute to livelihood opportunities and reduce pressure on forest resources and conflict with wild animals. There is a sharp rise in the expenditure of transport department, due to the expenditure incurred by the department under the head "Land Compensation including NPV".

Table 5.15: Department-wise Biodiversity Attributable Expenditure (Rs. Lakh)

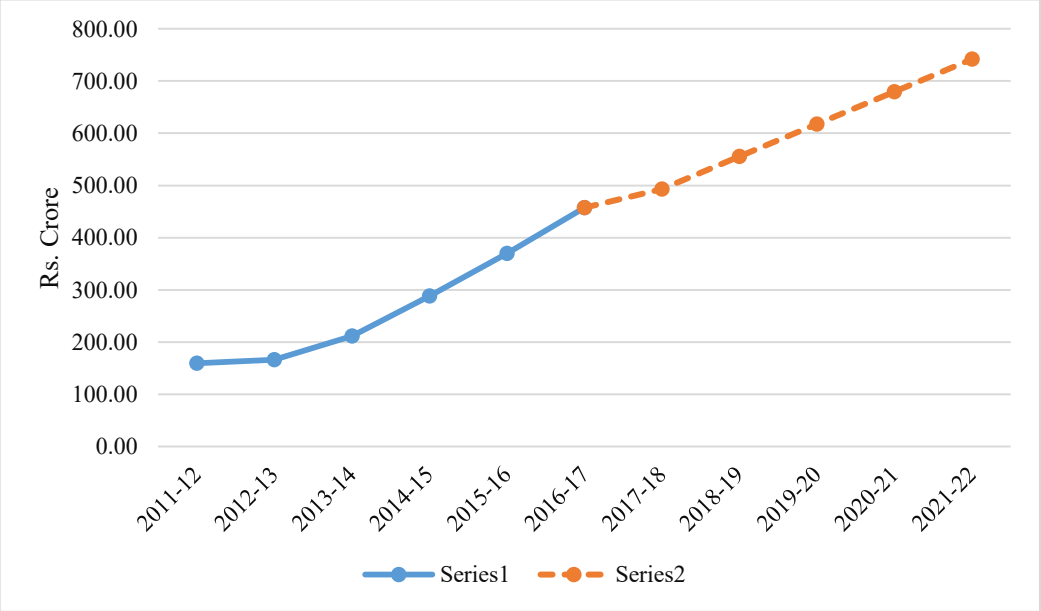
Departments	2014-15	2015-16	2016-17	Departments	2014-15	2015-16	2016-17
Agriculture	100.30	107.31	137.48	Irrigation	19.86	21.39	28.34
Animal Husbandry	4.18	4.18	4.37	Renewable Energy	0.26	0.35	1.04
Ayurveda	0	0.00	1.33	Rural Development	14.2	17.55	20.99
Fisheries	2.39	2.45	2.40	Tourism	0.06	0.06	0
Forest	60.78	44.01	77.60	Transport	0	0	197.24
Horticulture	19.18	49.07	62.97	Water & Sewerage	1.86	3.48	5.56
				Youth and Sports	0.19	0.11	0

Source: Computed by Authors

5.6 Projections

Using the principle of Least Square Methods which assumes a linear trend we project the attributable expenditure for biodiversity in Himachal Pradesh. We have actual data on expenditures for six years from 2011-12 to 2016-17. The projections or the forecast is made for the next 4 years starting from 2017-18 till 2020-21 (Figure 5.6).

Figure 5.6: Projections of Biodiversity Attributable Expenditure



Source: Authors' construct

5.7 Conclusion

The number of biodiversity relevant schemes, whether CSS or State Scheme, have seen an increase over the study period. Similarly, the expenditure incurred through these schemes has shown and increasing trend an impressive growth over the years. Expenditure on different aspects of biodiversity conservation in the state is expected to show variation across thematic areas in different years. This will be guided by central and state priorities which, in turn, will be guided by the local requirements and the need to meet the NBTs. We would like to mention here that since the BER analysis is based on actual expenditure, and this data becomes available with a lag of 2-3 years in different states; for HP 2016-17 is the latest year for which the data was available.

An important point to note here is that although, expenditure on restoration is negligible from the CSS, the state schemes have been increasingly focusing on restoration within the state which is encouraging. The expenditure on restoration has increased from Rs. 5.05 crore in 2011-12 to Rs. 23.67 crore in 2016-17 (which is little under 5 times). There is an urgent need to provide more funds for the purpose of restoration, given huge requirement for restoration in the state. CAMPA can be tapped for this purpose.

In Lahaul, Pangi, and Kinnaur biodiversity related expenditure shows a gradual increase during the period under study. While in Pangi the emphasis appears to be on promoting protection and sustainable use of natural resources; in lahaul and Kinnaur sustainable use of natural resources is the top focus followed by activities contributing to enhancing implementation of biodiversity conservation.

Chapter 6: Mapping Revenue from Biodiversity in Himachal Pradesh

6.1 Objectives and Scope

It is important to capture revenue from biodiversity to understand and describe the fiscal value that biodiversity and ecosystem services provide to the national and state governments.

However, mapping and analysis of full potential of revenue from biodiversity or even current revenue from biodiversity is an under researched subject in the literature. There is an increasing recognition that it is important to identify and map the revenue to the governments from biodiversity for at least the following reasons:

i. Well-designed fiscal and other economic instruments are important instrument for governments to shape relative prices of goods and services and address the problems with property rights.
ii. An analysis of the type of instruments used to raise revenue can help assess the appropriateness and under-utilized potential of some of these instruments in conservation of biodiversity.
iii. Identifying and supporting revenue streams from biodiversity-positive actions that could generate increased private sector investment
iv. Explore the feasibility of using these revenues for creating a fund dedicated to biodiversity management and conservation.

In this chapter, we have mapped the revenue from biodiversity for Himachal Pradesh. This involved the following steps:

i. Identify economic sectors within the state having positive and negative impacts on biodiversity.
ii. Identify revenue generated from biodiversity within these sectors by referring to official Acts, rules, notifications and reports.

6.2 Guidance from Literature

Table 6.1: Economic Instruments for Biodiversity Conservation and Addressing Specific Externalities

Economic Instrument	Description
Property Rights	Established or strengthened to reinforce private incentives for conservation, and to underpin other market-based conservation tools.
Market creation and enhancement	Used to strengthen the role of the market in guiding the allocation and use of resources, and providing economic incentives for conservation. Includes establishment of: • Carbon sequestration offsets, • Tradable development rights, • Tradable quota systems, • Eco-labelling and environmental certification, • Bioprospecting
Charges for service provided directly to consumer	• User fees • Collection of charges for solid waste pick-up • Tolls on public roads • Access fees (ex – for recreational access)

Economic Instrument	Description
Fiscal Instruments	Used to discourage unsustainable production and consumption practices and raise public revenues. Examples: • Differential land use taxation • Deforestation taxes[82] • Tax exemptions or tax deductions • Removal or mitigation of perverse fiscal policies relevant to biodiversity protection[83]
Liability Systems **Addressing risks of past future activities**	• Required liability or environmental insurance • Performance bonds for proper site remediation/closure • Civil and criminal penalties for natural resource damages
Environmental Funds	While not per se economic instruments, can be used to complement such instruments by financing conservation activities.

Based on UNEP, 2004.

OECD dataset on environmental related tax revenues

Taxes related to environment[84] are an important instrument for governments to shape relative prices of environmental goods and services. In OECD data set[85], sources and instruments of revenue are identified by economic sectors.

Table 6.2: Sectoral Categorization of Environmentally related Tax Revenues in OECD Dataset

Sectors	Revenue source/Instruments
Energy	• Energy products (Fossil Fuels, Electricity) • Transportation fuels (Petrol, Diesel) • All CO_2 related taxes
Motor Vehicles and Transport[86]	• One-off import or sales taxes on transport equipment • Recurrent taxes on ownership • Registration or road use of motor vehicles • Other transport-related taxes.
Other environment related tax	Environment related taxes not included elsewhere, e.g. • hunting and fishing taxes, • SOx and NOx emission taxes.

[82] Apply a high(er) tax rate to certain logging activities thus providing a disincentive for activities that cause deforestation. They usually are unit payments applied to each hectare or cubic metre of wood extracted. They can be partially refunded if the logging enterprises engage in reforestation within a certain time period.
[83] It involves the reform of a range of measures such as subsidies in the agricultural sector, the fisheries sector or other natural resource sectors, and import taxes related to technology transfer relevant to biodiversity protection.
[84] The characteristics of such taxes included in the database (e.g. revenue, tax base, tax rates, exemptions, etc.) are used to construct the environmentally related tax revenue with a breakdown by environmental domain.
[85]The OECD maintains a database of Instruments used for environmental policy, originally developed in co-operation with the European Environment Agency (EEA). The database contains detailed qualitative and quantitative information on environmentally related taxes, fees and charges, tradable permits, deposit-refund systems, environmentally motivated subsidies and voluntary approaches used for environmental policy. www.oecd.org/env/policies/database. https://stats.oecd.org/Index.aspx?DataSetCode=env_envpolicy
[86]Excludes excise taxes on automotive fuels.

Sectors	Revenue source/Instruments
Water and wastewater[87]	Taxes on: • Water extraction • Piped water • Discharge of wastewater • Other water-related taxes.
Mining and Quarrying	• Mining royalties • Excavation taxes (e.g. sand and gravel).
Waste Management	Taxes on: • Final disposal of solid waste • On packaging (e.g. plastic bags), and • Other waste-related taxes (e.g. batteries, tyres).
Ozone – depleting substances	Taxes on specific substances, such as • Chlorofluorocarbons (CFCs) • Carbon tetrachloride, • Hydro chlorofluorocarbon (HCFCs) • Other Ozone-depleting substances.

Source: Compiled by Authors

6.3 Framework and Methodology

Economic sectors and biodiversity are usually evaluated separately from each other, even though they are linked in significant ways. This is because these links are often invisible. However, some economic sectors rely, and impose several unquantified externalities[88] on biodiversity. Profitability in some sectors (tourism, forestry and wildlife, fisheries) directly depend upon healthy ecosystems and biodiversity. Whereas, other sectors, like mining and hydropower, have a direct impact on biodiversity through their process of production. Sources of revenue in these sectors have been analysed and those related to biodiversity have been identified[89].

Table 6.3: Sectors Related to Biodiversity

Sector	Relation to biodiversity
Tourism	HP is increasingly becoming a prime attraction for nature-based tourism. Therefore, maintaining a healthy eco-system and conserving biodiversity is of importance to maintain viability of the tourism ventures. However, due to high influx of the tourism, there is a threat to the fragile ecosystem of the State which leads to loss of biodiversity.
Forestry and Wildlife	Forests of the state are haven of floral and faunal diversity of any area, especially threatened and rare flora and fauna.
Fisheries	This sector is dependent on diversity among fish species.

[87]Fees and charges related to water supply are not included.

[88] An externality is said to arise when (i) the actions of one economic agent in society impose costs or benefits on other agent(s) in society, and (ii) these costs or benefits are not fully compensated for and thus do not factor into that agent's decision-making. Without intervention in the free market to internalize externalities, positive externality benefits are chronically under-supplied and negative externality costs are over-supplied

[89] For mapping the revenue, the acts, rules, official notification and departmental reports were referred to.

Sector	Relation to biodiversity
	However, over-exploitation due to unchecked fishing activities may lead to some of the fish species being threatened. There are scientific evidences that, on the time scale of decades, over-fishing can change genetic, species, and ecosystem diversity from levels that have been achieved over millions of years through natural selection (Boehlert 1996)
Mining	Mining does not rely on biodiversity for inputs in the process of production. But site preparation for mining operations is a destructive process which changes abiotic and biotic conditions, sometimes causing decline in rare and threatened species and ecosystems.
Hydropower	Although hydropower does not depend on biodiversity for inputs in process of production, setting up a hydropower plant leads to submergence, deforestation, loss of flora/fauna, and soil erosion. Local natural water sources get disturbed and often dry up as a result of the tunnelling activity for hydro projects (Sharma and Rana 2014)

Source: Compiled by Authors

6.4 Revenue Receipts: Sectoral Analysis

6.4.1 Tourism

It is one of the primary sources of revenue for the state. The state collects revenue from the sector in form of the economic instruments shown in Table 6.4. Table 6.5 show the budgetary receipts from the sector.

Table 6.4: Economic Instruments Levied in Tourism Sector related to Biodiversity

Environmental Fees	Registration Fees	Permits
• Composite Environmental Fees, Manali • Green Fees, Shimla • Green Tax, Bir Billing • Entry Tax, Pong Lake • Congestion Charges, Gulaba Bridge (Near Rohtang Pass	Himachal Pradesh Tourism Development and Registration of Tourism Trade Rules, 2012	Rohtang Pass

Source: Compiled by Authors

Table 6.5: Revenue Earned from Tourism (Rs. Lakh)

Budget Code	Budget Head	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Actual	2016 Actual
1452	**Tourism**	**104.92**	**26.50**	**57.85**	**59.95**	**89.95**	**76.44**
105	**Rent and Catering Receipts**	**11.27**	**6.24**	**19.34**	**3.53**	**4.79**	**3.14**
01	Rent and Catering Receipt	11.27	6.24	19.34	3.53	4.79	3.14

Budget Code	Budget Head	2011 Actual	2012 Actual	2013 Actual	2014 Actual	2015 Actual	2016 Actual
800	**Other Receipts**	**93.64**	**20.26**	**38.51**	**56.42**	**85.16**	**73.30**
01	Registration of Hotels, Travel, AG and Guides	16.24	15.55	28.47	47.87	35.89	50.98
13	Recovery of over payment	77.40	4.71	10.04	8.54	49.27	22.31

Source: State Budget, Various Years

6.4.2 Forests and Wildlife

The state keeps a check on human activities in the forest through a number of economic instruments in form of royalty, import fees and entry fees. These economic instruments, in addition to keeping a check on the human intervention within the forest ecosystem, also generate revenues for the state. A part of this should be diverted towards conservation of that biodiversity. Table 6.6 shows the economic instruments levied on the forest products in the state.

Table 6.6: Economic Instruments Levied on Forest Produce

Economic Instrument	Purpose	Levied On
Royalty	It is levied on use of a natural resource. It is an important means of discovering resource price.	Deodar Stumps: 20% of the Sale realisation per quintal; revised every three years. Timber (Refer to Annexure – 4)
Transit Fees	Regulate the movement of forest produce within the state, into the state from outside and from the state to the outside areas. Keeps a check on illegal activities	Medicinal Plants and other minor forest produce
Entry Fees	It is levied to recover the cost of providing recreational services.	National Parks Wildlife Sanctuaries Zoos
Other fees	Fees collected for the purpose of issue of certificates for purposes defined by the forest department. Keeps a track on the number of people engaged in economic activities within the forest area, checks over exploitation and illegal activities.	All persons willing to transport forest produce by land routes shall register at the office of the Divisional Forest Officer. Registration of growers for cultivation of medicinal plants[90]:
Net Present Value and Charge for Compensatory Afforestation	Addressing loss of biodiversity and ecosystem due to commercial or developmental activities	On user agency meaning any person, organisation or company or department of the Central Government or State Government making a request for diversion or de-notification of forest land for non-forest purpose or using forest land for non-forest purpose.

[90] Notification No. FFE-B-A(3)-2/2013 dated 26-11-2013; Available at: https://hpforest.nic.in/files/transit%20rules_1.pdf

Economic Instrument	Purpose	Levied On
Bioprospecting[91]	Sustainable use of genetic resources	Medicinal and aromatic plants of the state.
Fines and Penalties	• Induce behavioural change • Check activities harmful for environment	On contravention of the provisions of the rules and acts being implemented in the state.

Note: For details on Transit fee, refer to annexure - 4

A. ABS as potential source of revenue from biodiversity

Objectives of implementing ABS:

- To stop Bio-piracy.
- To protect biodiversity in general in a holistic manner.
- To regulate use of Biodiversity.
- To ensure sustainable utilization and equitable benefit sharing.
- To provide legal recognition & support to the Biodiversity and associated traditional knowledge.

Himachal Pradesh is very rich in bio-resources. There are 3400 species of plant diversity in the state. The bio-resources of the state are also a source of revenue. 130 species of medicinal plants are in heavy demand in the markets; however, the economic potential of the plants is not realised fully as major trade in medicinal plants goes unrecorded.

The implementation of Biological Diversity Act, 2002 and increasing awareness of ABS has created opportunities for local communities for ABS arrangements with bio-prospecting industries and checking the illegal channels of trade leading to unsustainable extraction of these bio-resources. The State Biodiversity Board has approved the draft HP biodiversity rules in January 2020 and also reported that an amount of Rs. 71,19,790 has been received in biodiversity fund from Dabur India Ltd.[92]

A study by Himachal Pradesh State Biodiversity Board "Tradable Bioresources in Himachal Pradesh… Potential and Scope" has identified important bio-resources that have economic potential (See Annexure 4). Some bio-resources of the state, that have high economic value have reached a stage of being near critically endangered (atis, chirayata), endangered (somlata, jatamanasi, kutki, talispatra), vulnerable (tejpatta, kalihari, taxus wallichiana), and near threatened (Abies spectabilis) due to unregulated and unscientific harvesting. Focused on sustainable utilisation of these resources, ABS assumes importance in regulating the use of biodiversity.

It is reported that there are 706 industries/companies that are accessing the biological resources from the State for commercial utilisation. With the recent notification of Biodiversity Rules, revenue from ABS is expected to start yielding results.

Table 6.7: Revenue Earned from Forestry and Wildlife

(Rs. In Crore)

Budget Code	Budget Head	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
0406	**Forestry and Wildlife**	**106.54**	**63.90**	**357.83**	**115.78**	**34.47**	**18.50**
01	**Forestry**	**106.52**	**63.89**	**357.82**	**115.73**	**34.42**	**18.37**
101	**Sale of Timber and other Forest Produce**	**87.78**	**33.21**	**51.98**	**44.47**	**19.60**	**7.72**

[91] Systematic search for biochemical and genetic information in nature in order to develop commercially valuable products for pharmaceutical, agricultural, cosmetic, and other application.
[92] Proceedings of fourth meeting of HPSBB dated 23.01.2020, Available at: http://hpbiodiversity.gov.in/Pdf/4th%20HP%20State%20Biodiversity%20Board%20Proceeding%20Final.pdf

Budget Code	Budget Head	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
01	**Timber and Other Forest Produce Removed from Forests**	0.22	0.37	0.10	0.14	0.08	0.06
02	Timber and Other Forest Produce Removed from Forests by Consumers	31.67	12.64	45.38	32.64	7.00	3.98
03	Drift and Waif Wood	0.00	0.01	0.00	0.00	0.03	0.00
04	Other Forest Produce Removed from Forests by the Government	0.00	0.00	0.00	0.00	0.00	1.28
05	Sale of Timber and other Forest Produce Removed from FSC	55.65	19.69	5.93	10.73	11.66	1.80
06	Minor Forest Produce including Medicinal Plants	0.11	0.37	0.32	0.83	0.74	0.50
07	Receipt from Grazing and Grass	0.13	0.13	0.25	0.13	0.09	0.10
102	**Receipts from Social and Farm Forestry**	**0.00**	**0.00**	**0.00**	**0.00**	**0.66**	**0.44**
01	Receipt from Registration Fees	**0.00**	**0.00**	0.00	0.00	0.66	0.44
02	Receipts from Forest Societies	**0.00**	**0.00**	0.00	0.00	0.00	0.00
800	**Other receipts**	**18.74**	**30.68**	**305.84**	**71.26**	**14.16**	**10.20**
01	Receipt from Penalties and Damage Bills	0.94	0.34	0.22	0.52	0.45	0.15
02	Receipt from Sale of Trees To Right Holders	0.02	0.11	0.20	1.15	1.63	0.97
03	Compensation under Section 68 of IFA, 1927	1.99	3.75	2.97	3.63	3.06	1.95
04	Receipt from Rent of Building	0.87	0.92	0.92	0.98	0.89	0.86
05	Receipt from Registration Fees	0.19	0.22	0.31	0.37	0.00	0.00
06	Receipts from Forest Societies	0.00	0.00	0.00	0.00	0.00	0.00
07	Receipt from Passing of Timber	0.00	0.00	0.03	0.01	0.00	0.00

Budget Code	Budget Head	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
08	Receipt from Sale of Packing Cases	0.00	0.00	0.00	0.00	0.00	0.00
09	Receipt from Export Permit Fees	0.93	1.50	1.35	1.39	1.15	1.22
10	Miscellaneous (Seized Timber)	0.85	0.79	1.27	0.74	0.97	1.49
11	Guarantee Fee from Forest Corporation	0.00	0.00	0.00	0.00	0.00	0.00
12	Receipt from Other Departments to Compensation Forestry	8.19	0.86	0.59	59.68	5.16	1.05
13	Receipt from Forests not Managed by Government	0.01	0.06	0.02	0.01	0.02	0.00
15	Receipt from Sale of Trees to Other Deptt./Organisations	0.10	14.33	294.31	0.37	0.00	0.00
16	Receipt from Penalties and Damage Bills etc from HPFSC	0.13	0.14	0.12	0.07	0.21	0.19
17	Receipt from Distribution of Seedling	0.21	0.11	0.49	0.07	0.08	0.11
18	Other Miscellaneous Receipt	4.30	7.56	3.03	2.27	0.53	2.21
02	**Environmental Forestry and Wildlife**	**0.02**	**0.01**	**0.02**	**0.05**	**0.05**	**0.13**
800	**Other Receipts**	**0.02**	**0.01**	**0.02**	**0.05**	**0.05**	**0.13**
02	**Entry Fee from Zoos/Parks**	0.02	0.01	0.02	0.05	0.05	0.13

Source: State Budget, Various Years.

6.4.3 Fisheries

Fisheries are an important sector of food production and providing nutritional security to the food basket. Mapping revenues from this sector is tricky as the prime objective of the measures undertaken for promotion of sustainable fishing is enhancing the income of fishermen. The state earns revenue from this sector mainly in the form of fees, fines and sale of fish, fish seeds.

Table 6.8: Economic Instruments Related to Biodiversity levied in Fisheries Sector

License Fees	Fines/Penalty	Sale of Fish, Fish Seeds
Keep a check on the number of people indulged in fishing	Induce behavioural change	Recover the cost of production
This keeps a check on the pressure put on the marine resources of the state.	It keeps a check on activities harmful to the marine resources of the State.	Livelihood support to fishermen

Following revenues (in Table 6.9) have been identified from the state budget which are relevant for biodiversity conservation. The revenue collection in fisheries is showing a clear increasing trend.

Table 6.9: Revenue Earned from Fisheries (Rs. In Thousands)

		Actual					
Budget Code	**Budget Head**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
0405	**Fisheries**	**13586**	**19400**	**25573**	**29704**	**39830**	**42728**
102	**Licence Fees, fines, etc.**	**1703**	**1942**	**2080**	**2041**	**29262**	**11620**
01	Receipt from Licence Fees, Fines etc.	0	1942	2080	0	29262	11266
103	**Sale of Fish, Fish Seeds etc.**	**11159**	**16620**	**19769**	**22305**	**9106**	**20389**
01	Sale of Fish, Fish Seeds	731	517	1552	962	5782	14103
02	Royalty on Sale of Fish	10428	16103	18217	21343	3324	6285
800	**Other receipts**	**0.04**	**0.04**	**0.34**	**0.50**	**0.06**	**0.95**
01	Miscellaneous Receipts from Fisheries	0.04	0.04	0.34	0.50	0.06	0.95

Source: State Budget, Various Years.

6.4.4 Mining

Mining industry in Himachal Pradesh has emerged as a major economic activity in the recent years, and has been contributing significantly to the economy of the state. At the same time, increasing mining operations have increased the threat to biodiversity in the state. According to Sonter, Ali and Watson (2018), mining has direct and indirect impacts on biodiversity.

To counter such losses, in June 2015, the Mines and Minerals (Development and Regulation) Act, 1957 was amended to introduce a new section, i.e., Section 9(B), which provides for the establishment of *District Mineral Foundation* in any district affected by mining related operations, the object of which shall be to work for the interest and benefit of people and areas affected by mining.

Box 6.1: District Mineral Foundation

The District Mineral Foundation is funded by statutory contributions from holders of mining lease, in the following manner:

For Major minerals (as prescribed by Central Government):

a) 10% of the royalty paid in terms of the Second Schedule to the MMDR Act, 1957 in respect of the mining leases or, as the case may be, prospecting licence-cum-mining lease granted on or after 12th January, 2015; and
b) 30% of the royalty paid in terms of the Second Schedule to the said Act in respect of mining leases granted before 12th January 2015.

For Minor Minerals (as prescribed by the State Government):

a) Ordinary Soil/brick earth/Shale – Re. 1/-per tonne of the mineral dispatch
b) All other mineral material – Rs. 10/- per tonne of the Dispatch

The DMF will implement Pradhan Mantri Khanij Kshetra Kalyan Yojana (PMKKKY) for implementation of development projects in the areas affected by mining. PMKKKY guidelines prescribes that at least 60% of fund shall be utilised for high priority areas:

i. Drinking water supply
ii. Environment preservation and pollution control measures
iii. Health care
iv. Education
v. Welfare of women and children
vi. Welfare of aged and disabled people
vii. Skill development
viii. Sanitation

40% of funds shall be utilised for other priority areas:

i. Physical Infrastructure
ii. Irrigation
iii. Energy and Watershed Development
iv. Any other measure for enhancing environment quality in mining districts

Source: Compiled by Authors

Out of the permissible works that can be undertaken using the funds of DMF, 3 are related to biodiversity (Environment preservation, Sanitation, and Energy & Watershed Development).

Till November 2018, total collection under DMF in Himachal Pradesh amounted to Rs. 96.49 crore. Out of this, 89.33 percent of the collection comes from Major minerals (other than Coal and Lignite) and the rest comes from minor minerals. The following table 6.10 shows the details:

Table 6.10: Receipts of District Mineral Foundation

Head	Amount (Rs. Crore)
Total amount collected in respect of major Minerals (Other than Coal and Lignite)	86.19 (89.33%)
Total amount collected in respect of Minor Minerals	10.30 (10.67%)
Total amount collected in respect of coal and lignite	0
Total amount collected under DMF	**96.49 (100%)**

Source: Compiled by Authors

Out of the total collection of Rs. 96.49 crore, no amount has been spent on any project in the state.[93] Apart from the receipts of DMF, other revenue earned from mining may be diverted towards restoration and rehabilitation of biodiversity in mining affected areas. Table 6.11 shows the economic instruments by which revenue is raised in mining sector in Himachal Pradesh.

Table 6.11: Economic Instruments related to Biodiversity in Mining Sector

Economic Instruments	Purpose
Royalty	The mining lease confers upon the lessee the right to extract minerals from the land and to appropriate them for his own use or benefit. For this, the lessee is required to pay a certain amount in respect of the minerals extracted proportionate to the quantity so extracted. [94]
Fees	Charged for providing mining permit, mining lease.
Dead Rent	Charged to ensure a flow of income to the lessor in case the mine is not being operated on and therefore, no royalty is being paid.
Surface Rent	In a mining lease, a lessee has to pay the lessor the rent for the area leased. This rent is called **Surface Rent**
Penalty	On contravention of the provisions of the Himachal Pradesh Minor Minerals (Concession) and Minerals (Prevention of Illegal Mining, Transportation and Storage) Rules, 2015
District Mineral Foundation	Established to counter adverse impacts of mining on environment and livelihood of local people.

Source: Compiled by Authors

Box 6.2: Surface Rent, Royalty and Dead Rent

In a mining lease, a lessee has to pay the lessor the rent for the area leased. This rent is called **Surface Rent**.

Along with the right to use the property, the mining lease confers upon the lessee the right to extract minerals from the land and to appropriate them for his own use or benefit. For this, the lessee is required to pay a certain amount in respect of the minerals extracted proportionate to the quantity so extracted. This payment is called **Royalty.**

It might happen that the mine does not yield enough return to the lessor in shape of royalty. In order to ensure that the lessor gets a regular income, whether the mine is operated or not, a fixed amount is to be paid to lessor by lessee. This is **Dead Rent.**

Source: 1986 AIR 1323, 1986 SCR (1) 479)[95]

Following revenues (in Table 6.12) have been identified from the state budget which are relevant for biodiversity conservation. The revenue collection from rent and royalty is showing a clear increasing trend.

[93] Transform mining, released at National Workshop on DMF – PMKKKY, 2019
[94] D.K. Trivedi and Sons and ors. Etc. ... vs State Of Gujarat and ors. etc. on 5 March, 1986.
[95] D.K. Trivedi And Sons And Ors. Etc. ... vs State Of Gujarat And Ors. Etc. Etc on 5 March, 1986

Table 6.12: Revenues Earned from Mining

(Rs. In Crore)

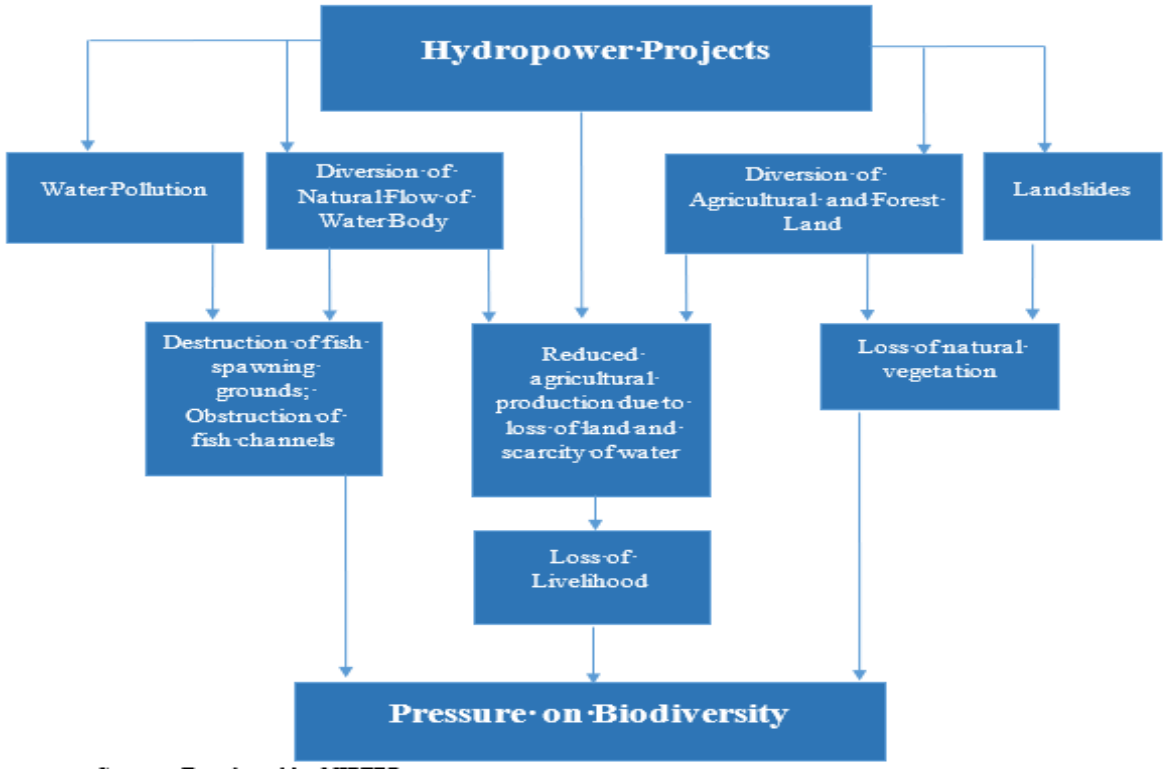
		Actual					
Budget Code	**Budget Head**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
0853	**Non-Ferrous Mining and metallurgical industries**	**120.12**	**147.90**	**111.08**	**161.52**	**155.08**	**176.22**
102	**Mineral Concession Fee Rent and Royalties**	**112.88**	**137.37**	**99.20**	**125.85**	**125.77**	**134.54**
01	Receipts from Mineral Concession, Fee	112.88	137.37	99.20	125.85	125.77	134.54

Source: State Budget, Various Years.

6.4.5 Hydropower

Although hydropower is clean energy, the construction of hydropower plants impact damages livelihood and environment and biodiversity in different ways (Carew-Reid et al, 2010) is well documented.

Figure 6.1: Impact of Hydropower Projects on Biodiversity



Source: Source: Compiled by Authors

However, the state has the potential to earn large revenues through hydropower projects. The state levies a free power royalty on all the new hydro projects in the state, which means that the power producer will provide the state royalty at the rate of 12 percent of net energy for the

entire agreement period.[96] The state also charges royalty on water usage (HP Small Hydro Power Policy, 2006).

Box 6.3: Local Area Development Fund

Local Area Fund Development (LADF) has been set up as per provision 10.1 (h) of National Hydro Power Policy 2008.

"An additional 1% free power from the project would be provided and earmarked for a Local Area Development Fund, aimed at providing a regular stream of revenue for income generation and welfare schemes, creation of additional infrastructure and common facilities, etc., on a sustained and continued basis over the life of the project. It is recommended that the host state governments would also provide a matching 1% from their share of 12% free power towards this corpus. This fund could be operated by a standing committee headed by an officer of the State Government, not lower than a district magistrate to be designated by the State Government, male and female representatives of the Project Affected People and the project head nominated by the developer. This fund would be available in the form of an annuity over the entire life of the project.

The objective of establishing the fund is to carry out local development activities so as to ensure visible additional benefit to local communities in the project area.

The Fund would receive revenue from sale of 1% additional free power by the project developer and matching share of the State Government from sale of 12% free power allocated by the projector developer.

The funds of LADF would be kept in a joint account in any scheduled bank. The interest earned on LADF will be a part of LADF

Source: Draft Guidelines for Management of Local Area Development Fund.

The following table 6.13 shows the revenue earned from power sector is shown in the following table.

Table 6.13: Revenue Earned from Power

(Rs. Crore)

Budget Code	Budget Head	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
0801	**Power**	**1145.70**	**637.15**	**696.29**	**1121.51**	**923.68**	**650.93**
01	**Hydel Generation**	**1145.70**	**637.15**	**696.29**	**1121.51**	**923.68**	**650.93**
800	**Other receipts**	**1145.70**	**637.21**	**696.29**	**1121.51**	**925.58**	**650.93**
01	Guarantee Fee on Loans by HPSEB	0	7.89	0	0	0	0.08
06	Free Power Royalty from HPSEB	47.64	34.79	25.00	112.24	333.42	0
10	Free Power Royalty from SJVN	101.74	170.04	121.58	437.53	242.50	179.95

Source: State Budget, Various Years

[96] Notification No. MPP (F)-2/2005-X dated 15-05-2018; Available at: http://hperc.org/File1/amendmentpolicy18.pdf

6.5 Way Forward

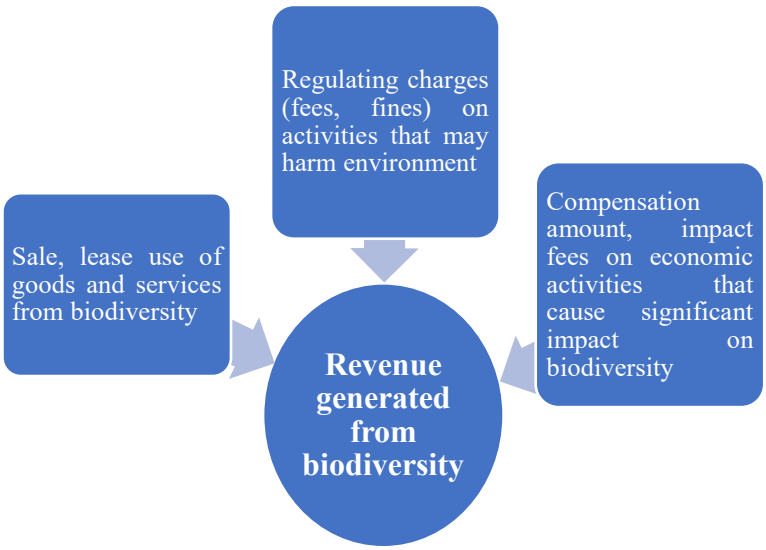
In this chapter, potential revenue sources have been identified; which can be divided into the following categories:

i. When revenue is generated from sale, lease, access, use, etc. of goods and services provided by biodiversity.

ii. When income is generated from implementing policies which regulate economic activities (that impact biodiversity) and encourage sustainable practices such as fee, fines, permits in case of fisheries, tourism, etc.

iii. When a compensation amount, impact fee etc. are levied on economic activities which cause significant adverse impact on biodiversity sometimes leading to complete destruction and loss.

Figure 6.2: Categories of Revenue Generated from Biodiversity



However, we find that the collection from these revenue items ranges from 0.27 percent of GSDP to 0.77 percent of GSDP[97], which is miniscule. To increase revenue from biodiversity, following are some recommendations:

1. **Effective Implementation of ABS:** Corporations utilizing bio-resources of the state should be persuaded to share the benefits accrued with the state. HP State Biodiversity Board has released a report on tradable bio resources of the state. This report has identified all the tradable resources of the state that have the potential for access and benefit sharing, along with the industries which are using these bio-resources as raw material. The resources identified in the report should be considered for development of a robust ABS mechanism and the industries should be persuaded to pay for the benefits they derive from state's bio-resources. However, without the implementation of strict rules, it would be difficult to bring all such stakeholders to the table of discussion. Therefore, formulation of rules is of utmost importance.
2. **Utilising District Mineral Foundation Fund:** The collection of Rs. 96.49 crore in DMF Fund has not ever been utilised. The state should start planning expenditure on the priority areas from the fund to negate the negative impacts on the biodiversity caused by mining activities. The state should also explore the possibility to transfer a specific amount from DMF to the Environment Fund, which could be utilised for conservation and restoration purposes.
3. **CAMPA Fund** is a promising source of revenue. There is a need to integrate biodiversity in utilisation of CAMPA, especially for restoration and afforestation activities. More focus should be on restoring the endangered and threatened species. The state should explore the possibility of earmarking a specific amount for conservation and restoration of biodiversity, which should be transferred to the Environment Fund.

[97] Authors' calculation, data taken from state budget for various years

4. **Environment Fund:** The Environment Fund (See Annexure – 5), although already established in 2008, has not been utilised till date. The amount in DMF and CAMPA fund meant for biodiversity should be transferred to this fund. This amount should be used for conservation of biodiversity and restoration of degraded area.
5. **Increasing Involvement of Traditional Governance Systems:** Traditional systems like Praja, Mahila Mandal should be encouraged to take actions for conservation of biodiversity like impose ban on environmentally harmful activities, implementing fees and fines. This will induce behavioural changes along with raising revenue which can be utilised for maintenance of biodiversity in their area.
6. The state already collects **entry fees** for ecologically fragile areas. The collection of such fees from famous tourist spots is generous. A part of this fees should be earmarked for maintenance of biodiversity in the area. To ensure that biodiversity is taken care of, an ecological fund can be created at local level, where the earmarked amount for biodiversity could be transferred.

Chapter 7: Financial Needs Assessment Based on Quantitative Targets

7.1 Financial Needs Assessment

The State Biodiversity Strategy and Action Plan (SBSAP) is a strategic policy document prepared with an aim to mainstream biodiversity through schemes and programmes of relevant sectors. The implementation of SBSAP requires a comprehensive estimation of finance resources. For this purpose, a financial needs assessment has been undertaken.

The methodology which has been adopted in this report for the purpose of assessment of financial needs for implementing the SBSAP was developed as part of the BIOFIN initiative. The comprehensive methodology is based on quantitative targets, developed with an aim to implement the National Biodiversity Action Plan and achieve the 12 National Biodiversity Targets.

With implications on country-level budgeting process and planning, finance for biodiversity conservation is a complex policy matter in India. For undertaking the financial needs assessment for implementation of SBSAP in Himachal Pradesh, quantitative targets have been introduced in respect of specific action points. These quantitative targets have been derived from the existing schemes, policies, programs and action plans, which have been prepared for and are being implemented by different government departments of Himachal Pradesh. This is because these policies, schemes, programs and action plans have been approved after much deliberation at the highest levels in the government. Financial projections for the quantitative targets were made by using government approved costs and cost norms.

The financial needs assessment has estimated the finances required to implement SBSAP, in alignment with existing schemes and programmes and is outlined below. The action points identified from the draft SBSAP of Himachal Pradesh form the basis of the assessment. These action points spread across 8 thematic areas: Wild flora and fauna, Agriculture, Animal husbandry, Aquatic biodiversity, Microbial biodiversity, Livelihood, Economic Valuation and biodiversity, Education, Awareness and Training as well as Policies, Laws and Institutions

Table 7. 1: Financial Needs Assessment for Implementation of SBSAP

S. No.	Action Points	Targets	Relevant Scheme	Funding Gaps and Remarks
Wild flora and fauna				
1	Training of JFMs, VFDCs, VFDSs, Yuvak Mandals, Mahila Mandals etc. to create opportunities for networking and awareness raising for conservation of PAs	Target: 1567 JFMCs 364 VFDSs 154 VFDCs	➢ Sanjhi Van Yojana (SVY)[98] ➢ Training in Soil Conservation ➢ Samudaik Van Samvardhan Yojana (SVSY)	Funds approved. No Additional funds needed.
2	Awareness campaigns for local communities to educate them about the impacts of illicit felling, unsustainable extraction of medicinal plants, overgrazing, etc.	To be achieved with target for training of JFMCs.	➢ SVY ➢ Vidyarthi Van Mittar Yojana ➢ SVSY	Funds approved. No Additional funds needed.
3.	Sterilization of animals like Monkeys	Annual target – 15,000	➢ Monkey Sterilization Programme	Annual cost = Rs. 1,35,00,000 (over 5 years)
4.	Periodic cleaning of shrubs to provide free movement of animals	Yearly target = 2500 ha each for very dense and moderately dense forest.[99]	➢ MGNREGA	Total Annual cost VDF and MDF = Rs. 3.64 crore
5.	Plant more fruiting trees in forests to avoid raiding by animals in agricultural lands in search of food	Target – 120000 hectares (HP Budget speech, 2020-21)[100]	➢ Raising nurseries for departmental planting and public ➢ CAPMA ➢ NAP ➢ Sanjhi Van Yojana	Funding has been approved, as indicated in the budget speech.
6.	Revive degraded pasturelands in uphill	Annual target = 5000 ha[101],[102]	➢ Development of Pastures and Grazing	Annual cost to the State = Rs. 1.85crore[103]
7.	Strengthen forest fire management in light of increasing incidents of forest fires	➢ 600 more need to be deployed. ➢ 92 home guards in sensitive division with equipment and good	➢ Forest Fire Management Scheme (State Scheme)	Total cost = Rs. 1.75 crore

[98] One of the objectives of Sanjhi Van Yojana is to provide training to Training of forest staff, VFDS members and CBOs / NGOs for facilitating and strengthening community participation, as outlined in HP Forest Manual, Volume I, Page no: 773: https://hpforest.nic.in/files/Forest%20Manual%20%20Volume%20I.pdf

[99] HP State budget, 2020-21 has a target of clearing of lantana from 2,500 ha of land in 2020-21. This target has been taken as a proxy for clearing of shrubs.

[100] https://ebudget.hp.nic.in/Aspx/Anonymous/pdf/FS_Eng_2020.pdf

[101] HP state budget,2020-21 has set target of doing plantation in 5000 ha of land in 2020-21. This target has been taken as proxy for restoring pasturelands.

[102] State aims to achieve the target of FTC by 2030 (State Budget Speech, 2020-21). This is the proxy duration for achieving the total target.

[103] Since the data is not available for area of pastures available in tribal and non-tribal areas, we will consider the upper limit of the cost using norms of tribal areas.

S. No.	Action Points	Targets	Relevant Scheme	Funding Gaps and Remarks
		vehicles to be deployed to bring fires under control.[104]		
8.	Provision of cooking gas to reduce dependency on biomass-based stoves often used in open areas	Himachal Pradesh is the first state to achieve 100% LPG Coverage under the PM Ujjwala Yojana.[105]	➢ Pradhan Mantri Ujjwala Yojana	Target achieved. No funding required.
9.	Provide anti-trafficking training to all the enforcement agencies	To be incorporated as a part of courses offered at FTIs for training of all forest staff[106]	➢ State scheme on wildlife preservation ➢ Crime and Criminal Tracking Network System	No additional funding required. To be imparted as part of regular training.
10.	Strengthen seed banks for seed conservation as well as plant breeding for seed development	One (One gene bank is already being established by GBPIHED, Mohal, Kullu,)	➢ Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seeds (CSS Scheme)	No additional funding required.
11.	Identify and plant native tree species to restore degraded landscapes and curb the issue of land desertification.	Annual target = 12000 ha. (Target for 2020-21 in state budget =12000 ha The State aims to achieve two-third FTC by 2030 (State Budget Speech, 2020-21)	➢ CAMPA ➢ National Afforestation Programme	Annual funds requirement = Rs. 15 crore (This is the proxy for annual cost to be borne for next 10 years, till 2030)
12.	Develop Restoration Plan for area affected by invasive species. The plan should include regeneration of native species as well	Annual target = 2500 ha.[107]	➢ CAMPA ➢ National Afforestation Programme ➢ Samriti Van Yojana ➢ Regeneration of forests ➢ Improvement of tree cover ➢ Sanjhi Van Yojana	Annual funds needed = Rs. 5.04 crore (Annual cost to be borne till 2030, similar to the target of FTC)

[104] https://www.thestatesman.com/cities/shimla/govt-initiatives-curb-forest-fires-in-himachal-pradesh-1502771273.html
[105] https://indianexpress.com/article/governance/himachal-pradesh-first-to-achieve-100-lpg-coverage-6283215/
[106] https://hpforest.nic.in/pages/display/NGY2NTRihnQ0ZjY1NA==-natural-resource-management-and-training-development-society
[107] Target for 2020-21 is set at 2500 ha in HP state budget, 2020-21 which has been taken as proxy for yearly target.

S. No.	Action Points	Targets	Relevant Scheme	Funding Gaps and Remarks
13.	Capacity building programme for local communities to manage homestays and restaurants	Target – 3544 people[108]	➢ Loan assistance from Asian Development Bank worth US $ 95.16 million[109]	Cost = Rs. 10,63,200 for a training session of 3 days No additional funding required. Funds will be sourced from the loan from ADB.
Agriculture and Biodiversity				
1.	Increase the number as well as reach of solar pumping sets to farmers under Saur Sinchayee Yojana	17.50 lakh standalone solar powered pumps to replace the diesel-powered agricultural pumps by 2022.[110]	➢ Saur Sinchayee Yojana ➢ KUSUM Yojana[111] (GoI)	No additional fund needed.
2.	Training in scientific production & management of fodder under Uttam Chaara Utpadan Yojana for higher productivity of livestock and less pressure on forests	➢ Target = 25000 farmers	➢ Uttam Chara Utpadan Yojana	No additional funding needed the provision is in the scheme.
3.	Develop a Fodder Bank to enhance quantity and quality of fodder.	Two fodder banks in an area of 6 ha each[112] proposed to be set in Lahaul-Pangi landscape.	➢ Rain fed Area Development Programme ➢ Sub mission on Fodder and Feed Development under NLM	Total cost = Rs. 15 lakh .
4.	Set-up high-tech nurseries in higher altitude regions	➢ 10 high tech nurseries are to be set within the state.[113]	➢ Establishment/Maintenance of government orchards/nurseries (Horticulture Department)	Total cost = Rs. 2 crore No additional funding required. Scheme has specific component for this purpose.

[108] In 2019-20, the Department of Tourism undertook training for Community Based Tourism in 6 districts: Chamba, Bilaspur, Kullu, Mandi, Solan and Shimla. The total number of people trained is 3544. So, the next target is training people in other 6 districts. Target to match is 3544.
[109] http://himachalservices.nic.in/economics/pdf/Economic_Survey_eng2019-20.pdf, page 116.
[110] https://economictimes.indiatimes.com/small-biz/productline/power-generation/govts-special-scheme-for-farmers-for-the-installation-of-solar-pumps-and-grid-connected-solar-power-plants/articleshow/69523504.cms?from=mdr
[111] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1565274
[112] The CFB in Maikhanda village in Uttarakhand was set up in community wasteland of 6 ha, an nursery was set up in small area of arable land; see page 21 in: http://gbpihed.gov.in/PDF/Publication/25%20years%20research_final%20Report.pdf
[113] http://www.hpagriculture.com/schemes.htm

S. No.	Action Points	Targets	Relevant Scheme	Funding Gaps and Remarks
5.	Introduce a comprehensive focused program to provide support for identified niche organic products	➢ Bring 20,000 ha into Natural Farming System ➢ Awareness campaigns for 1 lakh farmers	➢ Prakartik Kheti-Khushal Kisan scheme	Funds have been approved by the state budget. No additional funding required.
6.	Train farmers for residue management to improve soil health	Annual target: 50,.000 farmers (In 2019-20, the State had trained 50,000 farmers for organic farming; this target has been taken as a proxy for the annual target)[114]	➢ Soil Science and Chemistry (State Scheme) ➢ SHM under NMSA ➢ National Project on Management of Soil Health and Fertility ➢ NMAET	Annual cost = Rs. 4.45 crore
7.	Strengthen State Bio control labs to provide suitable bio-control agents especially for higher altitude regions	There are 2 biocontrol labs in the State, one in Palampur and one in Mandi[115]	➢ Plant Protection ➢ NMAET	Cost = Rs. 40 Lakh No additional funds are needed.
8.	Provide on-farm training to farmers in for adoption of Pesticide Application Technology for minimum residue and reduced pesticide risk	There are 9.61 lakh farmers in the State who need to be trained. Annual target: 50,000 farmers[116]	➢ NMAET	Annual cost = Rs. 4.45 crore
9.	Establish Community Seed Banks to make local variety of seeds available to farmers.	One in each district	➢ Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seeds (CSS Scheme) ➢ Promotion & Strengthening of agricultural machineries through training, testing and demonstration (100% CSS)	@highest cost norm the cost of seed banks in the State = Rs. 6.82 crore

[114] HP State Budget Speech, 2020-21
[115] http://www.hpagriculture.com/schemes.htm
[116] In 2019-20, the State had trained 50,000 farmers for organic farming; this target has been taken as a proxy for the yearly target

S. No.	Action Points	Targets	Relevant Scheme	Funding Gaps and Remarks
Animal Husbandry				
1.	Strengthen and extend veterinary services for migratory livestock	Start Mobile Veterinary Sewa on pilot basis Fill up 120 posts of Gram Panchayat Veterinary Assistants	➢ Mobile Veterinary Sewa	No additional funding required; funding approved in the State budget.
2.	Increase the number of Yak breeding farms similar to the breeding farm (with 62 yaks) in Lari, Lahaul and Spiti district	➢ One farm	Conservation of Threatened Livestock Breed of Yak/Spiti Pony	Total cost = Rs. 50 lakh
3.	Establish 'Gokul Grams' under Rashtriya Gokul Mission	➢ One gokul village in Una to be set up.[117]	➢ Rashtriya Gokul Mission	Funds sanctioned under Rashtriya Gokul Mission[118]
4.	Explore providing incentive to local communities as a possible strategy such as monthly remuneration to adopt stray cattle	Annual target = 12,816 cattle	Funds needed to be allotted by State. No schemes supporting this initiative.	Annual cost = Rs. 13.84 crore
Aquatic Biodiversity				
1.	Establish and strengthen fish brood bank, especially for native species such as mahseer	Establish 1 brood bank for Mahseer and 1 for trout.	Rashtriya Krishi Vikas Yojana (Animal Husbandry)	Total cost = Rs. 10 crore (Rs. 5 crore for each brood bank)
3.	Desilt the riverbeds and reservoirs	27 hydroelectric stations are there in the state. Target for desilting: 27 hydro stations	No scheme. State government needs to allot money.	Total cost = Rs. 5,35,21,074
4.	Identify locations to lay down additional pipelines to treat effluents before their disposal in river	The Department of Irrigation and Public Health has a target to lay the pipeline for sewerage system of Industrial Area Kala Amb and Moginand	No scheme.	Total cost = Rs. 30.40 crore Project and cost have been approved. No additional funding is required.
Microbial Diversity				

[117] https://pib.gov.in/PressReleasePage.aspx?PRID=1575277
[118] https://pib.gov.in/PressReleasePage.aspx?PRID=1575277

S. No.	Action Points	Targets	Relevant Scheme	Funding Gaps and Remarks
1.	Establish Microbial Germplasm Bank (MGB) in the state.	One gene bank No gene bank for microbial diversity yet in the State.	National Mission on Himalayan Studies	Total Cost = Rs. 69,61,760 Funds need to be allocated by the State.
2.	Facilitate availability of endosymbionts to farmers for biological nitrogen fixation such as Rhizobium	Target: 9.55 lakh hectare.[119]	Integrated Nutrient Management Scheme	@highest cost norm total cost for 9.55 lakh ha is Rs. 119.37 crore.
Education, Awareness and Training				
1.	Prepare short films and documentaries on ecological wealth as well as the conservation challenges of HP such as threats posed on endangered species with their local names & pictures in films for wider circulation	One documentary on the lines of the documentary produced in Karnataka.		Yearly budget – Rs. 50 lakh State needs to allocate funds for this purpose.
2.	Promote stories in print media, comic strips that revolve around biodiversity and related issues such as weekly columns in local newspapers	Publicity in Print media – 75 numbers Publicity in electronic media – 20 numbers (This is the target set for spreading awareness related to forest fire)		Total Cost = Rs. 20.51 lakh State needs to allocate funds.
Total annual funding required				**Rs. 51.795 crore**

Source: Computed by Authors

[119] http://mospi.nic.in/sites/default/files/cocsso/2_HimachalPradesh.pdf

7.2 Mobilizing Conservation Finance

We suggest a combination of the following 4 different strategies for mobilisation of additional funds.

7.2.1 Leverage existing sources like MNREGA, CAMPA, and Agriculture and Horticulture Sector Schemes

There is a need to focus on mobilising resources through CAMPA, and other well-funded Sectoral schemes such as the MGNREGA, Parampragat Krishi Vikas Yojana, Rashtriya Krishi Vikas Yojana, National Agroforestry Program, KUSUM, and National Mission on Sustainable Agriculture -- for implementation of relevant SBSAP action points covered under these schemes and programs. This will require the relevant departments to pro-actively identify, plan, and prioritise their activities accordingly so that the allocations made to their respective departments are fully and efficiently utilised in a systematic manner. In other words, the departments will need to augment their execution and thus absorption capacity. To facilitate this process we recommend a formal institutional platform in the form of either an inter departmental group or an inter-ministerial group where an annual action plan and/or multi-year action plan for mainstreaming Action Points in SBSAP in programs of relevant departments.

Analysis in Chapter 5 clearly brings out that the key interventions required for conservation of biodiversity such as: conservation of endangered species, afforestation, management of protected areas, and conservation of ecosystems like wetlands, river rejuvenation; budgetary finance is the primary sources of funding in India. The BER analysis shows that in HP, biodiversity relevant expenditure has increased from Rs. 159.33 crore in 2011-12 to Rs. 457.35 crore in 2016-17 and is projected to increase to Rs. 741.87 crore in 2020-21. The detailed analysis shows that while some aspects of conservation have received the required policy and programmatic focus along with adequate funding, in some areas increase in both the policy focus and funding is necessary. For instance, while a significant share (over 31-68%) of the total biodiversity attributable expenditure is on 'protection' of biodiversity in the state; expenditure on restoration has been low (3.16-5.17%) especially when compared with restoration needs in the state. This calls for a greater policy focus and additional funding on restoration. Similarly, additional funding will be required in other key areas such as management of HWC, livelihood support, adequate compensation of farmers as an incentive for wild biodiversity conservation, training and awareness etc.

7.2.2 Levy a Charge on Identified Sectors

Tourism department, and tourism activities by Forest department, and private sector tourism activities benefit from the presence and enhancement of biodiversity. We propose that a 'biodiversity cess' at 10 percent on revenues from the tourism activities (irrespective of the department involved) be charged and be transferred to the 'Environment Fund' of Himachal Pradesh (Annexure 5).

Table 7.2: Economic Instruments Levied Across Economic Sectors in Himachal Pradesh

Sector	Economic Instruments
Tourism	Fees: • Environmental Fees (Green Fees (Shimla), Green Tax (Bir Billing), Congestion Charges (Gulaba Bridge)) • Registration of Tourist Trade and Homestays

Sector	Economic Instruments
	• Environmental Fees Permits: • Rohtang Pass
Forestry and Wildlife	• Royalty • Transit Fees • Entry Fees • Fees collected for the purpose of issue of certificates for purposes defined by the forest department. • CAMPA fund • Fines and Penalties

Source: Compiled by Authors

Mining and Hydro power operations inflict negative stress on biodiversity. A number of charges are levied on these two sectors which go the general budget or collected in a special fund. For instance, in the case of Mining sector besides royalty and other levies, there is a 'District Mineral Fund'. Similarly, from Hydro power sector besides the royalty and other charges there is a 'Local Area Development Fund'. We propose, that 50 percent of the annual accruals in these funds be charged as 'biodiversity cess' and be transferred to the 'Environment Fund' of Himachal Pradesh.

Table 7.3: Economic Sectors for Mainstreaming Biodiversity

Sector	Economic Instruments
Mining	• Royalty • Permit Fees • Surface Rent • Dead Rent • Penalties • District Mineral Foundation
Hydropower	• Royalty • Sale of power • Local Area Development Fund

Source: Compiled by Authors

7.2.3 Augment Environment Fund, Local Trust Fund through Rationalising user charges, Environment Tax/Cess, CSR

PAs: The funding support to PAs is often limited with the exception of tiger reserves, leading to a resource crunch in the other PAs (NBA, 2019). To finance the funding gap, the Government of Himachal Pradesh needs to utilise the entry fees of PAs as has been done in Sikkim. The Government of Sikkim has already developed a 'Local Trust Fund' for each PA in the state which is serviced by the entry fee of PAs —70 percent of the proceeds go to EDCs and 30 percent are retained by the Department of Forest and Environment for the management of the PAs.

The Government of Himachal Pradesh should consider establishing a Local Trust Fund in addition to revising and rationalizing the entry fee commensurate with the demand for the PA and the pristine nature and services it offers. The state should also consider and levy a conservation cess on tourism activities in 4-5 sq. km. area around PAs for augmenting the receipts of Local Trust Fund.

CSR: The potential of CSR expenditure on biodiversity is estimated at Rs. 718.44 crore (Pandey et al, 2020) for India. The same study shows that in India currently 2.64 percent of total CSR is being spent on biodiversity. The reasons for low CSR investment towards biodiversity are twofold—biodiversity is a complex multidisciplinary subject and that the projects in this sector are of long gestation and often with intangible results and benefits. In order to overcome this, at least partially, there is a need for SBB to develop a pipeline of projects in priority areas of biodiversity in Himachal Pradesh. SBB should develop collaboration with the India Business and Biodiversity Initiative (IBBI) for guidance and technical help.

7.2.4 Focussed Efforts for Realising the full Potential of ABS

ABS is a highly underutilised tool in Himachal Pradesh. SBB should conduct a detailed study on the potential of ABS in the state and the challenges in implementation of ABS. Also prepare a detailed action plan on ABS with the help of policy and planning support from technical agencies.

The ABS provisions of the Convention on Biological Diversity (CBD) are designed to ensure that the physical access to genetic resources is facilitated and that the benefits obtained from their use are shared equitably with the providers. In some cases, this also includes valuable traditional knowledge associated with genetic resources that comes from indigenous and local communities.

ABS is an important tool for raising conservation funds at the same time ensuring its equitable distribution. It is based on the principle that the proceeds from commercialization of biological resources should contribute to conservation of the resources that are monetized, and for bridging the gap between users and providers/conservers of biological resources. Of all the funds accrued by the NBA from ABS, five per cent is to be used by the NBA; of which 50 percent is to be passed on to the concerned SBB for administrative charges[120]. The remaining ninety five percent of ABS amounts are to be disbursed to the concerned BMC(s) and/ or benefit claimers[121]. If the benefit claimers are not identified, the funds accrued are to be used to support conservation and sustainable use of biological resources and to promote livelihoods of the local people from where the biological resources are accessed. Similarly, when the SBB grants the approvals directly under the ABS Guidelines, it can retain 5 percent of ABS fees towards administrative charges and the remaining 95 percent is to be passed on to the relevant BMC or to the benefit claimers directly[122].

7.2.5 Carbon Credits

Carbon credits create a market for reducing greenhouse emissions by giving a monetary value to the cost of polluting the air. The mechanism of carbon credit trading was formalised in Kyoto Protocol, which is an international agreement among more than 170 countries. Under the

[120] Regulation 15 (1) (a) of the ABS Guidelines, 2014
[121] Regulation 15 (1) (b) of the ABS Guidelines, 2014
[122] Regulation 15 (1) Proviso of the ABS Guidelines, 2014

Protocol, all the developed countries are assigned a quota or cap for greenhouse gases known as '**Assigned amounts**'. The countries that are not able to use up their quota are allowed to sell it to the country who has outrun its quota of emissions, thus rewarding the country that has reduced its emissions and thus, has unused quota left (UNFCCC, 2008). In India, there are precedents where civic bodies or PSUs have generated revenue using carbon credits. The most recent example is that of Indore Municipal Corporation, which has generated a revenue of Rs. 50 lakhs by trading 1.70 million tonne of CO2 under Verified Carbon Standard (VCS) Programme of UNFCCC. The civic body had registered three of its projects – a 6oo tonnes-a-day compost plant, a bio methanation plant of 35 35 Tons per Day (TPD) capacity and a 1.5 MW solar plant under the Verified Carbon Standard Programme. These projects reduced carbon emissions by over 1.70 lakh tonnes (PTI, 2020). In past, Delhi Metro Rail Corporation (DMRC) has benefitted from sale of carbon credits. In fact, Delhi Metro is the world's first railway network to earn carbon credits from UNFCCC. In 2011, the United Nations body administering the clean development mechanism under the Kyoto Protocol had certified that Delhi Metro has reduced emissions which earned DMRC carbon credits. The sale of these carbon credits has fetched DMRC a revenue of Rs. 2.41 crore (PTI, 2011).

The Kyoto Protocol focuses on soil conservation by identifying the sequestration of carbon in soil as a global environmental benefit that is eligible for payments under the carbon credit mechanism (Dumanski, J., 2004). NITI Aayog, in its virtual high-level round-table on 'Agroecology and Regenerative Agriculture' stressed that India can have access to carbon credits worth USD 50-60 billion if it propagates natural farming and agroecology.

Taking lessons from these experiences, HP can explore the option of registering its environment friendly programmes and initiatives under VCS and generating revenue through the carbon credits earned. Following are some recommended programs that can be considered:

- Natural Faarming in Pangi
- Restoration of degraded landscape
- Initiative to address the issue of invasive species
- Electric vehicles for public transport; like electric cars for taxis, or electric buses (as has been already been done in the State).

7.3 Other Sources

7.3.1 Payment for Ecosystem Services (PES)

The basic idea behind PES is that those who provide ecosystem services – like any service – should be paid for doing so. The 'business-like' conditional payment form is what differs PES from traditional conservation mechanisms and therefore provides an opportunity to put a price on previously un-priced ecosystem services (ES) like climate regulation, water quality regulation and the provision of habitat for wildlife and, in doing so, brings them into the wider economy. International donors, impact investment funds, private donors are potential funders of PES programs.

In order to protect and manage natural resources in the state for sustained production of ES as well as to generate additional economic incentives to the communities, Government of Himachal Pradesh formed 'Policy to institutionalize Payments for Ecosystem Services' in 2013. The policy has outlined the following objectives:

- To provide sustained flow of ES
- To facilitate interface mechanism between ES generators and user
- Incentivize ES generators for ecosystem conservation for incremental and continued flows of ecosystem services

The ecosystem services which are eligible for payments under the policy includes: soil erosion control, sediment load reduction, fire control, discharge in streams and springs especially potable water, carbon sequestration, rehabilitation of weed infested areas, organic and conservation agriculture, conservation horticulture, pollination and biodiversity conservation. The following have been considered for identifying and quantifying ecosystem services: temporal and spatial scales at which the ES are produced, an understanding of the impact of land-cover and land-use patterns, soil conditions, hydrological cycles, etc., establish dynamic baseline levels of the supply of the ES, determine practical incremental steps – both preventive and restorative & assess gaps in current understanding and measurement.

The process to implement PES in the state includes not only identification of ES that needs to be incentivized but also identification of stakeholders, strengthening the role of local level community-institutions for mainstreaming eco-systems approach, as well as financial arrangements. Appropriate economic instruments, such as environment cess, green tax, voluntary payments, mitigation payments etc. will be explored for improving the financial basis of PES and creating a larger financial pool, while also attempting to reduce transaction costs and minimize overheads.

The policy also envisages regular monitoring of physical flow of ES as well as build capacity of various institutions at all level. For successful implementation of the policy, the state needs to resolve issues like absence of data and symmetric information and difficulty in monitoring the effectiveness of PES schemes.

7.3.2 Fintech: These instruments have the potential to increase the breadth and depth of conservation finance. Fintech reduce transaction cost and improve economic efficiency. The use of technology reduces the cost of transaction, credit investigation, resources matching and help overcome the scale issues. These work well at the retail level and bring overall efficiency. There are several success stories available around these. SBB should explore this in addressing man-animal conflicts.

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Annexure – 1

Table A1. 1: A Snapshot of Consultative Workshops and Meetings in HP

S. No.	Particulars	Date	Venue	Participation (Forest Department)	Line Departments/Other Organisations
1	Roundtable meeting	14th December, 2018	Vigyan Bhawan, Bemloe	DFO (hqrs.)	HP State Biodiversity Board Department of Animal Husbandry, Department of Agriculture, Department of Horticulture, Himalayan Forest Research Institute
2	Small group meeting	14th December, 2018	Himachal Pradesh Forest Department, Talland, Shimla	PCCF (WL) DFO (hqrs.) UNDP representative of PMU	
3	Questionnaires sent to line departments	April-May 2019	Email, fax and post mail	Secretary, Principal Secretary	Department of Horticulture, Department of Agriculture, Department of Forest, Department of Health and Family Welfare, Department of Irrigation, Department of Rural Development, Department of Tribal Development, Department of Urban Development, Department of Tourism, HP State Biodiversity Board, Department of Animal Husbandry, Police, Department of Education, Directorate for empowerment of SCs, OBCs, Minorities Affairs and Specially Abled
4	Several follow ups on questionnaires sent to line departments via email, telephonic conversations	May-July 2019	Telephone and email	Secretary, Principal Secretary	
5	Second round of follow up on questionnaires	August 2019	Telephone and email	Secretary, Principal Secretary	
6	One-to-one and small group meetings and consultations				
6.1	One- to One consultations and meetings with Department Officials	16th May 2019	Himachal Pradesh Forest Department, Talland, Shimla	APCCF-cum-CPD	Department of Forest, Environment and Wildlife Management
			HP State Biodiversity Board, Vigyan Bhawan, Bemloe	Group Meeting Senior Scientific Officer, State Project Coordinator, Senior Scientific Professional	HP SBB
			Udyog Bhawan, HP	Section Officer, Additional Secretary	Department of Irrigation and Public Health

S. No.	Particulars	Date	Venue	Participation (Forest Department)	Line Departments/Other Organisations
			Udyog Bhawan, HP	Principal Secretary	Department of Agriculture
			Udyog Bhawan, HP	Principal Secretary, Deputy Director	Department of Tribal Development
			Udyog Bhawan, HP	Additional Chief Secretary	Department of Rural Management and Development
7	Consultation workshop	25th September 2019	Library Conference Hall, Kilar	**53 Participants** RO Kilar, Forest Guards	BMCs, Department of Animal Husbandry, Tribes Advisory Council, Representatives from local bodies like Panchayat, Mahila Mandal, Praja
8	One-to-one and small group meetings and consultations				
8.1	One- to One consultations and meetings with Department Officials	24th September	Library Hall, Pangi	Range officer, Pangi	
8.2	One- to One consultations and meetings with Department Officials	24th September	Library Hall, Pangi	BMC Chairperson, Mindhal	
8.3	One- to One consultations and meetings with Department Officials	26th September	Agriculture Department, Pangi	Agriculture Development Officer, Kilar	
8.4	One- to One consultations and meetings with Department Officials	26th September	BDO Office, Pangi	Block Development Officer, Kilar	
8.5	One- to One consultations and meetings with Department Officials	26th September	BDO Office, Pangi	Panchayat Pradhan, Pangi	
8.6	One- to One consultations and meetings with	26th September	BDO Office, Pangi	Panchayat Pradhan, Karyas	

S. No.	Particulars	Date	Venue	Participation (Forest Department)	Line Departments/Other Organisations
	Department Officials				
8.7	One- to One consultations and meetings with Department Officials	26th September	Tehsildar Office	Naib Tehsildar, Kilar	
8.8	One- to One consultations and meetings with Department Officials	26th September	Pangi	Panchayat Pradhan, Lujh	
8.9	One- to One consultations and meetings with Department Officials	26th September	Pangi	Pradhan, Mahila Mandal, Pangi	

Table A1. 2: List of Participants in Consultative workshop in Kilar, Pangi

S.no.	Name of the participant	Organization/Department	Designation	Contact Details
1.	Suneel Kumar	H.P. Forest Department	Forest Guard	8988538838
2.	Rajinder Kumar	H.P. Forest Department	Forest Guard	8988796515
3.	Neeraj Kumar	H.P. Forest Department	Forest Guard	9418781088
4.	Vimla	Mahila Mandal	Pradhan	9459516742
5.	Suresh Kumar	H.P. Forest Department	Forest Guard	7649952602
6.	Bhoopesh Thakur	WII	JRF	8219317989
7.	Himanshu Burgali	WII	JRF	9627878981
8.	Shiv Yadav	WII	JRF	8090939937
9.	Amit Mehta	UNDP	UNV-L	9816620513
10.	Tej Singh	H.P. Forest Department	Forest Guard	9418743379
11.	Man Singh	H.P. Forest Department	Forest Guard	8988520089
12.	Diwan Chand	H.P. Forest Department	Peon	
13.	Bimla Sharma	Gram Panchayat Hudan	Pradhan	9459233747
14.	Sunita Sharma	Gram PanchayatKilar	Pradhan	9459934205
15.	Sarita Sharma	A.P. GDC Pangi		9459040105

S.no.	Name of the participant	Organization/Department	Designation	Contact Details
16.	Meghma Ghosh	WII	Junior Project Biologist	7044910363
17.	Bhawna Pandey	WII	Senior Project Biologist	8979738898
18.	Himanshu Bargali	WII	Junior Project Biologist	9627878981
19.	Manisha Mathela	WII	Junior Project Biologist	8630660034
20.	Manika Sharma	WII	Junior Project Biologist	9455170070
21.	Nidhi Singh	WII	Junior Project Biologist	8004261042
22.	Inder Prakash	BMC Mindal	Chairman	9418718325
23.	Sonu	Office of BDO Pangi	LVDC	
24.	Hari Ram Sharma	Agriculture Department	Senior Officer	9459086940
25.	Bhag Singh	Gram Panchayat Sechu	Up Pradhan	9418639609
26.	Pan Devi	Mahila Mandal Kilar	Secretary	
27.	Sunam Devi	Mahila Mandal Sach		9418239311
28.	Sheela	Mahila Mandal Kilar		8988325811
29.	Raj Kumari	Gram Panchayat Luj		
30.	M.K. Thaplial	Forest Department	Range Officer Kilar	9459856140
31.	Turup Chand	TAC		9418884383
32.	Dr. Sanjeev Rana	Animal Husbandry Dept.	Senior Veterinary Officer	
33.	Prem Singh	Forest Department	B.O.B	9418462491
34.	Suji Ram	Agriculture Department	V.P.O Karyas	9459222724
35.	Sony	Kilar, Pangi	Local	7292243229
36.	Gian Chand	Hudan Bhatori, Pangi	Local	
37.	Sham Lal	Office of BDO Kilar	JE	9418960184
38.	Hans Raj	Gram Panchayat Luj	Up Pradhan	9418593053
39.	Meena Kumari	Sach, Pangi	Local	9418756604
40.	Dhani Ram	Kulal, Pangi	Thekedar	9459823594
41.	Tem Chand	Gram Panchayat	Farmer	9459986889
42.	Shanta Kumar Sharma	Gram Panchayat	Up Pradhan	9418553545
43.	Dev Raj Sharma	Murch, Pangi	Farmer	9459438618
44.	Chatter Singh	Mahaliyat, Pangi	Farmer	9418550219
45.	Hari Singh	Jhalwas, Pangi	Farmer	9459068429
46.	Sanjay Pradhan	WII		7895019702

S.no.	Name of the participant	Organization/Department	Designation	Contact Details
47.	Tej Singh	Forest Department	Forest Guard	9418743879
48.	Man Singh	Forest Department	Forest Guard	8988520089
49.	Abhishek Kumar	UNDP	Project Associate	9548562281
50.	Dr. Amit Kumar	WII	Scientist	9012701262
51.	Er. Arun Bhardwaj	Himurja	Project Officer	8988903603
52.	Er. Yatin Sharma	HPPWD	Motor Vehicle Inspector	
53.	Ram	Karyuni, Pangi	Local	9418255703

Annexure - 2

Table A2. 1: Threatened Medicinal and Aromatic plants in Himachal Pradesh[123]

S.No.	Scientific Name
Medicinal Plants	
1.	Aconitum deinorrhizum Stapf
2.	Aconitum heterophyllum
3.	Aconitum laeve Royle
4.	Aconitum violaceum Jacquem ex Stapf
5.	Allium consanguineum Kunth
6.	Angelica glauca Edgew.
7.	Arnebia benthamii (Wall. Ex G.Don) I. M. Johnst
8.	Arnebia euchroma (Royle)
9.	Atropa acuminate Royale ex. Lindl.
10.	Berberis aristata DC.
11.	Betula utilis D.Don
12.	Bunium persicum B. Fedtsch
13.	Cinnamomum tamala (Buch.-Ham.) T. Nees & Nees
14.	Colchicum luteum Baker
15.	Dactylorhiza hatagirea D. Don
16.	Desmodium gangeticum (L.) DC.
17.	Didymocarpus pedicellata R.Br.
18.	Dioscorea deltoidea Wall. ex Griseb.
19.	Ephedra gerardiana Wall. ex Stapf
20.	Fritillaria royalei Hook.
21.	Gentiana kurroo Royale
22.	Habenaria edgeworthii Hook. f. ec. Collett

[123] https://hpforest.nic.in/files/ANNEXURE%20-%20I.pdf

S.No.	Scientific Name
23.	Habenaria intermedia D. Don
24.	Hyoscyamus niger L.
25.	Hypericum perforatum L.
26.	Hyssopus officinalis L.
27.	Juniperus communis L.
28.	Jurinea dolomiaea Boiss
29.	Lilium Polyphyllum D. Don
30.	Litsea glutinosa (Lour.) C. B. Rob.
31.	Malaxis muscifera (Lindl.) Kuntze
32.	Malaxis acuminata D. Don
33.	Nardostachys grandiflora DC
34.	Onosma hispidum Wall. ex G. Don
35.	Oroxylum indicum (L.) Kurz
36.	Paeonia emodi Wall. ex Royle
37.	Paris polyphylla Sm.
38.	Picrorhiza kurroa Royle ex Benth.
39.	Podophyllum hexandrum Royle
40.	Polygonatum cirrhifolium (Wall.) Royle
41.	Polygonatum multiflorum (L.) All
42.	Polygonatum verticillatum (L.) All.
43.	Rheum australe D. Don
44.	Rheum moorcroftianum Royle
45.	Rheum spiciforme Royle
46.	Rheum webbianum Royle
47.	Roscoea alpina Royle
48.	Roscoea procera Wall.
49.	Saussurea obvallata (DC.) Edgew.
50.	Selinum connifolium
51.	Selinum vaginatum (Edgew.) C. B. Clarke
52.	Skimmia laureola (DC.) Siebold & Zucc. ex Walp

S.No.	Scientific Name
53.	Symplocos paniculata (Thunb.) Miq.
54.	Swertia chirayita (Roxb, ex Fleming) Karsten
55.	Taxus wallichiana Zucc.
56.	Uraria picta (Jacquin) Desvaux ex DC.
57.	Trillium govanianum Wall. Ex D. Don

Source: Himachal Pradesh Forest Department

Table A2. 2: Threatened Species of Animals Notified by the Himachal Pradesh State Biodiversity Board[124]

S. No.	Scientific Name	Common Name	Family
1.	Aquila nipalensis Hodgson	Steppe eagle	Accipitridae
2.	Canis lupus chanco	Tibetan wolf	Canidae
3.	Capricornis thar hodgson	Himalayan serow	Bovidae
4.	Catreus wallichii Hardwicke	Chir pheasant	Phasiandae
5.	Gypaetus barbatus Linnaeus	Bearded vulture	Accipitridae
6.	Gyps bengalensis Gmelin	White rumped vulture	Accipitridae
7.	Gyps tenuirostris Gray	Slender billed vulture	Accipitridae
8.	Hemitragus jemlahicus C.H. Smith	Himalayan Tahr	Bovidae
9.	Moschus chrysogaster Hodgson	Himalayan Musk deer	Moschidae
10.	Parnassius charltonius Gray	Regal apollo	Papilionidae
11.	Parnassius imperator augustus Oberthur	Snow Apollo/Imperial apollo	Papilionidae
12.	Polypedates maculatus Gray	Himalayan tree frog/ Indian tree frog	Rhacophoridae
13.	Pucrasia macrolopha Lesson	Koklass pheasant	Phasianidae
14.	Sarcogyps calvus Scopoli	Red headed vulture	Accipitridae

[124] http://www.hpbiodiversity.gov.in/BMC/Proceeding%20Threatened%20Animal.pdf

S. No.	Scientific Name	Common Name	Family
15.	Tragopan melanocephalus Gray	Western tragopan/Jujurana	Phasianidae
16.	Uncia Schreber	Snow leopard	Felidae

Source: Himachal Pradesh State Biodiversity Board

Table A2. 3: Forest cover across districts of Himachal Pradesh

District	Geographical Area (GA)	2019 Assessment				% of GA
		Very Dense Forest	Mod. Dense Forest	Open Forest	Total	
Bilaspur	1,167	21.70	190.72	168.28	380.70	32.62
Chamba	6,522	767.89	1012.51	674.76	2455.16	37.64
Hamirpur	1,118	38.91	102.84	213.15	354.90	31.74
Kangra	5,739	298.76	1288.65	766.78	2354.19	41.02
Kinnaur	6,401	79.81	329.28	236.90	645.99	10.09
Kullu	5,503	586.08	879.25	510.96	1976.29	35.91
Lahaul &Spiti	13,841	15	30.87	114.48	160.35	1.16
Mandi	3,950	368.51	756.98	647.53	1773.02	44.89
Shimla	5,131	745.74	1090.30	583.37	2419.41	47.14
Sirmaur	2,825	130.22	689.96	570.69	1390.87	49.23
Solan	1,936	41.44	444.54	404.31	890.29	45.99
Una	1,540	18.65	310.03	303.67	632.35	41.06
Total	55,673	3112.71	7125.93	5194.88	15433.52	27.72

Source: State of Forest Report 2019, Forest Survey of India

Table A2. 4: Classification of forests in Himachal Pradesh

Forest Type	Altitude and other Features	Important Tree Species
Tropical Dry Deciduous	Occupy the area having altitude up to 1000 m above mean sea level. Rainfall varies from 75 to 125 cm/annum.	Shorea robusta, Acacia catechu, Anogeissus latifolia, Boswellia serrata, Lanea coromandelica, Aegle marmelos, Mallotus philipinensis
Tropical Thorn		Prosopis spicigera, Salvadora spp., Azadirachta indica
Sub-tropical Pine	Occupy area between altitudes of 1000 m to 1800 m above sea level. Rainfall varies from 90 to 250 cm/annum.	Pinus roxburghii, Cedrus deodara, Pinus wallichiana, Quercus incana, Lyonia ovalifolia, Pyrus pashia, Cartaegus crenulata, Rhododendron arboreum

Sub-tropical Dry Evergreen	Extend up to an altitude of 1000 m above mean sea level. Rainfall varies from 50 to 100 cm/annum.	Olea cuspidate, Pinus roxburghii
Himalayan Moist Temperate	Between the altitude of 1500 to 3300 m.	Quercus incana, Cedrus deodara, Pinus wallichiana, Pinus roxburghii, Rhododendron arboretum, Lyonia ovalifolia, Litsia umbrosa, Quercus dilatata, Q. semicarpifolia, Picea smithiana, Abies pindrow
Sub-Alpine and Alpine	Between the altitude of 2,900 m and 3500 m. Snowfall is a regular feature.	Abies spectabilis, Pinus wallichiana, Picea smithiana, Rhododendron companulatum, Taxus baccata

Source: State of Environment Report 2009, Himachal Pradesh

Table A2. 5: Crop Diversity in Himachal Pradesh

Crop species	English name	Local name in H.P.
Allium cepa	Onion	Pyaz
Amaranthus hypocondriacus	Amaranth	Chaulai
A. caudatus	Amaranth	Chuwa/Marcha/ramdana
A.cruentus	Amaranth	Chaulai
Avena sativa	Oat	Jai
Brassica compestris	Rape	Toria
Brassica juncea	Indian Mustard	Sarson
Cajanus cajan	Pigeon Pea	Tur
Canabis sativa	Hemp	Bhang Beej
Chenopodium album	Pig-weed, Goose foot	Bethu, Bathu
Glycine max	Soybean	Bhatt
Colocasia asculenta	Taro, Dasheen	Pindalu, Kuchain, Kachalu
Echinochloa frumentasea	Barnyard millet	Jhangora
Elusine coracana	Finger millet	Koda
Fagopyrum esculentum	Buck Wheat	Oggal
Fagopyrum tataricum	Buck wheat	Phapher
Hibiscus cannabinus	Kenaf, Jute	Buili
Hordeum himalayens	Nacked bariey	O-wa-jau
Hordeum vulgare	Barley	Jau
Lens esculenta	Lentil	Masoor
Macrotyloma uniflorum	Horsegram	Gahat, Kultha
Oryza sativa	Paddy	Chawal, Dhan
Panicum millacuem	Hog-millet	Cheena/Bhangna
Penila frutescene	Perilia	Bhangjeera
Phaseolus vulgaris	Kidney bean	Rajmah

Crop species	English name	Local name in H.P.
Pisum sativum	Pea	Matar, Dal Matar
Sesamum indicum	Sesame	Til
Setaria italica	Foxtail millet	Kauni, Kangni
Solamum tuberosum	Potato	Aloo
Sorghum vulgare	Pearl millet	Junyail, Jawar
Triticum aestivum	Wheat	Gehun
Vigna aconitifolia	Mat bean	Bhringa, Moth
V. angularis	Adjuki bean	Rains, Riuns
Phaeseoius mungo	Black gram	Urad, Mah
P. radiata	Green gram	Mung
V. umbellata	Rice bean	Bhotia
Zea mays	Maize	Mungri, Makki, Kukdi
Zingiber officinate	Ginger	Adrak

Source: State of Environment Report, Himachal Pradesh, 2009

Table A2. 6: Crop Production of major food crops (2010-11 to 2018-19)

Item	Unit	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Food grains:							
A. Cereals:	'000						
1. Wheat	M.T	614.89	629.09	671.94	685.45	648.29	667.62
2. Maize	,,	670.90	715.42	657.16	678.25	735.96	737.65
3. Rice	,,	128.92	131.63	125.28	128.49	127.38	129.88
4. Barley	,,	32.17	31.46	34.83	35.18	36.70	34.33
5. Ragi	,,	2.11	2.80	2.50	1.97	1.91	1.93
6. Small Millets	,,	3.28	3.31	3.55	3.60	3.39	3.09
Total Cereals	,,	1452.27	1513.71	1495.26	1525.94	1553.63	1574.50
	,,						
B. Pulses:							
1. Gram	,,	0.60	0.66	0.49	0.40	0.38	0.38
2. Other Pulses	,,	40.99	30.12	45.58	51.80	53.88	59.17
Total Pulses	,,	41.59	30.78	46.07	52.20	54.26	59.55
Total Food grains	,,	1493.86	1544.49	1541.33	1585.14	1607.89	1634.05
Potato	,,	205.97	152.98	182.87	205.28	181.38	183.25
Vegetables	,,	1268.90	1356.60	1398.05	1465.96	1576.45	1608.55
Ginger	,,	1.56	1.53	1.69	1.84	16.50	32.33

Contd….

Item	Unit	2015-16	2016-17	2017-18 (3rd Estimate)*	2018-19 (Target)*
Food grains:					
A. Cereals:	'000				
1. Wheat	M.T	667.62	605.18	670.00	690.00
2. Maize	,,	737.65	736.46	644.44	742.00
3. Rice	,,	129.88	135.48	117.80	132.00
4. Barley	,,	34.33	28.66	36.00	36.00
5. Ragi	,,	1.93	1.60	1.48	2.10
6. Small Millets	,,	3.09	4.80	3.70	3.70
Total Cereals	,,	1574.50	1512.18	1473.42	1605.80
	,,				
B. Pulses:					
1. Gram	,,	0.38	0.41	0.45	0.45
2. Other Pulses	,,	59.17	50.14	57.00	62.50
Total Pulses	,,	59.55	50.55	57.45	62.95
Total Food grains	,,	1634.05	1562.73	1530.87	1668.75
Potato	,,	183.25	195.84	198.66	195.00
Vegetables	,,	1608.55	1653.51	1691.56	1650.00
Ginger	,,	32.33	35.39	33.70	35.00

Source: Compiled by NIPFP

*3rd estimates for the year 2017-18 and targets for the year 2018-19 have been taken to prepare the table from Economic Survey, Himachal Pradesh 2018-19.

Table A2. 7: Monsoon season rainfall (June-September, 2018)[125]:

District	Actual	Normal*	Excess or Deficient**	
	(mm)	(mm)	Total (mm)	%
Bilaspur	1211	877	334	38
Chamba	873	1406	534	(-) 38
Hamirpur	1388	1079	309	29
Kangra	2123	1582	541	34
Kinnaur	180	264	(-) 84	(-) 32
Kullu	776	520	256	49
Lahaul & Spiti	263	458	(-) 195	(-) 43
Mandi	1353	1093	20	24
Shimla	807	634	173	27
Sirmaur	1320	1325	(-) 5	0
Solan	1111	1000	111	11
Una	1375	863	512	59
Average	**917**	**825**	**92**	**11**

[125] http://himachalservices.nic.in/economics/pdf/EconSurveyEng2018-19.pdf

Source: Economic Survey, Himachal Pradesh

*Normal = -19% to +19%, Excess = 20% and above, Deficiency = -20% to -59% and Scanty = -60% to -59%

Table A2. 8: Post Monsoon Seasons Rainfall Data (October-December, 2018)[126]

District	Actual (mm)	Normal (mm)	Excess or Deficient	
			Total (mm)	%
Bilaspur	40	70	(-) 30	(-) 43
Chamba	88	127	(-) 39	(-) 31
Hamirpur	34	86	(-) 52	(-) 61
Kangra	40	105	(-) 64	(-) 61
Kinnaur	49	102	(-) 53	(-) 52
Kullu	110	98	12	12
Lahaul & Spiti	61	144	(-) 82	(-)57
Mandi	50	81	(-) 30	(-) 38
Shimla	52	75	(-) 23	(-) 31
Sirmaur	35	87	(-) 52	(-) 60
Solan	48	89	(-) 41	(-)46
Una	19	72	(-) 52	(-) 73
Average	**56**	**108**	**(-) 52**	**(-) 48**

Source: Economic Survey, Himachal Pradesh

*Normal = -19% to +19%, Excess = 20% and above, Deficiency = -20% to -59% and Scanty = -60% to -59%

Table A2. 9: Consumption of fertilizers (in M.T.):

Year	Kharif (N+P+K)	Rabi (N+P+K)	Total (N+P+K)
2010-11	19811	35322	55133
2011-12	21332	30151	51483
2012-13	19846	27818	47664
2013-14	20486	29673	50160
2014-15	19388	33667	53055
2015-16	23742	33838	57580
2016-17	22063	34428	53055
2017-18	21156	36404	57560

Source: Economic Survey, Himachal Pradesh (2018-19)

[126] http://himachalservices.nic.in/economics/pdf/EconSurveyEng2018-19.pdf

Table A2. 10: Species of honey bees in Himachal Pradesh

Honeybee Species	Remarks
Apis melifera	(Italian honeybee): Sub-Temperate and Sub-tropical zone; produces 3 times more honey than A.cerana, foraging range is double than that of Naïve honeybee.
A.cerana indica	(Indian honeybee); temperate zone; attacked by mites; kept in wall (fixed type) hives or movable hallowed out logs, wooden boxes, earthen pots, etc. Crude and indigenous method of honey collection from these traditional hives.
A.dorseta	(Wild honeybee in HP); makes single combs; hiney harvested fro wild hives by professional honey hunters.
A.florea	-do-

Source: Himachal Pradesh State Biodiversity Strategy and Action Plan (2002)

Table A2. 11: District-Wise Livestock in Himachal Pradesh[127]

District	Cattle			Buffaloes	Yak	Mithun
	Crossbred	Indigenous	Total			
Bilaspur	26170	21722	47892	100586	0	0
Chamba	50746	262448	313194	32465	643	73
Hamirpur	23402	3856	27258	108083	311	38
Kangra	222247	136882	359129	149719	54	4
Kinnaur	11971	9586	21557	0	225	72
Kullu	95372	79339	174711	720	39	535
Lahaul & Spiti	7969	5228	13197	3	1267	0
Mandi	223403	216364	439767	69320	236	137
Shimla	145223	131560	276783	9189	13	28
Sirmaur	66860	212265	279125	42907	7	9
Solan	71123	73927	145050	79937	63	10
Una	39442	12154	51596	123087	63	12
Total	983928	1165331	2149259	716016	2921	918

Contd…

District	Sheep			Goat	Horse and Ponies	Mule
	Crossbred	Indigenous	Total			
Bilaspur	1154	269	1423	59244	101	773
Chamba	13345	241584	254929	204511	1596	5418

[127] http://hpagrisnet.gov.in/Agrisnet/AnimalHusbandry/pdf%20files/19th%20Livestock%20Census-2012.pdf

Hamirpur	4740	4235	8975	24722	207	834
Kangra	49817	34811	84628	202694	3781	4068
Kinnaur	32461	34146	66607	33229	582	620
Kullu	82498	41195	123693	68946	2143	855
Lahaul & Spiti	19191	16823	36014	8196	1028	14
Mandi	36828	77125	113953	195465	2278	5114
Shimla	61425	40149	101574	103089	1959	2786
Sirmaur	3077	8236	11313	144722	862	1782
Solan	644	1057	1701	61104	277	982
Una	11	50	61	13569	267	69
Total	305191	499680	804871	1119491	15081	23315

Contd…

District	Donkey	Camel	Pig			Total
			Crossbred	Indigenous	Total	
Bilaspur	186	0	59	175	234	210439
Chamba	279	10	411	703	1114	814232
Hamirpur	245	0	170	58	228	170901
Kangra	390	16	205	432	637	805120
Kinnaur	2918	12	0	35	35	125857
Kullu	40	0	52	0	52	371734
Lahaul & Spiti	1803	50	3	3	6	61578
Mandi	183	13	238	330	568	827034
Shimla	747	16	202	343	545	496729
Sirmaur	285	46	398	816	1214	482272
Solan	182	2	122	183	305	289613
Una	91	12	83	12	95	188922
Total	7349	177	1943	3090	5033	4844431

District	Poultry		
	Backyard	Hatcheries/Farm	Total Poultry
Bilaspur	21143	74874	96017
Chamba	43576	3500	47076
Hamirpur	10492	32581	43073
Kangra	58419	307877	366296
Kinnaur	9149	241	9390
Kullu	13634	0	13634

Lahaul & Spiti	1854	172	2026
Mandi	36101	31254	67355
Shimla	27778	9000	36778
Sirmaur	10860	905567	101427
Solan	15451	232518	247969
Una	6041	67394	73435
Total	254498	849978	1104476

Source: Livestock Census (2012)

Table A2. 12: Government Poultry Farms/Extension Centres in Himachal Pradesh[128]

Name/Address of the Farm	Year of Opening of the Farm	Area of the Farm	Total Chick production
Poultry Farm, Jalgran, Distt. Una	1979	00-95-52 24 Kanal 12 Marla	Rearing centre only
Regional Poultry Farm, Kamlahi, Distt. Shimla	1956	54.6 bighas	Rearing centre only
Central Poultry Farm, (Hatchery) Nahan, Distt. Sirmour	1960	36 bighas	2,24,316
Poultry Farm, Chauntra, Distt. Mandi	1965	18-00-13 Hectare	Rearing centre only
Him Hatchery, Sundernagar, Distt. Mandi	1958	2503 sq. mts.	2,37,196
Poultry Farm, Palampur, Distt. Kangra	1958	10 kanal 13 marla	Rearing centre only
Poultry Extension Centre, Bhawarna, Distt. Kangra	1966	17 kanal 11 marla	Rearing centre only
Poultry Extension Centre, Reckong - Peo, Distt. Kinnaur	1962	02-80-69 Hectare (out of which 0-99-76 Hectare leased out to K.V. School)	Rearing centre only
Poultry Extension Centre, Sarol, Distt. Chamba	1958	2 acre	Rearing centre only
Poultry Extension Centre, Solan, Distt. Solan	1961	14.1 bighas	Rearing centre only
Poultry Extension Centre, Paonta-Sahib, Distt. Sirmour	1960	2.5 bighas	Rearing centre only

Source: Department of Animal Husbandry

Table A2. 13: Mahseer Major River Stretch in Himachal Pradesh

Name of river	Stretch	Stream length in kms.
Beas	Seri mulag-Confluence of Binwa to Beas	5

[128] http://hpagrisnet.gov.in/hpagris/AnimalHusbandry/Default.aspx?SiteID=3&PageID=286

Beas	Harsipattan-Confluence of Kunha tributary of Beas	10
Beas	Chambapattan	5
Beas	Kuran	5
Beas	Dehra Gopipur	10
Beas	Baner	5
Giri	Bata	

Source: Department of Fisheries, Himachal Pradesh

Table A2. 14: Trout Major River Stretch in Himachal Pradesh

Name of river	Stretch	Stream length in kms.
Beas	Katrain to Manali	18
Tirthan	Largi to Nagni	20
Sainj	Largi to Ropa	22
Lambadug	Barot to Lohardi	6
Uhl	Barot to Kothikhad	10
Ravi	Holi to Main bridge	5s

Source: Department of Fisheries, Himachal Pradesh

Table A2. 15: Recreational Fisheries Zone for Trout Water[129]

Name of river	Stretch	Stream length in kms.
Beas	Katrain to Manali	18
Tirthan	Largi to Nagni	20
Sainj	Largi to Ropa	22
Lambadug	Barot to Lohardi	6
Uhl	Barot to Kothikhad	10
Ravi	Holi to Main bridge	5

Source: HPBSAP, 2002

Table A2. 16: Recreational Fisheries Zone for Mahseer water[130]

Name of river	Stretch	Stream length in kms.
Beas	Seri mulag-Confluence of Binwa to Beas	5
Beas	Harsipattan-Confluence of Kunha tributary of Beas	10
Beas	Chambapattan	5
Beas	Kuran	5
Beas	Dehra Gopipur	10
Beas	Baner	5
Giri	Bata	

[129] https://himachal.nic.in/index1.php?lang=1&dpt_id=4&level=1&lid=168&sublinkid=146
[130] https://himachal.nic.in/index1.php?lang=1&dpt_id=4&level=1&lid=168&sublinkid=146

Source: HPBSAP, 2002

Table A3. 1: Sectoral Policy Analysis

Sector	Key Sectoral Drivers/Threats	Policy	Context	Objectives	Issues addressed	Recommendation in the policy	NBTs achieved	SDGs achieved
Forest	>Habitat loss/degradation >Forest Fire >Illicit felling >Animal-human conflict >Encroachment >Unscientific extraction of medicinal plants >Overgrazing	**Forest Sector Policy and Strategy 2005**	The policy has been implemented with an aim to identify forest as a "Sector" to encompass it's environmental and biophysical components	>To conserve natural resources through watershed management practices >To provide livelihood security to forest dependent communities >To focus on appropriate forest land use in the state >To review the policy regularly with changing circumstances and needs using best scientific information and management practices	>Various components of forestry such as classification of forests, rights and concessions on forest produce, afforestation, biodiversity conservation, forest-based industries, eco-tourism have been focused in the state level policy		Target 1, 3, 5	Target 8.9, 12.2, 15.2, 15.3, 15.4

		Policy on Development of Eco-tourism in H.P. 2005	State Government attempts to put in place adequate safeguards and systems for preservation of natural resources with tourist influx as well as bringing tourists closer to wilderness of the State	>To make the state a leading eco-tourism destination >To promote community-based eco-tourism (CBET) >To effectively regulate ecotourism activities in forest area >To generate resource through Special Purpose Vehicle via assets made available by Forest Department >To promote the concept of homestays in rural areas >To work in tandem with Rural Tourism Scheme of the Department of Tourism	Concentration of tourism activities to major hill stations like Shimla, Manali, Dharamshala and Dalhousie putting pressure on fragile ecosystem Employment opportunities to local communities Awareness for preserving environment	>Carrying capacity needs to be kept in mind while allowing for tourists >Management plans should establish standard for development, waste disposal, treatment of sewage and optimum use of fragile ecosystem >Environmental concerns should be a part Tourism Master Plans >A part of revenue generated should be ploughed back in restoring environment	Target 2	Target 1.4, 8.9, 17.14

		Himachal Pradesh Forestry Sector Medicinal Plants Policy 2006	The policy aims to look into the unregulated and exploitative nature of trade in medicinal plants which has caused threat to a number of plant species and has resulted in low remuneration to the local people despite the immense potential of this sector	>To develop a system of pricing the wild harvest reflecting both the conservation costs and community benefit >To put in place institutional mechanism for development of herbal sector in the state >To build network with other North-Western Himalayan states to push community-oriented trade >To maximize yield of medicinal plants through sustainable regeneration	Exploitation of medicinal plants for trade	>Recognition of Medicinal plant resources as important forest produce >Enabling institutional mechanism and legislation to develop this sector firmly >Germplasm of medicinal plant diversity needs to be conserved in its natural habitat	Target 2, 4, 5,7,	Target 12.2,15.4, 15.8

		Policy on Payment for Ecosystem Services (PES) in Himachal Pradesh	Due to anthropogenic pressure, there has been decline in the ecosystem services, adversely impacting lives of local communities. Therefore, incentive-based mechanism needs to be explored to promote sustainable livelihood	>To provide sustained flow of ecosystem services >To facilitate interface mechanism between ecosystem service generators and user >Incentivize ES generators for ecosystem conservation for incremental and continued flows of ecosystem services	Anthropogenic pressure on ecosystems	>Involving and incentivizing local communities to conserve ecosystem	Target 8	Target 6.4, 8.9, 15.4, 15.6
		Collection and Removal of Chil Pine needles from Forest land	The policy focuses on efficient utilization of Chil pine needles which are highly inflammable in nature	>To encourage stakeholders to work for removal of Chil Pine needles from the forest land in order to reduce fire hazards >To encourage industries to use Chil Pine needles as a fuel	Forest fire due to acidic and inflammable nature of Pine needles	>Local right holders shall be encouraged for collection of pine needles for bonafide use >Industries should be encouraged to use pine needles as raw material	Target 3,5,7	Target 2.5, 6.4, 13.1, 15.2, 15.4, 15.5

		Policy for managing Lantana in Himachal Pradesh	To eradicate Lantana camara which is a pan-tropical weed with very high management cost	>To encourage all stakeholders to work for Lantana eradication >To encourage Lantana based industry	Invasion of unwanted Lantana camara weed	>Already allocated budget can be utilized for eradication of lantana >Incentive can be provided to private industries by Forest Department as per the availability of budget		
Tourism	>Expansionist model of tourism[131] >Unplanned expansion of infrastructure	**Himachal Pradesh Sustainable Tourism Development policy 2013**	The state has built upon promoting sustainable tourism to ensure green growth in tourism sector	>To establish Himachal Pradesh as a leading global sustainable tourism destination >To make sustainable tourism as one of the prime engines of socioeconomic growth in the state >To achieve proposed targets by 2029	Growth in number of tourists		Target 2, 3, 8	Target 1.4, 8.9, 9.1, 15.4, 15.9, 17.14

[131] https://hillpost.in/2017/08/himachal-mass-tourism-not-sustainable/109286/

Agriculture	>Fragmentation of agricultural farmlands >Diversion of land for non-agricultural use >Increased use of pesticides >Inadequate infrastructure[132]	**Organic Farming Policy**	The policy aims for low consumption of fertilizers and facilitate adoption of organic farming by the farmers with relative ease in niche areas	>To recognize relevance of organic farming in overall development of agriculture in the state >To develop favourable plans to strengthen crop-livestock linkages of the farming sector >To facilitate organic fodder supply for livestock, organic grazing areas and organic NTFPs >To create investment environment for organic agro-business	High cost of chemical fertilizers and pesticides Decreased productive capacity of soil due to chemicals	>Building departmental linkages via appropriate institutional mechanism >Agriculture and allied sectors policies need to be brought in line with organic vision >Improvement in scientific manpower to undertake research in organic agriculture >Development of the state level web hosted data base system	Target 5	Target 2.4, 8.4, 12.2,
Biodiversity	>Fragmentation of habitat due to dam construction >Invasive species	**Biotechnology Policy 2014**	The policy aims to convert Himachal Pradesh into a Himalayan Bio business Hub via application of	>To support R&D in potential areas of biotechnology >To conserve and commercially exploit	Conservation and commercial exploitation of bio-resources		Target 5,7	Target 2.5, 12.2

[132] http://www.hpagriculture.com/Annual%20Action%20Plan%202018-2019.pdf

	>Illegal mining >Poaching of wild animals >Quarrying of river bed		biotechnology in agriculture, animal husbandry, horticulture, medicine, environment, biodiversity conservation and utilization and bio-industrial development	bio-resources of the state >To create awareness about the investment opportunities in biotechnology	Development of Biotechnology infrastructure			
Animal Husbandry	>Shortage of fodder >Inadequacy of Gosadans >Low budgetary provision	**Breeding Policy for cattle and buffaloes 2016**	The policy aims to fill some gaps in the existing cattle breeding policy which envisages upgrading of local hilly (Non-descript) cows with Jersey bulls	>To provide flexibility to farmers in selecting the kind of breed he/she wants to rear > To replace propagation of poor germplasm with high yielding pure bred animals > To ensure breeding soundness of all stud bulls and fix the minimum production standards (Dam's yield) for breeding bulls >To make area	Milk production potential of exotic breeds Disease resistance Choice of farmer regarding the breed he/she wants to rear Inclusion of indigenous breed in the policy	>Across different agro-climatic zones, depending upon whether a farmer keeping cattle is in an inaccessible area, is connected by road, wants to keep a hilly cattle or any other breed, she/he should be allowed to choose whether to keep local hilly cattle or opt for cross breeding with either Jersey, Red	Target 7	Target 2.5

				specific recommendations for cattle and buffalo breeding		Sindhi, Sahiwal breeds or Holstein Friesian.		
		Policy to tackle problem of stray cattle 2014	The existing stray cattle policy is constrained by a number of factors making it difficult to mitigate the problem of stray cattle which are abandoned by farmers once cattle become unproductive	> To address the constraints relating to the financing of Gosadans >To ensure performance of Gram Panchayats for the same >To reduce stray cattle population >To address factors responsible for unproductivity of cross bred cattle	Identification marks on the cattle Registration of livestock by owners with Gram Panchayat	>Greater resources need to be mobilized to run existing Gosadans >People/agencies/industrial houses etc. should be motivated to contribute towards stray cattle rehabilitation	Target 7	Target 2.5
		Policy for purchase of veterinary medicines 2017-18	The policy has been elucidated due to absence of any policy for veterinary medicines with HP Wool Federation as the Nodal Agency	>To provide medicine of specified quantity and quality >To procure medicines on a competitive basis at a lowest reasonable price >To procure	Purchase of medicines in accordance with the prevailing disease pattern Qualitative animal health care		Target 2, 7,	Target 2.5, 15.9

				medicines as per area-based requirement				
Energy (Hydropower)	>Deforestation for hydropower projects[133] >Loss of biodiversity due to stream diversion >Prevention of upstream fish movement >Reduced river flow and water quality[134]	**Hydro Power Plant Policy 2006**	The policy aims to ensure reliable and eco-friendly power development in the state	>To address the problem of ecological imbalance and environmental degradation caused by implementation of the Projects >To promote & provide continued support for development of renewable energy sources like SHPs, Solar, Biomass, and Water Mills	Synergy between departments by making separate Joint Inspection Committee of all departments	>Subsidies provided by different Departments should gradually be phased out >Gadgets using non-conventional energy sources at affordable prices (up to 50% of the cost) should be promoted by State Government	Target 2, 3, 8	Target 7.1, 7.2, 9.4, 12.2, 15.4, 15.9, 17.14
Water	>Water crises[135] >Exploitation of groundwater	**State Water Policy 2014**	The Policy aims to ensure sustainable utilization of water by resolving complex issues related to groundwater	>To protect water sources of the state >To map water sources and bring them	Provision of safe drinking water Pipes supply for irrigation		Target 2, 6,	Target 1.5, 2.4, 6.3, 6.4, 6.5, 6.6, 12.2, 13.1, 15.1,

[133] https://pdfs.semanticscholar.org/f545/35a3b85c7e91c9c2dda0e540d49a7b762f77.pdf
[134] https://www.researchgate.net/publication/295857661_EIA_of_Hydropower_Project_in_Himachal_Pradesh_An_Analysis
[135] https://www.indiatoday.in/india/story/severe-water-crisis-grips-himachal-a-land-where-ravi-beas-chenab-originate-1245671-2018-05-30

	>Damage to Kuhls[136]		extraction, water distribution and its usage as well as water quality in the State	in the category of utilizable resources >To engender community participation in water conservation >To promote water-shed management	GIS mapping of hand pumps to curb groundwater exploitation Revision of water adalats to resolve water conflicts Development of water related information system			15.4, 17.14

[136] https://www.indiawaterportal.org/articles/irrigation-systems-himachal-threatened-hydropower-projects

The Forest department earns royalty on timber extracted from timber lots that have been deemed as commercially unviable by the Himachal Pradesh State Forest Development Corporation Ltd. The following table shows the rates of royalty charged:

Timber extracted by Government Department	50% of the approved royalty on timber
Timber extracted to be utilised in Furniture workshop of Forest Department and HPSFDC Ltd.	25% of the approved royalty on timber

Source: Notification No. No. FFE-B-F(6)-1/2018, dated 27 July 2018, Forest Department, Government of Himachal Pradesh[137]

Details of Transit Fees

Table A4. 1: Transit Fees in Himachal Pradesh

S.no.	Botanical name	Local Name	Plant Part	Permit/ Pass Fee Rs/Qtl
1.	Abies spectabilis/ A. pindrow	Talis Patra	Needles/Leaves	125
2.	Acacia catetchu	Khair	a. Heartlwood/chips b. Khair billet 9With Bark) c. Khair waste chips after Katha extraction d. Dry uprooted waste lantana (not processed) in Government and private land	a. 250 b. 175 c. 25 d.10
3.	Aconitum dienorrhizum	Mohra	Tubers	7,500
4.	Aconitum heterophyllum	Atis/Patis/Karvi Patis	Tubers	5,000
5.	Aconitum violaceum	Mitha Patis	Tubers	1,000
6.	Acorus calamus	Bach/Bare/Ghor Bach	Rhizomes	150
7.	Adhatoda zeylanica/ A. vasica	Basuti/Bansa	Leaves	125
8.	Adiantum lunulatum	Dungtuli/Hansraj	Whole Plant	125
9.	Aegle marmelos	Bilgiri	Fruits	500

[137] http://rajpatrahimachal.nic.in/OPENFILE1.aspx?ID=%2094/GAZETTE/2018-01/08/2018%20&etype=SPECIAL

S.no.	Botanical name	Local Name	Plant Part	Permit/ Pass Fee Rs/Qtl
10.	Aesculus indica	Khanor	Fruits/Seeds	150
11.	Ainsliae aptera	Sathjalori	Roots	150
12.	Ajuga beacteosa	Neelkanthi	Leaves	125
13.	Alnus nitida	Kosh Cones	Dry Cones	150
14.	Angelica glauca	Chora	Roots	150
15.	Aretiim lappa	Jangli Kuth	Roots	125
16.	Arnebia enchroma/ A. benthami	Ratanjot	Roots	200
17.	Artemisia brevifolia	Seski	Flowering shoots	125
18.	Asparagus adscendens	Shatavari/Sanspai	Root tubers	200
19.	Atropa acuminata	Jharka	Leaves	125
20.	Berberis spp	Kashmal/ Daruhaldi	Roots/Stems	200
21.	Bergenia ciliata	Pasahnbhed	Roots	150
22.	Betula utilis	Bhoj Patra	Bark Dry Cone	500 200
23.	Bunium persicum	Kala Zira	Fruits	2,000
24.	Carum Carvi	Shingu Zira	Fruits	1,000
25.	Cedrus deodara	Deodar Rosette	Dry Cone Part	150
26.	Cinnamomum tamala	Tejpatra	Leaves	500
27.	Colebrookia oppositifolia	Bindi Phool	Leaves/Roots	125
28.	Coleus aromaticus	Pathan Bail	Leaves, Seeds	30
29.	Curcuma angustifolia	Ban Haldi	Rhizomes	150
30.	Dactylorhiza hatageria	Salam Panja	Root tubers	6,000
31.	Dioscorea deltoidea	Singli Mingli	Roots	900
32.	Emblica officinalis	Amla	Fruits	150
33.	Ephedra gererdiana	Somlata	Twigs	200
34.	Fritillaria roylei	Ban Lehsun	Bulb	10,000

S.no.	Botanical name	Local Name	Plant Part	Permit/ Pass Fee Rs/Qtl
35.	Geranium nepalense	Raktjari	Roots	125
36.	Girardiana diversifolia	Bicchu Buti	Roots	150
37.	Hedychium acuminatum	Kapur Kachri	Roots	100
38.	Heracleum spp candicans	Patrala	Roots	100
39.	Hyocymus niger	Khurasani Ajwain	Seeds/Leaves	150
40.	Hypericum patulum	Khaarera	Whole plant	250
41.	Hyssopus officinalis	Juffa	Flowering Twigs	500
42.	Iris germanica	Safed Bach	Rhizomes	125
43.	Juglans regia	Akhrot	Bark	1000
44.	Juniperus communis	Hauber	Berries	250
45.	Juniperus recurva	Bether Patta	Leaves	150
46.	Jurinea macrocephala	Dhoop	Roots	500
47.	Lichens	Chalora/ Chharila /jhula/ Mehndi/ Stone	Thallus	500
48.	Mentha longifolia	Jangli Pudina	Leaves	125
49.	Morchella esculenta	Gucchi	Fruiting Body	10,000
50.	Mosses	Green Moss Ghas	Thallus	250
51.	Murraya koenigii	Mitthi Neem	Leaves	150
52.	Myrica esculenta	Kaphal	Bark	200
53.	Nardostachys grandiflora	Jatamanasi	Roots	1000
54.	Origanum vulgare	Ban Tulasi	Leaves	150
55.	Oroxylum indicum	Shyonak, Tatpalanga	Bark, Pod	125
56.	Paris polyphylla	Dudhiya Bach/ Satva	Rhizomes	200
57.	Picrorhiza kurrao	Karoo/Kutki	Rhizomes	1000

S.no.	Botanical name	Local Name	Plant Part	Permit/ Pass Fee Rs/Qtl
58.	Pinus gerardiana	Chilgoza	Seeds	1000
59.	Pinus roxburghii	Chil Cones	Dry Cones Dry Needles	1000 5
60.	Pinus wallichiana	Kail Cones	Dry Cones	500
61.	Pistacia integerrima	Kakarsingi	Leaf Galls	1000
62.	Podophyllum hexandrum	Bankakri	Fruits Roots	250 450
63.	Polygonatium spp.	Salam Mishri	Rhizomes	1000
64.	Potentilla nepalensis	Dori Ghas	Roots	125
65.	Prunus cerasoides	Pjja/Padam	Wood	125
66.	Punica granatum	Daru/Anar	Fruits/Seeds	500
67.	Pyrus pashia	Kainth/Shegal	Fruits	125
68.	Rauvolfia serpentina	Sarpagandha	Roots	500
69.	Rheum spp.	Revandchini	Roots	200
70.	Rhododendron anthopogon	Talis Patra	Leaves	125
71.	Rhododendron arboretum	Brash	Flowers	150
72.	Rhododendron campanulatum	Kashmiri Patta	Leaves	150
73.	Salvia moorcroftiana	Thuth	Roots	200
74.	Sapindus mukorossi	Ritha	Fruits	150
75.	Saussurea costus/S. Lappa	Kuth	Roots	300
76.	Selinm spp.(S. vaginatum/ S. tenuifolium)	Bhutkesi	Roots	400
77.	Swertia spp	Chirata	Whole Plant	700
78.	Taraxacum officinale	Dudhi	Roots	125

S.no.	Botanical name	Local Name	Plant Part	Permit/ Pass Fee Rs/Qtl
79.	Taxus wallichiana	Birmi/ Thuna/ Rakhal	Needles	600
80.	Terminalia bellirica	Bahera	Fruits	300
81.	Terminalia chebula	Harar	Fruits	500
82.	Thalictrum foliolosum	Mamiri	Roots	350
83.	Thymus serpyllum	Banajwain	Aerial Parts	125
84.	Tinospora cordifolia	Giloe	Stems	125
85.	Toona ciliata	Bari Phool	Dried fruits	125
86.	Trillidium govanianum	Nag Chhatri	Roots/Rhizomes	8000
87.	Valeriana spp.	Mushakbala/ Tagar/ Nihanu	Roots/Rhizomes	600
88.	Viola Spp.	Banafsha	Flowers/aerial	2250
89.	Withania somnifera	Ashvagandha	Roots	200
90.	Woodfordia fruticosa	Dhatki/ Dhai	Flowers	150
91.	Zanthoxylum armatum	Tirmir	Fruits/Seeds	250

Source: Notification No. FFE-B-A(3)-2/2013 dated 09-12-2014[138]

Table A4. 2: Potential Bioresources of Himachal Pradesh

S. No.	Name (Scientific, Common)	Estimated Annual Trade (MT)	Estimated Market Price (Rs. per Kg)	Geographical Location	Traditional Uses	Status (CR, EN, VU, NT)
1.	Abies spectabilis (D. Don) Spach (Talispatra)	500 – 1000	30 – 50	At altitude of 2800 – 4000 m		NT
2.	Acacia catechu (L.F.) Willd. (Katha)	200 – 500	10 – 15	Mandi, Hamirpur, Una, Bilaspur, Nalagarh, Solan	Used in bronchial asthama, chest pain, sore mouth, colic pain and cancer	
3.	Aconitum heterophyllum Wall. ex Royle (Atis)	200 – 500	2000 – 4000	Shimla, Kinnaur, Lahaul - Spiti, Chamba, kangra and Kullu	Used stomach ache, bilious complaints, intermittent fevers, diarrhoea, dysentery, acute inflammatory	CR

[138] https://hpforest.nic.in/files/Notification%20in%20english.pdf

S. No.	Name (Scientific, Common)	Estimated Annual Trade (MT)	Estimated Market Price (Rs. per Kg)	Geographical Location	Traditional Uses	Status (CR, EN, VU, NT)
					infections, antiperiodic, aphrodisiac, and as bitter tonic.[139]	
4.	Acorus calamus L. (Vach)	500 – 1000	30 – 35	Shimla, Kinnaur, Kullu, Mandi, Sirmour, Chamba and Kangra	Root powder is used as vermifuge. Used to treat bronchitis and fever.	
5.	Adhatoda zeylanica Medic. (Adusa)	2000 – 5000	10 – 25		Leaf juice is used to treat chronic bronchitis and asthama. Flowers improve circulation of blood, and roots are useful in bronchitis, asthama, and sore eyes. (Sutare and Kareppa 2009)	
6.	Aegle marmelos (Bael)	2000 – 5000	10 – 25	Nalagarh, Una, Kangra, Bilaspur, Mandi, Kunihar, Nahan, and Paonta Sahik	Fruit of the plant is used for cure against dysentery, diarrhoea, and to improve appetite and digestion. The leaf of the plant has antibiotic properties.	
7.	Asparagus racemosus Willd. (Shatavari)	2000 – 5000	40 – 70	Solan, Mandi, Kangra, Bilaspur, Hamirpur, Chamba and Una	Mostly used as veterinary medicine. Useful in dysentery, diarrhoea, leprosy, and throat infection	
8.	Bacopa monnieri (L.) Pennell (Brahmi)	2000 – 5000	30 – 35	At an altitude of 1341 m	Used to treat anxiety neurosis, and mental fatigue, epilepsy, insomnia, asthma, rheumatism. It is effective against bronchitis, arthritis, backache, constipation, hair loss, fever, digestive problems.	
9.	Berberis aristata DC. (Daruhaldi)	500 – 1000	15 – 35	Shimla, Sirmour, Kullu, Chamba, Mandi, and Kinnaur	Used to treat skin ailments, eye infections, jaundice, menorrhagia and diarrhoea.	
10.	Bergenia ciliate (How.) Stern. (Pashanabheda)	200 – 500	15 – 20	Kinnaur, Shimla, Kullu, Chamba, Sirmour,Mandi and Kangra	Root is used as astringent, tonic, diuretic useful in fever, opthalmia, and boils.	

139 http://www.bioinformaticssikkim.gov.in/pages/added/Medicinal/Aconitum%20heterophyllum%20Wall.%20ex.%20Royle.htm

S. No.	Name (Scientific, Common)	Estimated Annual Trade (MT)	Estimated Market Price (Rs. per Kg)	Geographical Location	Traditional Uses	Status (CR, EN, VU, NT)
					Also useful in dissolving kidney stones.	
11.	Bombax ceiba L. (Mochrus)	100 – 200	50 – 60	Found in warmer regions with an elevation not exceeding 1400 m.	Used to treat tooth aches, and gum problems, fever, mouth sores, rheumatism, enlarged spleen, leg pains, pneumonia, leprosy, atropy, cholera, neuralgia, and rinderpest disease.	
12.	Butea monosperma (Lam.) Taub (Tesu phool)	200 – 500	15 – 20	Solan, Bilaspur, Hamirpur, Kangra, Chamba, Mandi, and Sirmour	Used to treat diarrhoea, dysentery, ulcers, sore throat, bladder haemorrhage and pthisis.	
13.	Cassia fistula L. (Amaltas)	200 – 500	30 – 40	Una, Hamirpur, Bilaspur, Mandi, Kangra, Chamba, and Solan	Used to treat leprosy, indigestion, heart diseases, flatulence, ringworm, gripping boils, fever colic, and heart diseases.	
14.	Cassia tora L. (Chakoda beeja)	5000 – 10,000	5 – 10	Throughout HP up to elevation of 1400 m	Leaves are applied on cuts and wounds. It also treats skin ailments, tumours, leprosy, psoriasis and ulcers.	
15.	Cedrus deodara (Roxb.) loud. (Devdar)	500 – 1000	25 – 35	Found in most part of the state between elevation of 2200 – 2800 m.	Used to treat paralysis, fever, heart palpitations, flatulence, urinary diseases, and pulmonary problems.	
16.	Celastrus paniculatus Willd. (Malkangani)	200 – 500	48 – 55	Found at an altitude of 1800 m	Used to treat tuberculosis, acidity, intestinal worms, skin diseases, ringworm, and stomach ache	
17.	Centella asiatica (L.) Urban (Bhrami Booti)	500 – 1000	25 – 35	Throughout HP below 1300 m elevation	Used for treating leprosy, epilepsy and loss of memory.	
18.	Centratherum Anthelminticum (L.) O. Kuntze (Kali Zeeri)	500 – 1000	70 – 75		Used to treat skin diseases, itching and skin irritation, roundworm, tapeworm, thread worm.[140]	
19.	Cinnamomum tamala	500 – 1000	15 – 35	Solan, Shimla, Mandi, Hamirpur,	Used to treat rheumatism, colic and diarrhoea	VU

[140] https://www.ayurtimes.com/kali-jeeri-kalijiri-centratherum-anthelminticum/

S. No.	Name (Scientific, Common)	Estimated Annual Trade (MT)	Estimated Market Price (Rs. per Kg)	Geographical Location	Traditional Uses	Status (CR, EN, VU, NT)
	(Tejpatta)			Kangra and Chamba		
20.	Emblica officinalis Gaertn (Amla)	16000	30 – 35	Nahan, Nalagarh, Mandi, Solan, Hamirpur and Bilaspur	Enriched in Vitamin – C and bears laxative, diuretic and astringent properties.	
21.	Ephedra gerardiana Wll. (Somlata)	200 – 500	25 – 35	Chamba, Kinnaur, Lahaul-Spiti	Used to treat asthma, and other respiratory ailments, syphilis, and rheumatism.	EN
22.	Gloriosa superba L. (Kalihari)	100 – 200	600 – 750	Kangra and Sirmour	Used to treat ulcers, leprosy, inflammation, piles, skin ailments and intestinal worm disorders.	VU
23.	Holorrhena pubescens Wall. ex. G. Don (Kutja)	1000 – 2000	75 – 100	Nahan, Una, Hamirpur, Kangra, Bilaspur, Solan and Mandi	Used to treat amoebic dysentery, piles, anaemia, asthma, bronchopneumonia, dropsy, influenza, tooth ache, rheumatism, vomiting and nausea.	
24.	Juniperus communis L. (Hauber)	500 – 1000	35 – 45	Kullu, Chamba, Sirmaur, Kinnaur and Shimla	Useful in asthma, stomatitis, hemicranias, chronic bronchitis, diseases of liver and spleen	
25.	Jurinea macrocephala (Dhoop)	1000 – 2000	75 – 100	Chamba, Kullu, Kinnaur and Shimla	Aromatic roots are used as incense and are main ingredient of Dhoop industry. Root oil is useful in treatment for gout and rheumatism.	
26.	Litsea glutinosa (Lour.) Robinson (Maida Chhal)	100 – 200	20 – 35	Altitude of 500-1900 m	Powdered form used to treat bruises inflicted by blows, skin diseases and use as plastering material over fractures or sprains in humans and animals. (Ramana and Raju 2017)	
27.	Nardostachys grandiflora DC. (Jatamanasi)	200 – 500	110 – 150	Alpine rocky slopes, The Great Himalayan National Park	Used to treat epilepsy, hysteria, leprosy, respiratory disorders, nervous excitement, palpitation of heart and flatulence.	EN
28.	Onosma hispidum Wall. ex G. Don (Ratanjot)	500 – 1000	50 – 60	At altitude of 4000 m	Root yields red colour commercial dye, mainly used for colouring foodstuffs, wools, oils and medicinal preparations. Also, used	

S. No.	Name (Scientific, Common)	Estimated Annual Trade (MT)	Estimated Market Price (Rs. per Kg)	Geographical Location	Traditional Uses	Status (CR, EN, VU, NT)
					in the treatment of wounds, pain relief, fevers, infectious diseases, bites and stings. Flowers are used as stimulant and cardiac tonic. Bruised roots of ratanjot are applied externally to cutaneous eruptions.[141]	
29.	Oroxylum indicum (Tetu chhal)	1000 – 2000	20 – 30	Kullu, Kangra, Una, Hamirpur, Bilaspur, Chamba, Solan, and Sirmaur	Useful for treating dysentery and diarrhoea, headaches, and ulcers treatment.	
30.	Parmelia perlata (Chadila)	1000 – 2000	80 – 90		Useful in bronchitis, excessive salivation, vomiting, toothache, boils, inflammations.[142]	
31.	Picrorhiza kurrao Royle ex. Benth (Kutki)	200 – 500	220 – 230	Kinnaur, Chamba, Kullu and Lahaul	Used to treat blood pressure, cold, cough, leprosy, jaundice and asthma.	EN
32.	Pistacia integerrima (Kakar singi)	150 – 200	90 – 110	Chamba, Kinnaur, Kullu, Mandi, Shimla, Solan, Hamirpur, Una and Sirmaur	Used to treat asthma, phtisis and other respiratory ailments.	
33.	Rheum austral D. Don (Revan Chini)	500 – 1000	25 – 30	Kangra, Chamba, Kullu, Shimla, Kinnaur, Lahaul and Spiti	Used to clean teeth and treat ulcers.	
34.	Rhododendron anthopogon D. Don (Talispatra)	100 – 200	15 – 30	Shimla, Kullu and Chamba	Leaves possess stimulant properties. These are aromatic and are administered as an errhine to produce sneezing.	VU
35.	Sapindus mukorossi (Reetha)	200 – 500	30 – 40	Chamba, Kangra, Una, Hamirpur, bilaspur, Solan, Sirmaur, mandi and Shimla	Used to treat epilepsy and chlorosis. Leaves are used as fodder.	
36.	Swertia chirayata (Chirayata)	500 – 1000	200 – 225		Treats asthma, cold, cough, ulcer, asthma, inflammation, piles and skin diseases	CR

[141] https://www.motherherbs.com/onosma-hispidium.html

[142] Kumar GP, Kumar VS, Kumar SA (2015), "Pharmacological and phytochemical aspects of Lichen Parmelia Perlata: A review", Int. J. Res. Ayurveda Pharm. Jan – Feb 2016; 7(Suppl 1): 102 – 107; Available at: http://dx.doi.org/10.7897/2277-4343.07138

S. No.	Name (Scientific, Common)	Estimated Annual Trade (MT)	Estimated Market Price (Rs. per Kg)	Geographical Location	Traditional Uses	Status (CR, EN, VU, NT)
37.	Taxus Wallichiana Zucc. (Talispatra)	100 – 200	75 – 90	At an altitude of 1800m to 3300 m	Used in treatment of headaches, falling pulse	EN
38.	Terminalia arjuna (Arjun)	2000 – 5000	10 – 15	Nahan, Nauni and Solan	Used in treatment of blood dysentery, blood pressure, bone fracture, heart diseases and ear aches.	
39.	Terminalia bellirica (Behra)	2000 – 5000	10 – 15	Shivalik zone of HP	Used in treatment of piles, spleen enlargement, leprosy and headaches	
40.	Terminalia chebula (Harda)	5000 – 10,000	10 – 15	Sirmaur, Hamirpur, Mandi, Bilaspur, Kangra and Una	Used to treat asthma, blood pressure, gum ulcers, dysentery, and piles	
41.	Tinospora cordifolia (Giloy)	2000 – 5000	10 – 15		It has medicinal properties like anti-diabetic, anti-periodic, anti-spasmodic, anti-inflammatory, anti-arthritic, anti-oxidant, anti-allergic, anti-stress, anti-leprotic, anti-malarial, hepatoprotective, immunomodulatory and anti-neoplastic activities. (Kumar et al 2015)	
42.	Valeriana jatamansi (Musakbala)	100 – 200	95 – 100	Kinnaur, Kullu, Chamba, Mandi and Shimla	Used for producing perfumed powder and also medicines for hysteria and nervous disorders.	VU
43.	Viola pilosa bi. (Banafsa)	200 – 500	300 – 350	Chamba, Kinnaur, Kullu, Mandi, Kangra, Bilaspur, Shimla and Solan	Used to treat asthma, bleeding piles, throat cancer, fever, headache and skin diseases	
44.	Withania somnifera (Ashwagndha)	2000 – 5000	60 – 70	Una, Hamirpur, Kullu, Kangra, Mandi, Bilaspur, and Sirmaur	Used to treat cough, dropsy, general weakness, debility, rheumatism and it is a potent tonic for delaying aging.	
45.	Woodfordia fruticosa (L.) Kurz (Dhai phool)	2000 – 5000	10 – 15		Used for curing/ treating various ailments/disorders like leprosy, toothache, leucorrhea, fever,	

S. No.	Name (Scientific, Common)	Estimated Annual Trade (MT)	Estimated Market Price (Rs. per Kg)	Geographical Location	Traditional Uses	Status (CR, EN, VU, NT)
					dysentery, bowel disease. (Kumar et al 2016)	

Annexure – 5

Himachal Pradesh Environment Fund

The Department of Environment, Science and Technology created The Himachal Pradesh Environment Fund on 4th November 2008. For administering the fund, the Environment Fund Administering Committee was also notified which was to administer the Fund.
The following amounts would be credited to the Fund:

i. Direct contribution, donations from individuals, industrialists, NGOs, industries associations, hotel associations, Departments, Corporations, etc.
ii. Any other source of donation which the State Government may deem fit.

Out of the total collection from the Fund, computed at the end of the financial year:

% of Funds	Permissible Works
50% of the collected fund	Environmental protection, conservation, restoration and mitigation works, including the efforts to reduce the carbon footprints
25% of the collected fund	Development of the environmental infrastructure in the state
10% of the collected fund	Environmental educational activities awareness programmes
10% of the collected fund	Any environmental purposes at the discretion of Chairman of the 'Environment Fund Administering Committee'
5% of the collected funds	Keep as contingency for administering of the Fund including expenses for maintenance of accounts, logistics, organizing of meetings, etc.

Expenditure from the Fund can only be incurred after approved by the Environment Fund Administering Committee for the purposes defined in the table above, except for the 10% of the total earmarked for expenditure at discretion of Chairman of the 'Environment Fund Administering Committee.