



**BIODIVERSITY STRATEGY AND ACTION PLAN &
FINANCE SOLUTIONS FOR LAHAUL-PANGI AND
KINNAUR LANDSCAPES IN HIMACHAL PRADESH**

PREPARED AS PART OF
STUDY ON “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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**BIODIVERSITY STRATEGY AND ACTION PLAN & FINANCE
SOLUTIONS FOR LAHAUL-PANGI AND KINNAUR LANDSCAPES IN
HIMACHAL PRADESH**

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Final Report

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Contents

Preface
Acknowledgement
Executive Summary

I. List of Chapters

Chapter 1: Overview of Legislative and Policy Actions for Biodiversity Conservation in Himachal Pradesh and their Scope within SECURE Himalaya Project

- 1.1 Background
- 1.2 Study on Updating BSAP of Himachal Pradesh
- 1.3 About this report

Chapter 2: Overview and Process Documentation

- 2.1 Vision and Guiding Principles
- 2.2 Methodology and Process
 - 2.2.1 Key Process Details

Chapter 3: Landscape Profile, Threats to Biodiversity

- 3.1 Landscape Profile
 - 3.1.1 Lahaul-Pangi Landscape
 - 3.1.2 Kinnaur Landscape
- 3.2 Threats to Biodiversity in the SECURE Landscape
 - 3.2.1 Threats faced by the floral diversity in the SECURE Landscape
 - 3.2.2 Threats faced by the faunal diversity in the SECURE Landscape

Chapter 4: Biodiversity Strategy and Action Plan

- 4.1 Theme-wise Recommendations and Action Plan

Chapter 5: Biodiversity Expenditure Review

- 5.1 What is a Biodiversity Expenditure Review
- 5.2 Fund Flow Arrangements to the Landscapes
 - 5.2.1 A snapshot of number of biodiversity relevant schemes implemented
- 5.3 Conclusion

Chapter 6: Financial Solutions for SECURE Landscape

- 6.1 Financial Solution I: Community Fodder Bank
 - 6.1.1 Background
 - 6.1.2 Shortage of fodder and pressure on grazing lands due to overgrazing: A serious issue

- 6.1.3 Issues related to fodder in Lahaul-Pangi Landscape, and the need of fodder bank
- 6.1.4 Lessons from Best Practices
- 6.1.5 Technical Requirements of Setting up a CFB
- 6.1.6 The Model for Community Fodder Bank
- 6.1.7 Capacity Building Framework for the Community Fodder Bank
- 6.1.8 Management of Community Fodder Bank
- 6.1.9 Components of Cost for Establishment of CFB
- 6.1.10 Budgetary Sources of Finance

6.2 Financial Solution II: Cultivation of Medicinal and Aromatic Plants

- 6.2.1 Background
- 6.2.2 Why do communities not take up cultivation of MAPs
- 6.2.3 Case Studies on Value Chains of Medicinal Plants
- 6.2.4 Best Practices
- 6.2.5 Medicinal and Aromatic Plants in Lahaul – Pangi Landscape
- 6.2.6 Creation of Value Chain through Partnership between Industry and Local Communities
- 6.2.7 Components of Cost for setting up of the model
- 6.2.8 Budgetary Sources of Finance

Annexure – 1

Chapter – 2

Tables	
Table 2.1	Snapshot of Meeting and Consultative Workshops in HP
Figures	
Figure 2.1	Linkages between Ecosystem Services & Human Well-being
Box	
Box 2.1	Key Steps

Chapter – 3

Tables	
Table 3.1	Land-use Pattern in Lahaul-Pangi Landscape
Table 3.2	Sub-types of Forests in Pangi
Table 3.3	Faunal Diversity of Pangi Valley
Table 3.4	Wildlife Census, 2019 in Sechu Tuan Nalla, Wildlife Sanctuary
Table 3.5	Land-use Pattern in Kinnaur (for 2016-17)
Table 3.6	Livestock in Kinnaur (2016-17)
Table 3.7	Protected Areas in Kinnaur
Figures	
Figure 3.1	Map of Pangi
Figure 3.2	Map of Lahaul
Figure 3.3	Mammals in Lahaul-Spiti, Himachal Pradesh
Figure 3.4	Map of District Kinnaur, Himachal Pradesh
Box	
Box 3.1	Increased number of Snow Leopard in Himachal Pradesh
Box 3.2	Religion and Biodiversity

Chapter – 4

Tables	
Table 4.1	Issues, Recommendations, Action Points, Time Frame, Indicators and relevant Agencies for Lahaul-Pangi Landscape

Chapter- 5

Tables	
Table 5.1	Framework Used in Analysis of BER
Table 5.2	Number of Biodiversity Relevant Scheme by Type of Impact
Table 5.3	Number of Biodiversity Relevant Schemes (CBD) Classification
Table 5.4	Biodiversity Attributable Expenditure in Pangli
Table 5.5	Expenditure of Biodiversity Relevant Scheme by Type of Impact (Rs. Lakh)
Table 5.6	Department-wise Biodiversity Attributable Expenditure (Rs. Lakh)
Table 5.7	Biodiversity Attributable Expenditure in Lahaul
Table 5.8	Expenditure of Biodiversity Relevant Scheme by Type of Impact (Rs. Lakh)
Table 5.9	Department-wise Biodiversity Attributable Expenditure (Rs. Lakh)
Table 5.10	Biodiversity Attributable Expenditure in Kinnaur
Table 5.11	Expenditure of Biodiversity Relevant Scheme by Type of Impact (Rs. Lakh)
Table 5.12	Department-wise Biodiversity Attributable Expenditure (Rs. Lakh)
Figures	
Figure 5.1	Biodiversity Related Expenditure (CBD Classification) - Pangli
Figure 5.2	Biodiversity Related Expenditure (CBD Classification) - Lahaul
Figure 5.3	Biodiversity Related Expenditure (CBD Classification) - Kinnaur

Chapter - 6

Tables	
Table 6.1	Demand, supply and deficit of dry and green fodder
Table 6.2	Demand of Fodder for Livestock in Pangli and Lahaul for 2016 (in tonnes)
Table 6.3	Global Lessons and Local Experiences for CFBs
Table 6.4	Responsibilities, Actions and Skill Sets Required for Community Fodder Bank
Table 6.5	Teaching aids for imparting training
Table 6.6	National Livestock Mission
Table 6.7	Uttam Chara Utpadan Yojana
Table 6.8	The cost- benefit ratio of species cultivated under Project Green Gold in Chamba
Table 6.9	Species proposed for the project
Table 6.10	Requirements for setting up a value chain
Table 6.11	Responsibilities, Actions and Skills Required for Value Chain Model for MAPs
Table 6.12	Training needs of farmers of cultivation of MAPs
Table 6.13	Components of Cost for Setting up the MAP Value Chain
Table 6.14	Budgetary Sources of Finance (Rs. Crore)
Figures	
Figure 6.1	Model for Community Fodder Bank
Figure 6.2	The market channel for MAPs in the Lahaul-Pangi landscape
Figure 6.3	Proposed Model for MAP Cultivation
Boxes	
Box 6.1	Fodder Species for Lahaul-Pangi Landscape
Box 6.2	Skills and Knowledge base that needs to be inculcated within the community members for CFB
Box 6.3	Components of Cost for Setting up CFB
Box 6.4	Quantity of MAPs extracted from HP during 1995-2000

Annexure – 1

Table A1.1	A Snapshot of Consultative Workshops and Meetings in HP
Table A1.2	List of Participants in Consultative workshop in Kilar, Pangi

List of Abbreviations

AYUSH	Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy
BER	Biodiversity Expenditure Review
BIOFIN	Biodiversity Finance Initiative
BMC	Biodiversity Management Committee
BSAP	Biodiversity Strategy and Action Plan
CBD	Convention on Biological Diversity
CCAFS	Climate Change, Agriculture and Food Security
CFB	Community Fodder Bank
CGIAR	Consultative Group on International Agricultural Research
CPR	Common Property Resource
CRIDA-KVK	Central Research Institute for Dryland Agriculture – Krishi Vigyan Kendra
CSIR-ARI	Council for Scientific and Industrial Research-Animal Research Institute
CSKHPKV	Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya
DIPP	Department of Industrial Policy and Promotion
DOA	Department of Agriculture
DoAH	Department of Animal Husbandry
DoEST	Department of Environment, Science and Technology
DoH	Department of Horticulture
FAO	Food and Agriculture Organisation
GBPIHED	G.B. Pant Institute of Himalayan Environment & Development
GEF	Global Environment Facility
GSDP	Gross State Domestic Product
HP	Himachal Pradesh
HPAB	Himachal Pradesh Ayush Board
HPFD	Himachal Pradesh Forest Department
HPSBB	Himachal Pradesh State Biodiversity Board
HPSMPB	Himachal Pradesh State Medicinal Plant Board
HRDI	Herbal Research and Development Institute
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IEC	Information, Education and Communication
IFFCO	Indian Farmers Fertiliser Cooperative Limited
IGFRI	Indian Grassland and Fodder Research Institute
ILCA	International Livestock Centre
ITDP	Integrated Tribal Development Project
JFM	Joint Forest Management
JV	Joint Venture
MAP	Medicinal and Aromatic Plants
M & E	Monitoring and Evaluation
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MMD	Mahila Mangal Dal
MoEF&CC	Ministry of Environment, Forests and Climate Change
MOU	Memorandum of Understanding
NBA	National Biodiversity Authority
NBAP	National Biodiversity Action Plan
NBT	National Biodiversity Target
NDC	Nationally Determined Contribution

NGO	Non-government Organisation
NIPFP	National Institute of Public Finance and Policy
NMSA	National Mission on Sustainable Agriculture
NPV	Net Present Value
NTFP	Non-Timber Forest Produce
OBC	Other Backward Classes
PBR	People's Biodiversity Register
PGFRA	Plant Genetic Resources for Food and Agriculture
PKVY	Paramparagat Krishi Vikas Yojana
PMU	Project Management Unit
PRI	Panchayati Raj Institution
PTI	Press Trust of India
RAD	Rainfed Area Development
RKVY	Rashtriya Krishi Vikas Yojana
SBB	State Biodiversity Board
SBSAP	State Biodiversity Strategy and Action Plan
SC	Scheduled Caste
SDG	Sustainable Development Goal
SHG	Self Help Group
SIFCO	Sikkim IFFCO
TERI	The Energy and Resource Institute
UMMB	Urea Molasses Mineral Block
UNDP	United Nations Development Programme
USA	United States of America
USD	United States Dollar
VFDC	Village Forest Development Committee
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 and Finance Solutions for Lahaul-Pangi and Kinnaur Landscapes” covers important issues around conservation of biodiversity in identified landscapes in Himachal Pradesh, India on which the authors have done exhaustive research through desk-based research, 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 report is a part of the larger study “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”.

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. Archana 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), 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.

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Executive Summary

The SECURE (Securing livelihoods, conservation, sustainable use and restoration of high range Himalayan ecosystems) Himalaya project is a part of “Global Partnership on Wildlife Conservation and Crime Prevention for Sustainable Development” funded by Global Environment Facility (GEF). The project aims at addressing the threats that the natural Himalayan ecosystems are facing, such as, pressures from economic development, selective removal of medicinal and aromatic plants, and the emerging threat of illegal wildlife trade and wildlife crime.

The project has the following major outcomes:

- i. Improved management of high range Himalayan landscapes for conservation of Snow leopard and other endangered species and their habitats and sustaining ecosystem services;
- ii. Improved and diversified livelihood strategies and improved capacities of community and government institutions for sustainable natural resource management and conservation;
- iii. Enhanced enforcement, monitoring and cooperation to reduce wildlife crime and related threats;
- iv. Effective knowledge management and information systems established for promotion of sustainable management practices in the high range Himalayan ecosystems.

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.

The present report titled, “Biodiversity Strategy and Action Plan and Finance Solutions for Lahaul-Pangi and Kinnaur Landscapes”, is part of the above referenced NIPFP study. It focuses on identifying the threats to biodiversity in Lahaul-Pangi and Kinnaur Landscapes and makes policy recommendations for improving the status of biodiversity, natural resources and ecosystem services in identified landscapes in the state. The preparation of this document has undertaken an exhaustive research through field visits and stakeholders’ consultations. In addition, a review of literature and secondary data sources was carried out for:

- status and trends of biodiversity and biological resources in the landscape,
- threats to biodiversity in the landscape
- review of the biodiversity relevant schemes and expenditure in the landscape

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

The Lahaul-Pangi and Kinnaur Landscapes identified under the SECURE project are very rich floral and faunal diversity. A study by Champion and Seth (1968) recognizes ten sub types of forests in Pangi while the district statistical abstract of Lahaul states that the area has little area under forests. In Kinnaur, while 51.19 per cent of the total area is covered under permanent pastures 20 per cent area has

uphill by *gaddis*. Fodder banks should be established, one in each Lahaul and Pangri, and the communities should be trained in scientific production and management of fodder under Uttam Chaara Utpadan Yojana. The communities should also be trained in enriching the crop residue by adding mineral supplements, so that the residue can be used as fodder.

It is vital to tackle the problem of overgrazing as excessive grazing has led to degradation of wild habitat, which has directly resulted in decreased number of prey species and indirectly, increased the incidents of human-wildlife conflict in the landscape. Conflicts caused by monkeys, and bears are common in the landscape. Thus, there is a need to identify risk mitigation measures like ensuring availability of food for animals in their habitats by planting more fruiting trees in forests, identifying specific zones for grazing of livestock, reviving degraded pasturelands uphill, and periodic clearing of shrubs to provide free movement of animals, sterilisation of animals like monkeys. A comprehensive database for human-wildlife conflict along with nature and extent of conflicts in the landscape should be prepared. The ongoing insurance programmes such as Insurance Scheme by Nature Conservation Foundation (NCF) in Spiti should be evaluated and linked with existing compensation policy of the State.

To tackle the issue of unsustainable extraction of medicinal plants in the landscape, creation of a value chain through partnership between industries and local communities is recommended. There is also a need to develop community-based sustainable cultivation mechanism for medicinal plants which are on the verge of extinction. Some economically and culturally significant species identified for this purpose are: *Aconitum heterophyllum* (Atish), *Picrorhiza kurrao* (Kadu), *Rheum australe* *Taxus Wallichiana* (Chukri), and *Valeriana jatamansi* (Musakbala).

In Pangri, farmers are shifting away from cultivation of traditional staple crops such as millets, barley, wheat and pulses to cash crops such as apples, peas, potato, tomato, due to unfavourable changes in climate. 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). It is recommended that through schemes like Pramparagat Krishi Vikas Yojana (PKVY), branding, labelling and marketing be done for the niche organic products of the landscape. Community seed banks be established to make local varieties of seeds available to the farmers and incorporate traditional knowledge in PBRs for crop breeding, especially for the crops of economic importance to help farmers.

The report also includes an analysis of the expenditure undertaken by the State within the landscape that is attributable to biodiversity. 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). The number of schemes implemented in Kinnaur, Lahaul-Spiti, and Pangri landscapes (Tables 5.2 and Table 5.3) ranged from (64 – 72) during 2014-15 to 2016-17.

In both the landscapes, the biodiversity attributable expenditure has gradually increased. Department of Forest and Department of Agriculture are the key departments in terms of total expenditure on biodiversity, while Department of Horticulture and Department of Rural Development show an increasing trend in expenditure. Concerted efforts should be made to increase expenditure in the departments of tourism, transport and Ayurveda which can potentially lead to livelihood opportunities and reduce pressure on forest resource and conflict with wild animals.

Based on the consultations in the landscape, and the exhaustive review of literature, two financial solutions for the landscape have been identified:

1. Community Fodder Bank
2. Cultivation of Medicinal and Aromatic Plants

A community fodder bank is formed when a group of farmers come together, to raise multiple fodder crops consisting of trees, grasses, and legumes (largely in wastelands), to meet the fodder requirement, especially during peak winter season, increasing productivity of livestock with appropriate nutrition through quality feed and reducing pressure on forests and replenishing arable lands that have lost fertility.

During consultation visit to Kilar, Pangri, the locals highlighted the shortage of fodder in winters, when the valley receives heavy snowfall. Even though the locals stock up fodder to be used in winters, it is not possible to stock up the optimal amount. Over the years, the locals have observed a decline in the availability of fodder in the landscape. Khanna (2019) has found that in Himachal Pradesh, the grasslands are poor in respect of their productive potential and carrying capacity; and there is also an imbalance in human cattle population (1:1.25) which indicates heavy pressure on natural forest for fodder, small pole, timber and fuel wood etc.

The proposed model of community fodder bank is based on the best lessons drawn from other national and international experiences (Table 6.3). To establish a successful model, active involvement of community members is absolute, which has to be ensured through rigorous training. Partnership building for effective governance and coordinated efforts are the backbone of a CFB, as inferred by studying the best practices worldwide.

The model proposed for SECURE Landscape is inspired by the project in Maikhanda village, Uttarakhand (Figure 6.1).

It is proposed that the Department of Forest and UNDP take a lead and facilitate the negotiations among the key stakeholders and finalising the contracts. The fodder bank will be established as a joint venture between the Department of Agriculture and Department of Animal Husbandry. Department of Agriculture will establish itself as a nodal agency leading the effort for the success of the project, and will also take lead in documentation of knowledge in production of fodder, best practices and case studies along with monitoring the implementation of the project.

Building capacities at the grass root level is a necessity for the success of the fodder bank. For this, coordination of Department of Rural Development, Department of Agriculture, Department of Animal Husbandry and the chosen technical agency is needed. The selection of technical agency will be done in accordance with the guidelines of National Livestock Mission. The annexure C-V of the guidelines of the National Livestock Mission identifies the following agencies as eligible for imparting training to farmers, researcher, academicians and officials on production, conservation, and efficient utilisation of feed and fodder:

Department of Animal Husbandry Dairying & Fisheries, Agriculture Department, Krishi Vigyan Kendras, Indian Council of Agricultural Research, Institutions and Research & Development Organizations, Agriculture and Veterinary Universities. Based on this, the following technical agencies have been identified:

- Indian Grassland and Fodder Research Institute (IGFRI), Jhansi, India
- Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya (CSKHPKV), Palampur, HP
- Dr Y S Parmar University of Horticulture & Forestry, Nauni, Solan, HP
- G.B. Pant Institute of Himalayan Environment and Development, Almora, Uttarakhand

- Himalayan Forest Research Institute, Panthaghati, Shimla

Community members will need to be trained for techniques on planting fodder crops, calculation of forage requirements during the year and scarcity period, factors influencing the growth of fodder crops, use of fertiliser and manure/compost, maintenance of soil fertility, weed management, sustainable harvesting of fodder and cutting frequency, conservation and preservation of forage including hay making, treatment of crop residue with urea and construction of animal houses and sheds on scientific lines provided with cost-effective feeding and watering systems and proper ventilation using locally available materials. For this, teaching aids like training manuals, presentations, video aids, field demonstration and exposure visits are required.

The calculation of cost for establishment of fodder bank has been calculated on the base of the guidelines of National Livestock Mission, and the fodder bank in Uttarakhand. **Two fodder banks have been proposed, one in Lahual and one in Pangri.** For establishment of one community fodder bank, an area of 6 ha is needed along with an area of 250 sq. m to set up a nursery where a poly house and a net house will be constructed to sow the seeds and germinate them by providing appropriate environment. The total cost of setting up 2 fodder banks is Rs. 12 lakh. Since, these are remote areas with high infrastructure costs, we propose that a separate budget of Rs. 3 lakh be kept for unforeseen events and unexpected occurring. **The total cost of the project comes out to be Rs. 15 Lakh.**

To ensure continuity of funds to the fodder banks, schemes related to fodder production that are being implemented in the State have been identified:

- Development of Fodder and Feed
- National Livestock Mission
- Uttam Chara Utpadan Yojana
- Rashtriya Krishi Vikas Yojana (Has a sub-component of Accelerated Fodder Development Programme)
- Rainfed Area Development

The second finance solution is related to set up the value chain model for Medicinal and Aromatic Plants (MAP) in the landscape. The conditions enabling a successful value chain model for medicinal plants have been identified after reviewing similar projects that have been implemented in the Indian Himalayan Region. For any successful project, the cultivation of medicinal plants should be carried out on large plots as small plots do not incentivise the farmers to look after the plants properly. Cultivation should be promoted on barren, nonarable, and marginal lands under a participatory management action plan to improve the economy of deprived farmers. Commercially viable species should be selected for cultivation, so that the farmers earn good economic returns. Intensive on-site training and field demonstration is required for successfully introducing the species that are yet to be domesticated.

Himachal Pradesh has a successful precedence of cultivation of MAPs in the Green Gold Project, implemented in Chamba. The project covered 200 SHGs and was implemented at the cost of Rs. 432 Lakh. The project focused on four species, *Aconitum* (Atis), *Valeriana jatamansi* (Sugandhwala), *Podophyllum* (Bankakdi) and *Picrorhiza kurroa* (Kutki). The cultivation was done on zero income land so that the income generated by the farmers was an additional income (Table 6.8).

Based on the past experiences, for this project, five species have been proposed: *Aconitum heterophyllum* (Atish), *Picrorhiza kurroa* (Kadu), *Rheum austral* (Chukri), *Taxus Wallichiana* (Thuner) and *Valeriana jatamansi* (Musakbala) (See Table 6.9).

For setting up the value chain model (Figure 6.3), it is proposed that Department of Forest and UNDP act as facilitators by bringing all the players of the model to the table of negotiations and finalising of the contracts. Department of Forest will be the nodal agency leading the project. Along with State

Medicinal Plant Board, the Department of Forest will also lead the efforts for documentation of best practices, case studies and traditional knowledge related to cultivation of MAPs and making it available in public domain. For training of the farmers (See Table 6.12 for training needs of the farmers) for cultivation, labelling, branding and marketing, a technical agency needs to be involved, which will be identified based on the guidelines of the National Medicinal Plant Board. According to these guidelines, following agencies are eligible for carrying out training and capacity building in spreading best practices on conservation, cultivation, good agricultural practices, good field collection practices, post-harvest management, marketing etc. activities:

- Central and State Government organizations.
- Recognized Research/ Academic/ Educational institutions
- Registered professional and other philanthropic organizations working on non-profit basis.
- Registered Non-Government Organizations (NGO)/Voluntary Organizations/ Trusts with infrastructure and specific experience in the field of medicinal plants

Based on the above eligibility criteria, following institutes may be contacted for imparting training to the farmers:

- i. G.B. Pant National Research Institute of Himalayan Environment and Sustainable development, Mohal, Kullu, HP
- ii. Dr Y S Parmar University of Horticulture & Forestry, Nauni, Solan, HP
- iii. Institute of Himalayan Bioresource Technology, Palampur, HP

To ensure that the farmers are able to sell their produce, a pharmaceutical corporate house also needs to be incorporated in the project. Indicatively, some of the corporate houses that can be involved in the project are:

- i. Dabur, already operating in Lahaul (part of SECURE Landscape), therefore, it can be approached for the model.
- ii. Patanjali Ayurveda Limited
- iii. Organic India Private Limited
- iv. The Himalaya Drug Company
- v. Any other pharma company already operating in the State

Total cost of the project is proposed to be Rs. 26.56 Lakh for including 123 families in the project over 5 years¹. The nurseries for the project will require an area of 1.5 ha. The land for cultivation in the landscape will differ depending upon the area in which the participant families are residing.

To ensure continuity of flow of funds to the project, funds can be drawn from schemes like Van Samriddhi Jan Samriddhi under which, nurseries for medicinal plants will be set up to meet the demands of medicinal plants and other NTFPs for cultivation/plantation. Private entrepreneurs, NGOs/Societies working in this field will be given a seed fund up to Rs. 1 lakh for procurement and branding for which they have to render regular accounts to the department. For capacity building, existing Jadi-buti cell can be utilised, or a similar cell can be set up as part of the project. For capacity building, the main focus shall be cultivation techniques and post harvesting processing skills for value addition.

¹ No. of families to be included and the cost of the project have been calculated from the criteria used in the Project Green Gold in Chamba.

Chapter 1: Background and Overview of Legislative and Policy Actions for Biodiversity Conservation in Himachal Pradesh and their Scope within SECURE Himalaya Project

1.1 Background

Himachal Pradesh, the mountainous Indian state lying in the Western Himalaya, extends over a geographical area of 55, 673 sq. km. Owing to varied geological formations, topography, climatic conditions and altitudinal changes, the State 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). The state harbours rich and unique fauna with 5,721 species (out of a total of 89,451 species found in India). The state also has the largest population of Chir pheasants in the world.

However, biodiversity in the State 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.

To address the threats, the State prepared its first Biodiversity Strategy and Action Plan (BSAP) in 2002. However, there is a need for updating this plan on account of the following:

- i. HP SBSAP was developed in the year 2002, which is prior to the release of India's National Biodiversity Action Plan (NBAP), 2008 and thus is not aligned with NBAP. After formal release of CBD Strategic Plan for Biodiversity 2011-2020 and associated Aichi Biodiversity Targets, India developed 12 National Biodiversity Targets (NBTs) in harmony with the Aichi Targets (Addendum 2014 to NBAP, 2008).
- ii. In 2010, new guidelines for regional and National BSAPs were framed at the Nagoya 10th CoP Summit. For achieving this, the Ministry of Environment, Forest and Climate Change (MoEF&CC) prepared an addendum to India's NBAP and the states were asked to align their BSAPs according to the 2011-20 commitment of the country towards CBD.

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

1.2 Study on Updating BSAP of Himachal Pradesh

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". This report has also been completed (Pandey, Rita et al, 2021)

Key objectives of this 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.

The updated BSAP of the State under the SECURE Himalaya project 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

1.3 About this Report

The present report titled, “Biodiversity Strategy and Action Plan and Finance Solutions for Lahaul-Pangi and Kinnaur Landscapes”, is part of a larger study (Pandey, Rita et al, 2021). It focuses on identifying the threats to biodiversity in Lahaul-Pangi and Kinnaur Landscapes and makes policy recommendations for improving the status of biodiversity, natural resources and ecosystem services in identified landscapes in the state. The report also provides process documents for implementation of two financial solutions for conservation of snow leopard landscapes; namely Lahaul – Pangi and Kinnaur Landscape.

Chapter 2: Overview and Process Documentation

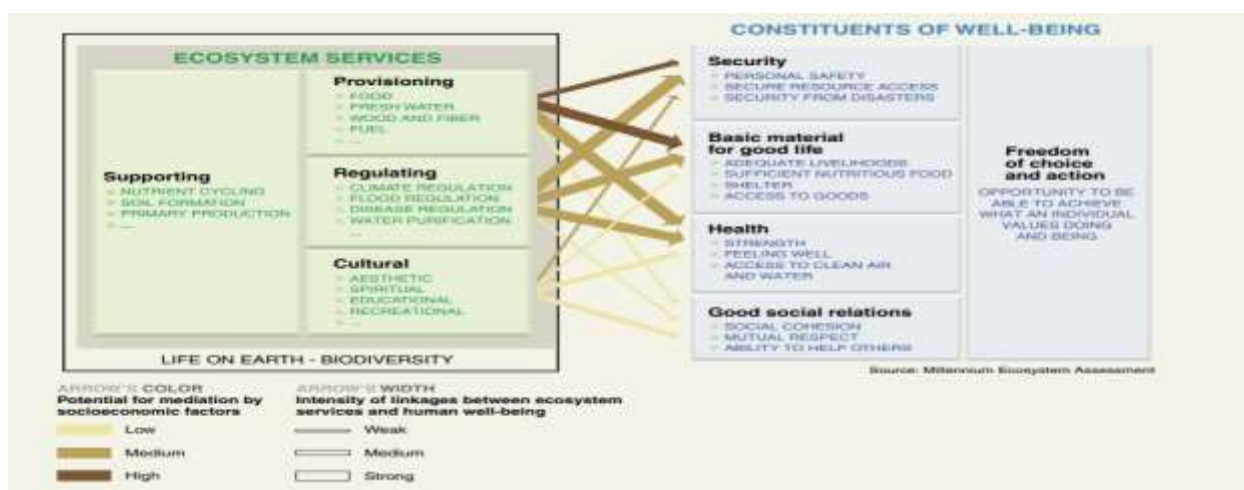
2.1 Vision and Guiding Principles

As mentioned earlier that the present report focusses on Biodiversity Strategy Action Plan (BSAP) and finance solutions only for Lahaul-Pangi and Kinnaur Landscapes in Himachal Pradesh. However, the vision and process adopted this report is same as for the BSAP for the entire state. Keeping in view the completeness of the report and also the convenience of the readers we have provided a detailed ‘overview and process documentation’ here as well. This chapter draws heavily from Chapter 2 in State BSAP report (Pandey, Rita et al, 2021).

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 Biological Diversity (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, 2005.²

* 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

² 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.

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 Research*

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

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

4. *Field-level consultations and 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	16 th 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	25 th 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 in landscapes	24 th September, 2019 and 26 th 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 at Kilar, Pangi
(25th September, 2019)





Chapter 3: Lahaul-Pangi and Kinnaur Landscapes: Profile, Issues and Threats to Biodiversity

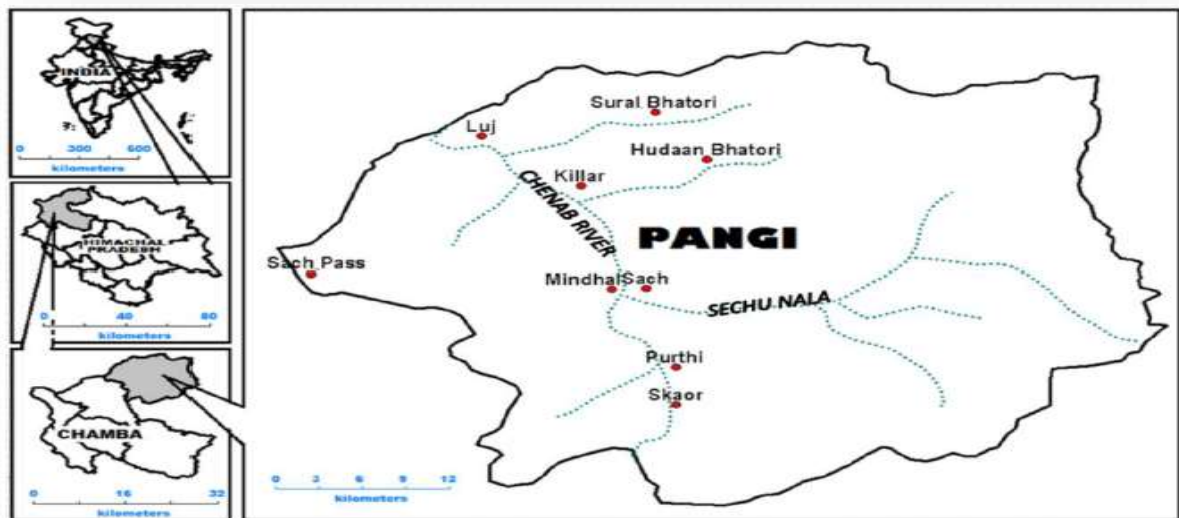
3.1 Landscape Profile

3.1.1 Lahaul-Pangi Landscape

The landscapes selected for the SECURE project are Lahaul-Pangi landscape and Kinnaur Landscape. The Lahaul – Pangi Landscape lies between the Dhauladhar – Pir Panjal and Zaskar ranges in Himachal Pradesh in the upper catchment of Chandrabhaga (Chenab) forming a transition zone between the Greater and Trans-Himalaya. This landscape is contiguous with Doda and Zaskar region of Jammu and Kashmir in the North and spread over an area of nearly 8000 sq. km. The landscape is tough, mountainous, dotted with a number of valleys. The lowest altitudinal limit of Pangi is 2000 m at Sansari Nala and ranges over at 6,000 m comprising the lofty peaks adjacent to the Zaskar range. There are some beautiful sub valleys in Pangi such as Sural Valley, Hudan Valley, Seichu Valley and Parmar Valley, the way through which leads to Zaskar range.

Biogeographically, Pangi region falls in the transition zone of the Himalaya and the Trans-Himalaya. Pangi is a remote, rugged and poorly developed tribal area. One of the reasons for its remoteness is rugged topography cut into deep gorge by river Chenab that flows initially in the western and subsequently north-western direction. Much of the landscape lies in the rain shadow zone of Pir Panjal, having scanty rainfall (<800 mm) and relatively high snowfall.

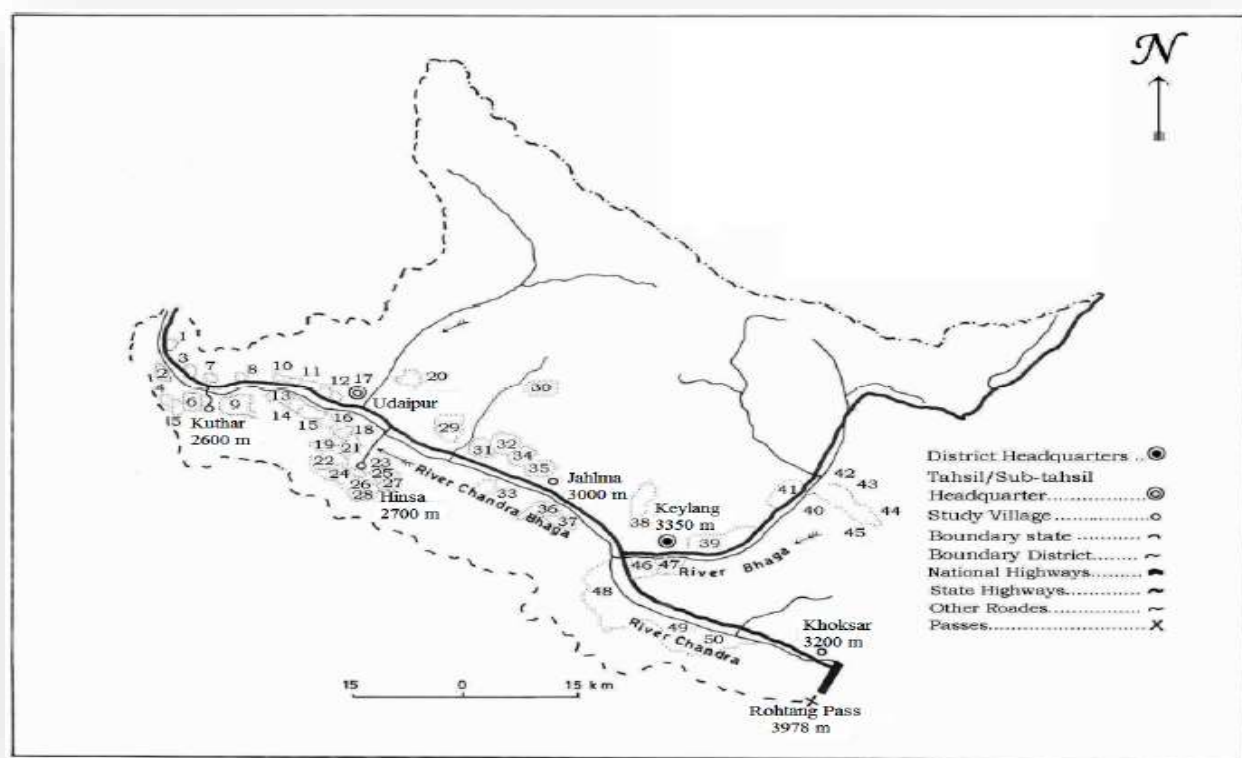
Figure 3.1: Map of Pangi



Source: Prakash et al, 2020

Lahaul is a valley comprising of the two branches of the Chenab River, Chandra and Bhaga. This is a region of crystalline high mountains interspersed with lush pastures that remain the favourite grounds for the nomadic Gaddi herders from lower Himachal Pradesh.

Figure 3.2: Map of Lahaul



Source: Rawat and Everson, 2012

A. Land-use Pattern

The total geographical area in Pangri is 1,60,052 ha. Of which around 87 % (1,39,352 ha.) is forested and 12 % is net sown area. Lahaul is relatively small with 3,472 ha. total area of which 40% is (1,375 ha.) is the net sown area (Table 3.1). In Lahaul-Spiti, forests cover only 7.9 per cent of the total geographical area and is dispersed as small isolated patches in a highly deserted landscape (Rawat and Everson, 2012).

Table 3.1: Land-use Pattern in Lahaul-Pangi Landscape (for 2016-17)

	Pangi (ha)	Lahaul (ha)
Total Geographical Area	1,60,052	3472
Forests	1,39,352	0
Area under Non-agricultural Use	195	320
Barren and Uncultivable Land	1315	188
Permanent Pastures and Other Grazing Land	16,858	1405
Land under Miscellaneous Tree Crops, etc	0	54
Cultivable Waste Land	108	125
Other Fallow Land	239	0
Current Fallow Land	7	5
Net Sown Area	1,978	1375

Source: District Statistical Abstract of Chamba and Lahaul-Spiti, 2017-18

B. Soil and Climatic Conditions

The landscape has mountainous soils (altitude more than 2200 m). The texture of the soil varies from loamy to sandy with varying percentage of gravels and the colour of the soil ranges from light to dark yellowish brown. The soil is slightly alkaline and low in fertility. The climate is extremely cold and the winters are characterized by heavy snowfall. In Lahaul, the winter spans from November to March while the higher altitudes of Pangi experiences first snowfall near mid-October. The snowfall confines people in their houses as the temperature plummets to several degrees below zero (Meena et al, 2019; DOA 2009).

Most of the rainfall (230-740 mm) is received during July-August although precipitation has also been recorded in winter months, when direct snowfall usually occurs. The cropping season spans from April to September. The valley, however, is experiencing the effects of climate change. Meena et al (2019) shows that the landscape has been experiencing decreased snowfall, a rise in the temperature and late onset of monsoon. The summer and winter seasons are getting hotter with the duration of winter season gradually decreasing.

C. Rivers and Lakes

The area is drained by three rivers, which originate from the perennial glaciers. From Baralachha glacier, originate the famous Chandra River (flowing through Lahaul) and Bhaga River (flowing through Spiti). They converge at Tandi, to form the famous Chandrabhaga River. The Chandra passes through barren land in Lahaul and Pangi valley. After entering the territory of Pangi (in Chamba), it is known as Chenab and assimilates many turbulent rivulets on the way. Chenab, the largest river in terms of volume of water, flows 122 km and has a catchment area of 7,500 sq. km. in Himachal Pradesh, before entering Kashmir. This river, as such, is of no economic significance to the area as its water flows uninterruptedly into Pakistan territory as per Indo-Pak Water Commission Treaty (DOA 2009).

D. Floral Diversity

Champion and Seth (1968) recognizes ten sub types of forests in the Pangi region:

Table 3.2: Sub-types of Forests in Pangi

Forest sub-type	Species Found	Location
Neoza Pine Forest	<i>Pinus geradiana</i> , <i>Cedrus. deodara</i> , <i>Fraxinus floribunda</i> , <i>Celtis australis</i>	Found in the dry and rocky areas in Luj and Kanun Reserve forest
Dry Deodar Forest	<i>Cedrus deodara</i> , <i>Pinus wallichiana</i> and <i>Picea smithiana</i> and broad-leaved trees in moist areas like <i>Corylus colurna</i> , <i>Celtis australis</i> , <i>Juglans regia</i> , <i>Prunus cornuta</i> , <i>Fraxinus xanthoxyloides</i>	Spread all over the Chenab and parts of Saichu Nallah
Pohu Scrub Forest	<i>Parroita Jacquemontiana</i>	Found in Bara Bambal, Kulal, Chakmanda, Ajog and Kaslun
West Himalayan Dry Temperate Deciduous Forest	<i>Aesculus indica</i> , <i>Corylus colurna</i> , <i>Acer caesium</i> , <i>Celtis australis</i> , <i>Salix spp.</i> , <i>Juglans regis</i> , <i>Prunus cornuta</i> , <i>Fraxinus spp</i>	NA
West Himalayan High Level Dry Blue Pine Forest	<i>Pinus wallichiana</i> , <i>Betula utilis</i> , <i>Juniperus macropoda</i> , <i>Ribis spp</i> , <i>Rhamnus prostrate</i> and <i>Rhododendron campanulatu</i>	Seichu Valley
West Himalayan Subalpine High Level Fir Forest	<i>Abies pindrow</i> , <i>Betula utilis</i> , <i>Picia smithiana</i>	Above the other coniferous forests

Forest sub-type	Species Found	Location
West Himalayan Birch/ Fir Forest	<i>Betula utilis</i> and <i>Rhododendron campanulatum</i>	Above West Himalayan Sub alpine High level Fir Forest
Birch Rhododendron Scrub Forest	<i>Betula utilis</i> , <i>R. campanulatum</i> , <i>Salix</i> spp, <i>Shrubs- Cotoneaster, Lonicera</i> and <i>Sorbus</i>	Found on the north and north western aspects of the valley
Alpine Pastures	<i>Grasses Agropyron longearistatum, A. semicostatum, Brachypodium sylvaticum, Bromus asper, Danthonia, Festuca, Oryzopsis, Poa. Forbs- Primula, Jurinea macrocephala, Aconitum heterophyllum, Pocomrhiza kurrooa, Anemone, Iris, Gentiana,</i>	Above the forest till snow line
Dry Alpine Scrub	<i>Juniperus pseudosalunia, Artemisia</i> spp. <i>Lonicera</i> spp., <i>Salix, Myricaria</i> and <i>Hippophae</i>	Found in the patches within alpine meadows

Source: Zoological Survey of India (2013)

In Lahual Valley, farmers practice agro-forestry and maintain the naturally regenerating tree and bushy woody species, such as willows, poplars and seabuckthorn along the margins of terraces. Willows and poplars have also been cultivated in the periphery of the villages in plantations on privately owned land and on village common land for fodder, fuelwood and raw material for various domestic uses.

Juniper species (*Juniperus polycarpus* C. Koch, *J. indica* Bertol. and *J. communis* L. var. *saxatilis* (Pallas)) form important species in Lahual valley due to their ability to grow under the barren and xeric conditions of the cold desert (Rawat and Everson, 2012).

Medicinal Plants

The landscape has rich presence of medicinal plants. 67 species of medicinal plants from 59 genre and 36 families have been documented in the area. The uses of these MAPs can be divided into four categories: Medicinal use, human food and food aromatizer, agricultural and veterinary use including plants and fodder, and domestic and handicraft uses (Rana et al, 2013). The study by Rana et al, 2013 found that in the area, only two wild plants, *Inula racemosa* and *Saussurea costus* are domesticated and cultivated for medicinal or commercial purposes and attempts were being made for domestication and cultivation of *Aconitum heterophyllum*, *Podophyllum hexandrum*, *Angelica glauca*, *Valeriana jatamansi*, and *Picrorhiza kurroa* as kitchen garden plants at high altitudinal villages of Sural-Bhatroi, Hudan-Bhatrorri, and Devi Kothi. However, during the consultations by the team of NIPFP in Pangli, it was revealed that any attempt of domestication and cultivation of medicinal plants has not been successful, mainly because of lack of technical know-how.

Lahaul valley has 354 recorded species of medicinal plants belonging to 208 genera and 76 families. In terms of altitude, the greatest number (337 spp.) of medicinal plants was recorded from 2801–3800 m, followed by the 2400–2800 m zone (176 spp.), with the lowest number (90 spp.) in > 3801 m altitudinal zone. The shady-moist habitat accounts for maximum diversity of medicinal plants (144 spp), followed by forest (141 spp.), grassland (108 spp.), dry (96 spp.) and rocky (56 spp.) habitats (Singh, Lal and Samant, 2009).

E. Faunal Diversity

Due to the transitional nature of the landscape, the fauna exhibits an assortment of elements from both Trans-Himalaya and the Himalaya. Owing to higher forest cover, Pangli holds the potential of prime refuge of wildlife in Himachal Pradesh. The following table gives a snapshot of the faunal diversity in Pangli region:

Table 3.3: Faunal Diversity of Pangri Valley

S.No.	Faunal Group	No. of Genera	No. of Species
1.	Protozoa	15	41
2.	Orthoptera	15	16
3.	Lepidoptera (Rhopalocera)	24	36
4.	Lepidoptera (Heterocera)	20	20
5.	Insecta: Heteroptera	05	05
6.	Reptilia	07	07
7.	Aves	50	75
8.	Mammalia	17	19
Total		133	219

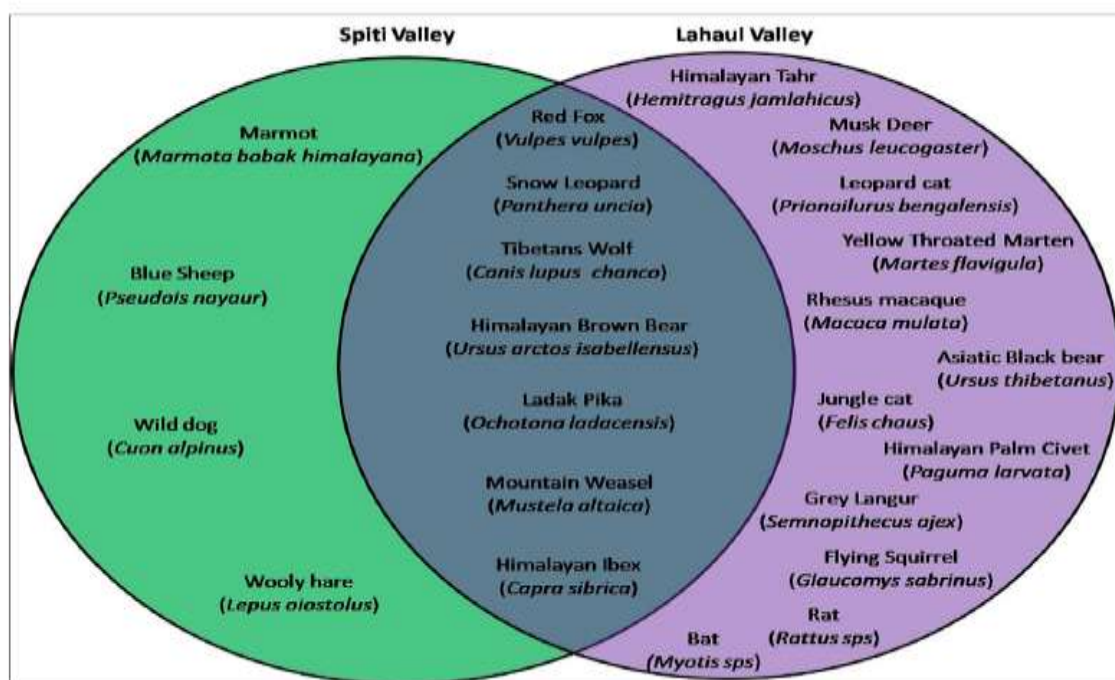
Source: ZSI, 2013

It may be noted that due to torrential nature of Chandrabhaga, there are no Pisces or amphibians in the region. The locals have mentioned that even introduced fishes in culture do not survive in Pangri valley.

Lahaul valley is also known for its unique faunal diversity. Some of the prominent wild animals and birds are Ibex (*Capra ibex*), Bharal (*Pseudois nayaur*), Snow Leopard (*Panthera uncia*), Musk Deer (*Moschus chrysogaster*), Ghoral, (*Nemorhaedus goral*), Himalayan Marmot (*Marmota bobak*), Wild Yak (*Bos grunniens*), Himalayan Snow Cock (*Tetra gallus himalayensis*), Himalayan Snow Pigeon (*Columba leuconota*), Crow (*Corvus caurinus*), Chukor (*Alectoris chukar*), and Bar-headed Goose (*Anser indicus*) (Sharma et al, 2011).

Joshi et al (2020) most recently has attempted to identify and monitor different mammals in Lahaul-Spiti. Figure 3.3 shows the mammals that were tracked down during the study in the area.

Figure 3.3: Mammals in Lahaul-Spiti, Himachal Pradesh



Source: Joshi et al (2020)

Protected Areas in the Landscape

The landscape has only one protected area – the Sechu Tuan Nalla Wildlife Sanctuary. Located in Pangri, the wildlife sanctuary covers an area of 103.00 sq. km. According to Champion and Seth classification, the sanctuary has three types of forests: Himalaya dry temperate forest, moist alpine scrub and dry alpine scrub. The Wildlife Census, 2019 in the sanctuary has found 35 kinds of herbs and shrubs. There is rich presence of medicinal plants such as *Aconitum heterophyllum*, *Jurinea macrocephala*, *Podophyllum*, *Berberis*, *Anglica glauca*, *Saxifraga ligulata*, *Thymus* species and *Ephedra geradiana* (BirdLife International, 2021; PTI, 2019)

The Wildlife Census, 2019 by state wildlife wing in Sechu Tuan Nalla found the following species:

Table 3.4: Wildlife Census, 2019 in Sechu Tuan Nalla Wildlife Sanctuary

Species	Numbers Sighted
Brown Bear	3
Musk Deer	2
Himalayan Ibex	47
Long-tailed marmot	65
Red fox	1
Royle's pika	3
Himalayan stoat	1

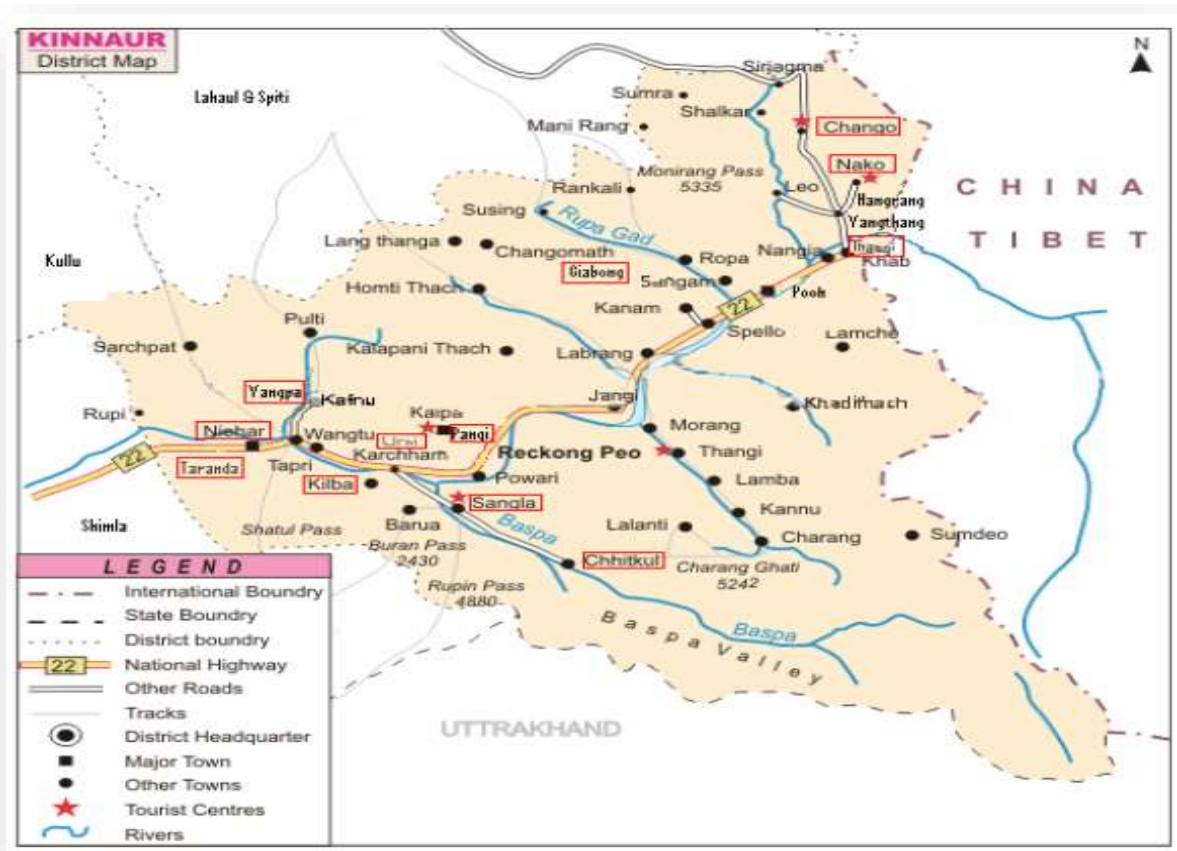
Source: PTI (2019)

The census also found 50 species of birds including Himalayan monal and koklass pheasant, along with 12 species of butterflies and two reptile species.

3.1.2 Kinnaur Landscape

Kinnaur constitutes the part of Trans Himalayan Zone, and is bounded by Lahaul & Spiti in the North, Kullu in the North-west, Shimla in West and in the South-west, state of Uttarakhand in South, while Tibet in its East. It is secluded and mountainous, and is characterised with three parallel mountain ranges, viz., the Zaskar, the Great Himalaya and the Dhaula Dhar successively crossing the river Satluj across the district. The mountain peaks are covered with perpetual snow. There are many glaciers over the Zaskar and the great Himalaya ranges (Census, 2011). Agro-climatically, almost 50 per cent of the area of the district falls in the high hills temperate wet region and 50 per cent in high hills temperate dry region (DOA, 2009).

Figure 3.4: Map of District Kinnaur, Himachal Pradesh



Source: DOA, 2009

A. Land Use Pattern

The total geographical area is 6,24,199 ha., of which 6 per cent of the land is under forests. It is important to note that almost 20 per cent of the area has been classified as barren and uncultivable by the district administration (District Statistical Abstract of Kinnaur, 2017-18). The majority of the area, i.e., almost 51.19 per cent is covered under permanent pastures.

Table 3.5: Land-use Pattern in Kinnaur (for 2016-17)

Land Use Kinnaur	(ha)
Total Geographical Area	6,24,199
Forests	38,592
Area under Non-agricultural Use	1,21,856
Barren and Uncultivable Land	1,30,843
Permanent Pastures and Other Grazing Land	3,19,574
Land under Miscellaneous Tree Crops, etc.	230
Cultivable Waste Land	3,180
Other Fallow Land	122
Current Fallow Land	1,546
Net Sown Area	8,256

Source: District Statistical Abstract of Kinnaur, 2017-18

B. Soil and Climatic Conditions

The topography of the region is such that it is characterised by extreme weather conditions, from heat of Torrid Zone to frozen temperature of Lapland winter (DOA, 2009). The area is characterised by coarse, medium fine and very fine categories of soil. The very fine texture area is highly vulnerable for the soil erosion. In the zones at lower altitude, the climate is humid, and the region has sandy loamy soil and moist salty soil.

The climate of the district varies with elevation and it ranges from the hot tropical type to almost the freezing temperature type of winter. There is a general decrease in rainfall as one goes from west to east (Census, 2011). The lower part (Satluj and Baspa valley) of the district receives monsoon rain. The upper areas above the Reckong Peo of the valley fall mainly in the rain shadow area and considered as arid region similar to the Tibet. Alpine species such as juniper, pine, fir, cypress, and rhododendron can be found at the elevations between 3500 and 5000 m. Oak, chestnut, maple, birch, alder, magnolia, apple, and apricot are temperate trees found at lower altitude (A. Jamwal et al, 2020).

C. Lakes and Rivers

Satluj, the largest river system in Himachal Pradesh, enters the State through Shipki in Kinnaur. It rises from the lake Mann Sarovar on the Tibetan high land and cuts the Zaskar range at Shipkila and enters the district of Kinnaur. The tributaries of river Satluj in this district are Spiti river (razing torrent at Khab village) Ropa, Taiti, Keshang, Mulgoon, Yula, Wanger, Shorang and Rupri on the right bank where as Tirung, Gyanthing, Baspa, Duling and Saol dung are its left bank tributaries (Census, 2011).

The second major river in the district is Spiti. It arises in the far-north on the eastern slope of the mountain ranges running between Lahaul & Spiti. Before meeting Satluj at Khab, it is joined by several tributaries: the Chaladokpo, the Yulang, the Lipak and the Tirasang. Yulang originating between Shiakhar and Leo joins Spiti river after coursing for about 13 kilometres.

Another important river of the area is Baspa, rising from Dhaula Dhar mountain of the Himalayas and passes through the valley by its name and meets the Satluj at a place called karchham. Zupkia, Thathang, Boring, Rukti and Suthi are its important tributaries.

One major lake in the area is Nako lake. It is situated on the western declivity of the large mountain of Reo Purgyal about 1.6 km above the left bank of Spiti river at an altitude of 3604 metre (State of Environment Report, 2009). Another small lake, locally called Sorang, is situated above the village of Ramni and Jamni in Nichar tahsil. A small lake is also situated above Labrang village of Poo tahsil

which is locally called Tomchho. Springs mostly originate from snow are scattered all over the district. The water of spring is used for drinking purposes as well as for irrigation by constructing Kuhls (Census, 2011).

D. Floral Diversity

A total of 893 taxa (*viz.*, species, subspecies and varieties) belonging to 881 plant species, 433 genera and 102 families of higher plants, and 30 species of ferns and fern allies have been recorded in the district. Ten most dominant families are *Asteraceae* (122 species), *Poaceae* (69), *Rosaceae* (58), *Leguminosae* (49), *Lamiaceae* (38), *Ranunculaceae* (30), *Brassicaceae* (29), *Polygonaceae* (29), *Apiaceae* (25) and *Caryophyllaceae* (22). Altogether, these 10 dominant families form 53.4 per cent of the total number of species in Kinnaur and 48.7 per cent of the genera occurring in this region (Chawla et al, 2012).

The region is rich in medicinal plants. The region has 22 of the most commercially valuable medicinal plants, of which 11 face the threats of extinction. These 11 species are: *Aconitum heterophyllum*, *Arnebia euchroma*, *Betula utilis*, *Dactylorhiza hatagirea*, *Ephedra gerardiana*, *Hippophae rhamnoides*, *Hyssopus officinalis*, *Hyoscyamus niger*, *Jurinea dolomiaea*, *Picrorhiza kurroo*, *Rhododendron campanulatum* (Verma and Tiwari, 2016)

Illegal and unscientific extraction are the two major threats that the medicinal plants face in the region (Chawla et al, 2012; Verma and Tiwari, 2016).

E. Faunal Diversity

The presence of snow leopards, blue sheep, ibex, brown bear, leopard cat and jungle cat has been recorded in the area by the Kinnaur Forest Division in a pilot survey conducted by the division in 2017 (Snow Leopard Trust, 2017). In addition to the wild fauna, the region has significant presence of livestock, as has been shown in the table below:

Table 3.6: Livestock in Kinnaur (2016-17)

Livestock	Number
Sheep	66,607
Goats	33,229
Poultry	9,390
Dogs	3,210
Yak	225
Horses and Ponies	582
Mules	620
Donkeys	2,918
Rabbits	29

Source: District Statistical Abstract of Kinnaur, 2017-18

Box 3.1: Increased number of Snow Leopard in Himachal Pradesh

The Wildlife Wing of the Himachal Pradesh has been conducting a wildlife census with the Nature Conservation Foundation, Mysuru. In the census, 52 snow leopards have been identified in 10 remote sites in Lahaul, Spiti, Chamba and Kinnaur. The population of the animal has reportedly increased in the valley since the wildlife wing initiated the Snow Leopard Conservation Project and began monitoring the animals in 2006.

HP is also the first state to set up the Himalayan Snow Leopard Research Centre in an effort to save the 'grey ghost' of the Himalayas. As part of the Census, about 52 animals were identified from 154 sightings across 10 sites, with upper Spiti Landscape recording the highest number of detections: 13 animals spotted 51 times, while 10 animals were found in the upper Kinnaur regions and six around the villages of Tabo in Spiti.

Other places where the cats were spotted included, Bhaga, Chandra, Pin valley and upper Spiti valley in tribal Lahaul and Spiti; upper Kinnaur region and Chitkul valley in Kinnaur district, Lippa Asrang in the upper reaches of Kinnaur and the Great Himalayan National Park as well as the Bharmour in Chamba district.

Source: PTI (2020)

Protected Areas

The district has three wildlife sanctuaries: Lippa Asrang, Rakchham-Chitkul, and Rupi-Bhaba.

Table 3.7: Protected Areas in Kinnaur

Wildlife Sanctuary	Vegetation/Reported Flora	Fauna	Threats
Lippa Asrang (est. 1962)	Himalayan dry temperate forest, alpine arid pastures, alpine dry scrub including kharsu oak, dry broadleaved and scanty coniferous trees	Musk deer, ibex, leopard, Himalayan black bear, brown bear, goral, blue sheep, chukor, yellow billed chough, snow cock, lammergeyer, griffon, and chestnut billed nuthatch	Habitat degradation due to over grazing
Rakchham-Chitkul (est. 1989)	Lower altitude (2,000 m and above): Forest of Deodar, Kail, Chilgoza and Board-leaved species; Higher altitudes (2,800 m and above): fire-Spruce combination with Bamboo-dominated undergrowth Alpine zone (above 2800 m): Rich growth of medicinal herbs like Dhup (<i>Jurinea macrocephella</i>), Karu (<i>Gentiana kurroo</i>), and Patish (<i>Aconitum heterophyllum</i>)	Musk Deer, Serow, Himalayan Thar, Bharal, Ghoral, Leopard and Snow Leopard, Monal, Koklas and white Crested Kaleej and western Tragopan Key Avifauna: Western Tragopan (<i>tragopan melanocephalus</i>), Himalayan or Impeyan Monal (<i>Lophophorus impejanus</i>), Koklass (<i>Pucrasia macrolopha</i>) and Kaleej Pheasant (<i>Lophura leucomelana</i>)	Development activities: Hydroelectric projects called Baspa – I and Baspa – II. The project has brought in roads, equipment of building construction, engineers and infrastructure. Traditional activities: Most of the people are non-vegetarian. Barking deer or Muntjac, which once had a good population, has now become almost extinct

Wildlife Sanctuary	Vegetation/Reported Flora	Fauna	Threats
			because of persecution for meat. Monal pheasant has been traditionally hunted for its crest feathers, which the villagers wear on their caps, as a status symbol. Other pheasants are also killed for meat.
Rupi Bhabha (est. 1982)	Based on the classification of Champion and Seth (1968), there are five forest types in this IBA: Alpine Pastures, Dry Temperate Coniferous Forests, Dry Broadleaf and Coniferous Forests, Kharsu Oak Forest, and Lower Western Himalayan Temperate Forest	Brown Bear, Black Bear, Barking Deer, Musk deer, red Fox, Goral, Ibex, Leopard, Snow Leopard, Serow, Blue Sheep and Himalayan Thar, Western Tragopan, Cheer, Kokals, Blue-throated Flycatcher, White-throated Tit, White-Cheeked Tit, Orange Bulfinch, Hill Partidge, Speckled Wood-Peagon, Himalayan Woodpecker	<p>Anthropogenic Pressure: Livelihoods of local villagers of 15 villages inside the sanctuary and shepherds related to the Sanctuary; both local residents and nomadic Gaddi and Gujjar communities have grazing rights</p> <p>Developmental Activities: Sanjay Vidyut Project led to construction of the generating plant and dam, ancilliary activities such as building, industry, transmission lines.</p> <p>Nathpa Jhakro project, will submerge part of the Sanctuary</p>

Source: Wildlife Wing, HP and Birdlife International

3.2 Threats to Biodiversity in the SECURE Landscape

The Government of Himachal Pradesh has been increasingly investing in the remote and secluded areas, including the landscapes identified under SECURE project. Developmental activities like construction of roads and hydropower plants while make the life of the community easier with opening up of economic opportunities, these also adversely impact the ecologically fragile area. The increasing anthropogenic pressure, climate change, illegal trade in wildlife and forest products also pose threats to biodiversity in the landscapes.

3.2.1 Threats to the floral diversity in the SECURE landscape

1. Illegal Extraction: The Government of HP has banned the extraction of *Aconitum violaceum*, *Angelica glauca*, *Berberis lycium*, *Inula racemosa*, *Picrorhiza kurroa*, *Podophyllum hexandrum*, *Saussurea costus*, *Fritillaria cirrhosa* and *Valeriana jatamansi*. Even then, these species are heavily exploited in the Pangti region (Rana et al, 2014). In Kinnaur, Chawla et al (2012) observed that endangered medicinal plant species viz., *Sinopodophyllum hexandrum*, *Picrorhiza kurrooa*, and *Aconitum heterophyllum* are illegally extracted in very large quantities from alpine meadows. The over extraction of *Fritillaria cirrhosa* (Jungli Lahsun) in Pangti and *Jurinea dolomiaea* in Kinnaur is rampant

so much so that it is almost extinct now (Chawla et al, 2012; Stakeholder consultation by NIPFP team in Kilar, 2019).

2. Excess dependence of locals for livelihood: The tribes in Lahaul-Pangi landscape (Pangwals, Bhots and Lahaulis) are dependent on local biodiversity for their sustenance. Local people collect local species of plants, such as *Taxus Baccata* as a source of trade and income generation and Juniper for religious purposes (Rana et al 2014, Sharma et al, 2014).

3. Habitat degradation: In Lahaul, the volume of removal of woods, leaves, roots and other biomass was higher in the areas in the vicinity of the villages with a bigger population. Overgrazing in the area is also a major issue leading to habitat degradation. The new emerging seedlings are tempered by grazing animals, leading to lower rate of regeneration. The medicinal plants in Kinnaur are facing the treat of extinction due to habitat degradation resulting from expansion of human and livestock population, and overgrazing (Rawat and Everson, 2012; Verma and Tiwari, 2016).

4. Climate Change: The climate change has resulted in warmer winters and longer summers. A decrease in rainfall has also been noted in the valley. This has led to a change in agricultural and natural vegetation in the region. Organic pea is emerging as an off-season cash crop and cultivation of apples is increasing (Meena et al, 2019). *Taxus baccata* L. ssp. *wallichiana* (Zucc.) Pilg. (Himalayan yew) is one of the most valuable medicinal tree species of the region, the germination and survival of which reduces as the temperature grows warmer and rainfall reduces (Sharma et al, 2014; Nimasow et al, 2015).

5. Developmental Activities: The State government has been investing in the landscape for development of social and economic infrastructure. This has caused change in the land-use pattern and occupational structure of the locals leading to a threat to biodiversity in the region (Sharma et al 2011; ZSI, 2013; Verma and Tiwari, 2016).

6. Invasive Species: In recent years, Khicha (local name), has been spotted in the region of Pangi. This species does not let any other plant/grass grow in its vicinity. Moreover, no animal eats it, so it cannot be used as fodder and there is no other known use of this species. Invasive species are also found in agricultural fields. To ensure healthy produce of their crops, the farmers have to hand pluck these species out of their fields (NIPFP Consultation in Kilar, 2019).

3.2.2 Threats to faunal diversity in the SECURE Landscape

1. Poaching and Hunting: Species like musk deer faces threat due to hunting for the musk pod, which is used in making perfumes, incense material and medicines. Hunting of deer is reported to be mostly done by the migratory labourers and outside professional hunters. Poaching is often done using snares, and path obstruction (Bhatnagar et al, 2008, ZSI, 2013 and PTI, 2019).

2. Developmental activities: The developmental activities being undertaken in the Pangi region, although essential to the economic development of the region, have adversely impacted the wild habitat.

Box 3.2: Religion and Biodiversity

The Juniper species of Lahaul Valley forms a significant part of folklore and mythology of the indigenous culture. In the evening local villagers burn juniper leaves in the homes as offerings to their deities. The root of *J. communis* is also used by the local people in the preparation of incense. This species is facing a threat from unsustainable extraction.

In Kinnaur, *Saussurea obvalata* (Brahmkamal) is collected as an offering to the Gods, and is now found only in two localities, namely Nalgong Pass (~4600 m and Chitkul Pass (~4900- 5000m).

Source: Rawat and Everson (2012); Chawla et al (2012).

One glaring example is the extinction of goral in the region, mainly due to road construction. The developmental activities also lead to influx of migratory labourers, whose presence in the area leads to illegal trade of floral and faunal biodiversity (Bhatnagar et al, 2008).

3. Climate Change: The Pangli valley has experienced a change in the population of bees, butterflies, mosquitoes, monkeys, and migration pattern of birds. The population of honey bees, butterflies has decreased while that of mosquitoes has increased. There has also been a decrease in the population of birds such as vulture, chakor, pigeon, monal and crow (Meena et al, 2019).

4. Population pressure: There are 11 villages inside the sanctuary with a population of around one thousand people and 14 villages in the surrounding area of the sanctuary with a population of around 3,000 people. These villagers hold rights for the collection of timber and fuelwood from the forests. The ever-increasing population in the area has also led to increased demand for land for agricultural expansion, and residential and commercial development. This has not only put pressure on forests leading to degradation of wild habitat but also fragmentation and degradation of agricultural land (BirdLife International, 2021, Stakeholder Consultation by NIPFP team in Kilar, 2019).

5. Pressure of Livestock: The local livestock in Pangli is 45,567³ and in Lahaul is 15,334⁴. Further, there are nomadic herders, called *Gaddis*, who also migrate to the region for grazing their livestock. These migratory livestock compete with the existing livestock as well as wild herbivore for fodder. Inside the Sechu Tuan Nalla Wildlife Sanctuary, the number of livestock grazing is also around 3,000. This translates into heavy pressure from human inhabitation, and land degradation due to over-grazing. In recent years, the region has been experiencing acute shortage of fodder, especially during the months of heavy snowfall (Bhatnagar et al 2008; ZSI, 2013; Stakeholder Consultation by NIPFP team in Kilar, 2019; BirdLife International, 2020).

6. Human-wildlife Conflict: In the region of Chasak Batori, Pangli, conflicts with bear are prominent. Bears mostly attack the fields of maize. Monkeys are also a source of trouble as they destroy almost all the crops. Human wildlife conflict happens when the predators come down to the populated areas in search of food, as their prey species have reduced in number due to habitat degradation, and heavy competition for fodder from livestock and migratory herds. Increasing pressure on forests from human and livestock population is leading to increasing cases of human-wildlife conflict in the region.

7. Increasing presence of Feral Dogs: In a survey conducted by Zoological Survey of India for the HP Wildlife Wing, about three feral dogs per 100 sq. km area have been found. Presence of feral dogs in the landscape is a cause of concern as their presence has been linked with loss of biodiversity, depreciation of wildlife species and competition with large carnivores like the Snow Leopard. Feral dogs often feed upon the prey species of Snow Leopard like blue sheep along with rodent species like marmot as well as livestock. Although the presence of feral dogs is not alarming at this stage, mitigation measures need to start now to prevent the imminent threat to the biodiversity of the valley (PTI, 2021; HP Information and Public Relations, 2021).

³ Includes Cows, Sheep and Goats. There are no recorded buffaloes in Pangli. Data has been taken from District Statistical Abstract of Chamba, 2017-18

⁴ Includes Sheep, Goats, and Yak. Data has been taken from District Statistical Abstract of Lahaul-Spiti, 2017-18

Chapter 4: Biodiversity Strategy and Action Plan for Lahaul-Pangi and Kinnaur Landscapes

4.1 Theme-wise Recommendations and Action Plan

This chapter presents the Biodiversity Strategy and Action Plan for Lahaul-Pangi and Kinnaur Landscapes in Himachal Pradesh. Since SECURE project is focused on these landscapes in the state, a BSAP has been put together around the key issues pertaining to Lahaul-Pangi and Kinnaur landscapes (Table 4.1).

The BSAP for these landscapes has covered only the following key threats/issues faced in the landscapes. Further details are available in (Pandey, Rita et al 2021).

1. Overgrazing and shortage of fodder
2. Human Wildlife Conflict
3. Unsustainable extraction of MAPs
4. Cultivation of local varieties of crops

Table 4.1: Issues, Recommendations, Action Points, Time Frame, Indicators and relevant Agencies for Lahaul-Pangi Landscape

Issues/threats	Recommendations/Strategies	Action Points	Time Frame	Indicators	Departments and other Organisations
1. Overgrazing and Shortage of fodder					
<p>1. Limited availability of land as well as long duration of winter season with heavy snowfall creates a shortage of fodder in Lahaul-Pangi landscape. The requirement of fodder for livestock in Lahaul and Pangi is estimated to be 36758.60t & 77926.68t respectively⁵.</p> <p>2. Gaddis are moving up hill in the wild animal habitat in search of pasture for their livestock</p> <p>3. Due to overgrazing, habitat of wild animal species (such as Ibex, brown bear, Himalayan tahr, Himalayan blue sheep, musk deer) in the landscape is shrinking (Greentumble, 2017; Saberwal, 1996).</p> <p>4. Limited awareness of relevant schemes such as ‘Uttam Chara Utpadan Yojana’.</p>	<p>The following recommendations are outlined for fodder management:</p> <p>1. Restore degraded pasture lands on regular basis with native species (native trees, grass, legumes) used as fodder.</p> <p>2. Establish check points for number of livestock taken up hill by Gaddis. Make them an integral part of VFDCs to address the problem of grazing conflicts.</p> <p>3. Training of communities for fodder management during winter season.</p>	<p>Prepare plans to grow species of grass, fodder trees and legumes which are high in protein & can be planted in Lahaul-Pangi landscape to feed livestock. Such as: Poplar tree (<i>Populus spp.</i>), Willow (<i>Salix spp.</i>), Himalayan Birch/Bhuj patra (<i>Betula utilis</i>), Sea-buckthorn (<i>Hippophae</i>), Bichhu Booti (<i>Urtica dioica</i>)</p> <p>Establish a Fodder Bank with the help of technical and local institutions to enhance quantity and quality of fodder. For increased milk output and less pressure on grazing lands.</p> <p>Training of local communities in scientific production & management of fodder under Uttam Chara Utpadan Yojana for higher productivity of livestock and less pressure on forests.</p> <p>Demonstrate methods to educate farmers to enrich crop residues and use it as fodder by adding urea, mineral supplements, etc.</p>	S-M	<p>Degradation of grazing lands is halted.</p> <p>Fodder situation has improved and dependence on forests for fodder is reduced</p> <p>Development of fodder bank at suitable site</p>	<p>DoA</p> <p>Rural Development Department</p> <p>DoAH</p> <p>CSKHPKV</p> <p>PRI</p> <p>VFDCs</p> <p>Praja Mandals, Mahila Mandals and local communities</p>

⁵ Fodder requirement for livestock has been estimated based upon the methodology outlined by Dev, Misri and Pathania (2006) and is discussed in detail in Chapter 8 (Table 8.2)

Issues/threats	Recommendations/Strategies	Action Points	Time Frame	Indicators	Departments and other Organisations
2. Human-Wildlife conflict					
<p>1. Shrinking wild prey base (Ibex, Himalayan Thar, Blue sheep, musk deer) of snow leopards due to habitat destruction of animals. Hence, livestock of pastorals like Gaddis are easy target for snow leopards.</p> <p>2. In Kilar, monkey and bears are the cause of nuisance in agricultural fields. Bears mainly attack the maize crop. Conflicts with bear are common in Chasak Bhattori, Pangi</p> <p>3. Limited Awareness of Compensation provided against losses due to human-wildlife conflict:</p> <ul style="list-style-type: none"> • Crop insurance • Rates of relief for loss to human beings and domestic livestock⁶ 	<p>Identify risk mitigation measures & effective compensation, based upon extensive consultations with state officials, PRIs, Praja Mandal, & local communities</p> <p>Comprehensive database for Human-wildlife conflict along with nature and extent of conflicts in the landscape should be prepared</p>	<p>Ensure availability of food for animals in their habitat. Some of the suggestions are⁷:</p> <p>Plant more fruiting trees in forests to avoid raiding by animals in agricultural lands, identify zones and mark them as grazing/ pasture lands, revive degraded pasturelands in up hills, periodic cleaning of shrubs to provide free movement of animals, sterilization of animals like monkeys</p>	M-L	<p>Number of Human wildlife conflict related cases registered</p> <p>Scientific investigation on HWC conducted</p> <p>A complete protocol of wild animals in conflict prone area established</p>	<p>HPFD</p> <p>SBB</p> <p>JFM</p> <p>PRI</p> <p>VFDC</p> <p>Praja Mandal & local communities</p>
		<p>Conduct investigation on abundance of wild animals in relation to habitat characteristics, land-use pattern, availability of prey species, as well as wildlife forensic genetics</p>		<p>Revival and demarcation of zones for grazing is done</p>	
		<p>Evaluate the experience of ongoing projects/programs such as Insurance Scheme by Nature Conservation Foundation in Spiti (Bijoor, et al, nd) and link it with existing compensation schemes. Make communities aware about such compensation schemes</p>		<p>Convergence of economic instruments for compensation done</p>	

⁶ <https://hpforest.nic.in/files/Rates.pdf>

⁷ Suggestions are based upon interaction with communities in Consultation Workshop organized by NIPFP on 25th September 2019, Kilar, Pangi Valley as well as one-on-one interaction with line departments

Issues/threats	Recommendations/Strategies	Action Points	Time Frame	Indicators	Departments and other Organisations
3. Unsustainable extraction of MAPs					
<p>1. Unscientific extraction: Extraction of <i>A. heterophyllum</i> is done at flowering stage and its tubers/rhizomes are harvested every year as against the suggested optimal harvesting rate of 2-3 years (Butola and Badola, 2008; Singh G. S., 2011).</p> <p>2. Over-extraction: Availability of MAPs like Neoza, kadoo, Panja, Gucchi, Mithi Patish, Nagchattri, Horse chestnut has reduced (Parikh et al, N.d.). <i>Fritillaria cirrhosa</i> (wild garlic) is on the verge of extinction.</p> <p>3. Misuse of Permits: Permits for extraction of NTFPs issued to local communities are misused for illegal extraction of MAPs from the wild. Illegal extraction is done by Gaddis also. The market channel is: Lahaul & Pangi>Bhuntar>Delhi & Amritsar</p> <p>4. There is evidence of locals selling permits, leading to illegal extraction.</p> <p>5. Some of the threatened MAPs in the landscape as listed by HPFD: <i>Aconitum deinorrhizum</i> Stapf, <i>Aconitum heterophyllum</i>, <i>Arnebia</i></p>	<p>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</p> <p>Community-based sustainable cultivation of MAPs by building capacity of institutions such as PRIs, VFDCs, JFMCs, Praja Mandals, Mahila Mandals</p>	<p>A comprehensive focused program should be introduced to provide support for identified medicinal and aromatic plants. From field level consultations, the following species have been identified: <i>Aconitum heterophyllum</i> (Atish), <i>Picrorhiza kurrao</i> (Kadu), <i>Rheum austral</i> <i>Taxus Wallichiana</i> (Chukri), and <i>Valeriana jatamansi</i> (Musakbala).</p> <p>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 MAPs. The model should include quality specifications, bio-chemical compositions suitable for crops and a buy-back guarantee to farmers.</p> <p>Explore cultivation of carefully selected species as a mixed, inter or companion crop in agro and farm forestry (Karki et al, 2003).</p> <p>Regulate enforcement of biodiversity related community-level rules (by-laws) such as penalties imposed by Praja Mandals for illegal extraction of</p>	M	<p>A focused program introduced</p> <p>A business model for promotion of MAPs implemented</p> <p>Capacity building of grass root level stakeholders</p>	<p>HPFD DoEST SBB HPAB HPSMPB GBPIHED JFM BMC PRI Praja Mandals, Mahila Mandals and local communities</p>

Issues/threats	Recommendations/Strategies	Action Points	Time Frame	Indicators	Departments and other Organisations
<i>benthamii</i> , <i>Dactylorhiza hatagirea</i> , <i>Sinopodophyllum hexandrum</i>		MAPs. Explore linking of permits with Aadhar cards.			
4. Cultivation of local varieties of crops					
<p>1. Farmers in Pangti valley are engaged in organic farming (except apples). Farmers face the issue of poor connectivity to market due to remote nature of the landscape.</p> <p>2. In Pangti, farmers are shifting away from cultivation of traditional staple crops such as millets, barley, wheat and pulses to cash crops such as apples, peas, potato, tomato, due to unfavourable changes in climate. The area under traditional crops like <i>Bunium persicum</i> bioss. (kala zeera), <i>Fagopyrum esculentum</i> Moench. (buckwheat), <i>Amranthus candatus</i> L. (amaranth), <i>Saussurea costus</i> Falc. (Kuth) and <i>Crocus sativus</i> L. (saffron) has decreased significantly in Lahaul valley (Rana et. al, 2013)</p> <p>3. Climate change is giving rise to diseases in local varieties of crops such as scab, woolly aphid, and wilt.</p>	<p>Implementation of scheme for branding, labelling and marketing, and value addition of organic produce of local varieties for example, Paramparagat Krishi Vikas Yojana (PKVY)</p> <p>Focus on community-led conservation of local varieties by organizing workshops at village-level with the help of BMCs.</p> <p>Improve seed viability and storage technology to conserve Plant Genetic Resources for Food and Agriculture (PGFRA)</p>	Introduce a comprehensive focused program to provide support to identified niche organic products such as peas, potato, kala jeera, wild garlic, kuth, kutki ⁸ . The program should involve branding, labelling, value added products, marketing, as well as pricing	S-M	<p>A comprehensive target-oriented program is introduced</p> <p>Area under organic shows an increase.</p> <p>Labelling and certification</p> <p>Trainings on organic farming organized</p> <p>Community seed bank established</p>	<p>DoA</p> <p>DoH</p> <p>HPSBB</p> <p>NBA</p> <p>GBPIHED</p> <p>Local communities</p>
		Training to farmers regarding suitable organic crop combination, crop rotation, nutrient and residue management protocol, crop-livestock integration, post-harvest management and storage practices			
		Establish community seed bank 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			
		Incorporate traditional knowledge in PBRs for crop breeding, especially for the crops of economic importance to help farmers (National Research Council, 1993, p. 119)			

⁸ Consultative workshop organized by NIPFP on 25th September 2019 in Kilar, Pangti Valley, Himachal Pradesh

Issues/threats	Recommendations/Strategies	Action Points	Time Frame	Indicators	Departments and other Organisations
4. Availability of Gucci has decreased					

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 biodiversity⁹. 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 in Lahaul-Pangi and Kinnaur landscapes.

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	Direct	Direct	Direct	Indirect

⁹ 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
	In most cases except Aichi Target 9 & NBT4		In most cases except when it is a very small component	Direct only when implemented by MOEF&CC; There can be some deviations

5.2 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 introduced a 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% 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. Since each ITDP has its own needs and requirements, therefore each ITDP is free to determine its own priorities and allocate funds only to those schemes which are relevant to the area.

5.2.1 A snapshot of number of biodiversity relevant schemes implemented

The number of schemes implemented in Kinnaur, Lahaul-Spiti, and Pangi landscapes (Tables 5.2 and Table 5.3) ranged from (64 – 72) during 2014-15 to 2016-17. It would be seen from these tables that in terms of the number of schemes implemented there is an upward trend during the period of the analysis which is encouraging.

Table 5.2: 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

Classification by Impact	2014-15	2015-16	2016-17
Major Scheme	8	9	9
Total	64	65	72

Source: Author's Calculation

Table 5.3: 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: Author's 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 identified districts/sub-districts. Therefore, we present the analysis and results separately for these areas.

A. PANGI (Tehsil of Chamba)

The biodiversity related expenditure shows a gradual increase during the period under study (Table 5.4). 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 conservation agenda are showing an upward trend (Figure 5.1).

Table 5.5 shows that maximum expenditure has been incurred in the schemes having direct and indirect very high impact on biodiversity, which is encouraging.

Table 5.4: Biodiversity Attributable Expenditure in Pangri

	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: Author's calculation

Table 5.5: 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: Author's calculation

Figure 5.1: Biodiversity Related Expenditure (CBD Classification) - Pangl

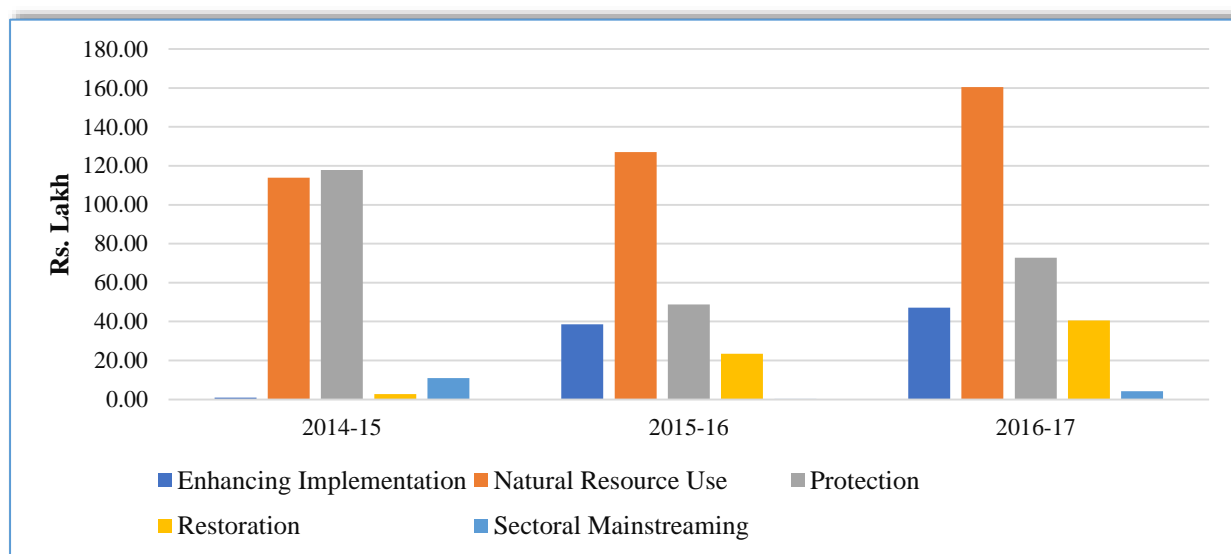


Table 5.6 presents department-wise expenditure on biodiversity conservation. As expected, the Departments of Agriculture and Forest are key departments in terms of total expenditure on biodiversity in Pangl. Department of Horticulture, irrigation and rural development show an increasing trend in expenditure 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 5.6: 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

Departments	2014-15	2015-16	2016-17	Departments	2014-15	2015-16	2016-17
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: Author's calculation

B. LAHAUL

Biodiversity attributable expenditure in Lahaul shows gradual increase during 2014-15 to 2016-17 (Table 5.7). Sustainable use of natural resource is the top focus followed by activities contributing to enhancing implementation of biodiversity conservation. As in the case of Pangri, expenditure on restoration activities shows a positive trend which is a good sign (Figure 5.2).

Table 5.7: 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

Table 5.8: Expenditure of Biodiversity Relevant Scheme by Type of Impact (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

Classification of Impact	2014-15	2015-16	2016-17
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: Author's Calculations

Figure 5.2: Biodiversity Related Expenditure (CBD Classification) - Lahaul

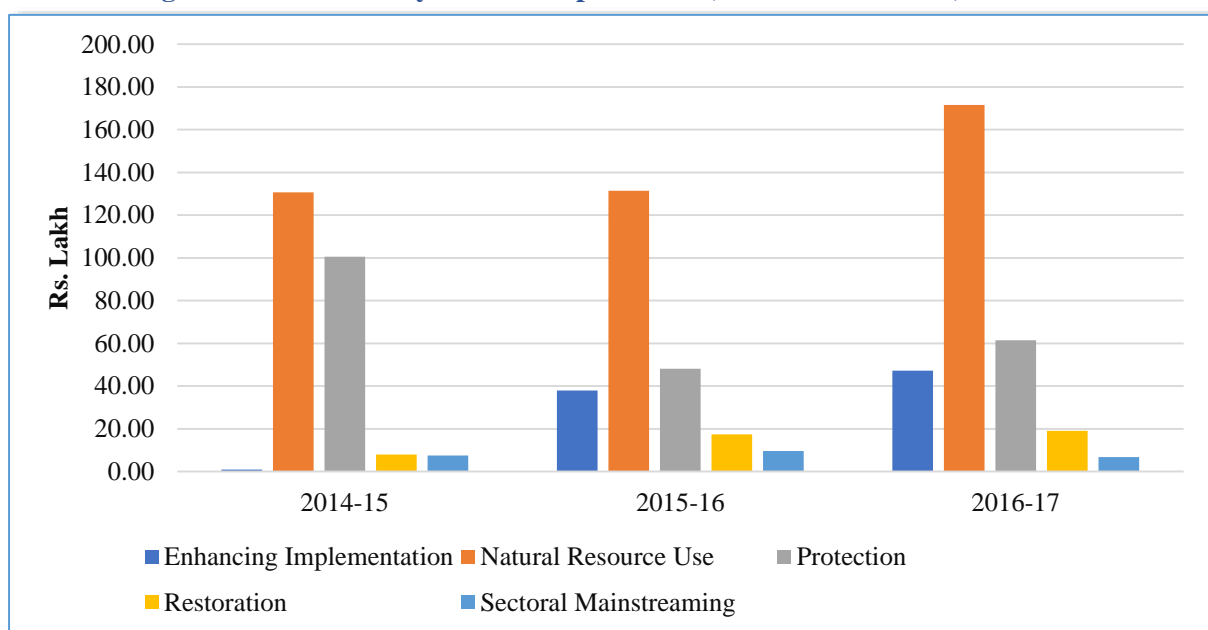


Table 5.9 shows the contribution of schemes of different departments of the District during the period 2014-15 to 2016-17 on various activities which support biodiversity conservation. As expected, the Departments of Agriculture and Forest are key departments in terms of total expenditure on biodiversity. 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 5.9: 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

Departments	2014-15	2015-16	2016-17	Departments	2014-15	2015-16	2016-17
Ayurveda	0	0.00	1.33	Rural	9.73	13.85	20.99
Fisheries	5.55	4.42	3.63	Development			
Forest	85.5	47.41	65.05	Tourism	0.00	0.00	0
Horticulture	11.88	44.92	53.04	Transport	0	0	0
				Water & Sewerage	2.06	2.88	2.58
				Youth and Sports	0.19	0.11	0

C. KINNAUR

The biodiversity related expenditure has increased gradually over the study period of 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. 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 5.3).

Table 5.10: Biodiversity Attributable Expenditure in Kinnaur

	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: Author’s Calculation

Table 5.11: 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

	2014-15	2015-16	2016-17
Total	223.25	249.96	539.32

Source: Author's Calculation

Figure 5.3: Biodiversity Related Expenditure (CBD Classification) - Kinnaur

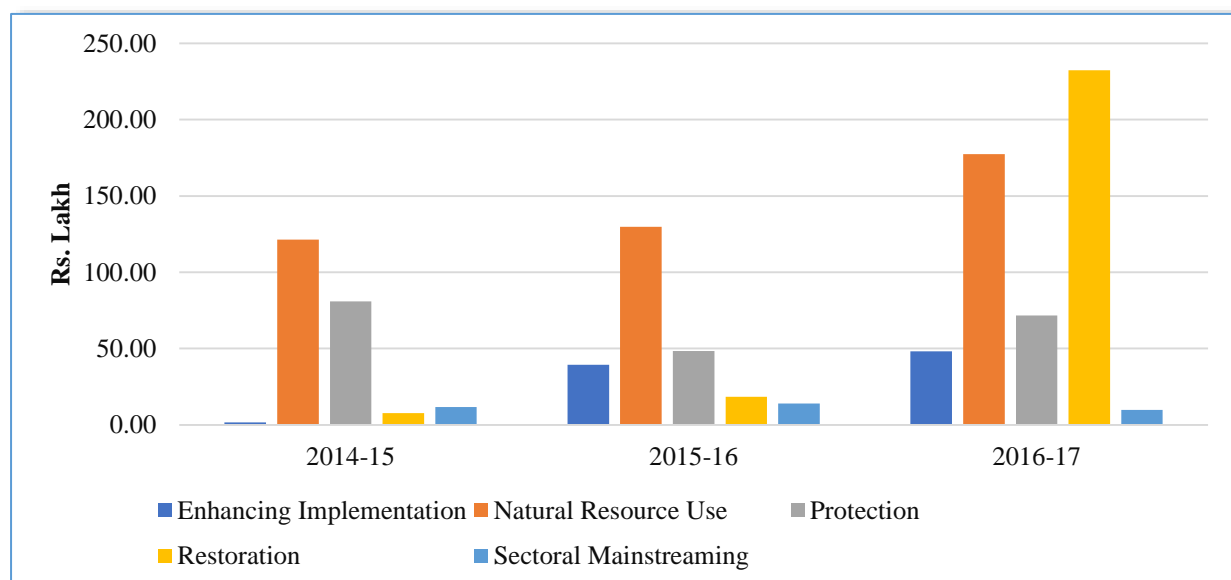


Table 5.12 shows the contribution of schemes of different departments of the District during the period 2014-15 to 2016-17 on various activities which support biodiversity conservation. As expected, the Departments of Agriculture and Forest are key departments in terms of total expenditure on biodiversity. Department of Horticulture 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 5.12: 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

Departments	2014-15	2015-16	2016-17	Departments	2014-15	2015-16	2016-17
				Youth and Sports	0.19	0.11	0

5.3 Conclusion

While the departments of forest, agriculture and horticulture incur significant expenditure on biodiversity, expenditure on tourism, transport and ayurveda is extremely low. A planned and focussed approach to increase expenditures on these can potentially contribute to livelihood opportunities thereby reducing the pressure on forest resources.

Chapter 6: Financial Solutions

6.1 Financial Solution I: Community Fodder Bank

6.1.1 Background

A Community Fodder Bank (CFB) is formed when a group of farmers come together, to raise multiple fodder crops consisting of trees, grasses and legumes (largely in wastelands), to meet the following:

- i. The fodder requirements, especially during peak winter can be met from a CFB.
- ii. Increasing the productivity of livestock with the appropriate nutrition through quality feed for ruminants. In view of their peculiar digestive system, the feed meets their digestive requirements. Fodder from common cereal crops like Maize, Sorghum and Oats are rich in energy and the leguminous crops like Lucerne, Berseem & Cowpea are rich in proteins (Meena and Singh, 2014).
- iii. Reduce pressure on forests and replenishing arable lands that have lost their fertility. Typically, a fallow land is sown to leguminous perennial forages or self-seeding perennials so as to rebuild the nitrogen content of the soil through biological nitrogen fixation. It also contributes to control soil erosion.

In Himachal Pradesh, the Forest Department and PMU, UNDP have shown great interest in the idea of establishing fodder bank at SECURE Landscape. The idea was also placed in front of the community during a consultation workshop held by the study team at Kilar, HP and the idea was well-received.

6.1.2 Shortage of fodder and pressure on grazing lands due to overgrazing: A serious issue

According to VISION 2050 report by Indian Grassland and Fodder Research Institute, India faces a net deficit of 10.95% dry crop residues, 35.6% green fodder, and 44% concentrate feed ingredients. The demand and supply scenario of fodder and deficit analysis for India is presented in the Table 6.1 below:

Table 6.1: Demand, supply and deficit of dry and green fodder

Year	Demand		Supply		Deficit		Deficit as %	
	Dry	Green	Dry	Green	Dry	Green	Dry	Green
2010	508.9	816.8	453.2	525.5	55.72	291.3	10.95	35.66
2020	530.5	851.3	467.6	590.4	62.85	260.9	11.85	30.65
2030	568.1	911.6	500	687.4	68.07	224.2	11.98	24.59
2040	594.9	954.8	524.4	761.7	70.75	193	11.86	20.22
2050	631	1012.7	547.7	826	83.27	186.6	13.20	18.43

Source: VISION 2050, Indian Grassland and Fodder Research Institute, 2015

This brings the urgency of meeting fodder demand with good quality fodder resources. Efforts are required to bring together potential technologies that have been developed by research institutes along with key local stakeholders to improve the quality as well as quantity of fodder.

Livestock rearing is an important occupation in Himachal Pradesh yet availability of fodder, especially in winter has remained an issue. Dev, Misri and Pathania (2006) have given a methodology to estimate the requirement of fodder, which has been used to derive the fodder requirement in Pangi and Lahaul¹⁰.

¹⁰ The data for livestock has been taken from District Statistical Abstract for Chamba and Lahaul & Spiti (2017) from Himachal Pradesh Economics and Statistical Department. Accessible at: https://himachalservices.nic.in/economics/pdf/ChambaAbstract_2017_18.pdf https://himachalservices.nic.in/economics/pdf/LahaulAbstract_2017_18.pdf

Table 6.2: Demand of Fodder for Livestock in Pangri and Lahaul for 2016* (in tonnes)

Animals	Pangri	Lahaul	Estimated Deficit Pangri	Estimated Deficit Lahaul
Cattle	28924.43	12973.01	9255	4151
Buffaloes	0.00	0.00	10,659	6939
Sheep	33311.36	21685.38	4981	162
Goats	15566.34	509.72	39	508
Others	124.56	1590.49	24,936	11,762
Total	77926.68	36758.60	9255	4151

Note: Deficit calculated at 32 per cent of the total demand (Gupta et al, 1998)

*latest year for which landscape data is available.

Source: Authors' calculation based on Dev, Misri and Pathania (2006)

6.1.3 Issues related to fodder in Lahaul-Pangri Landscape, and the need of fodder bank

During the consultation workshop held at Kilar, the members of community expressed the following concerns regarding access and availability of fodder, especially in the winters.

- The scarcity of fodder is severe in winters, as the valley receives heavy snowfall every year. Although, the residents stock up fodder to be used in winters, it is not possible to stock up the optimal amount. In such case, the residents, especially women, have to extract the grass from beneath the snow. Walking on snow on sloped land also causes accidents.
- There has also been a decline in availability of fodder in the valley, over the years.
- The members of the community suggested that to tackle the problem of shortage of fodder, nurseries be set up by the government to grow fodder grass in the trails which are not suitable for crop cultivation. Some nurseries can be set up uphill where plants like bhuj patra can be grown in suitable climatic conditions which are used as fodder in Pangri.
- There is a need to document the vegetation that can be used as fodder based on the nutrient content. The green grass of Kilar is very rich in protein and another local plant called bichoo booti is rich in calcium. Documentation and awareness about the nutrient rich plants is necessary to improve the quality and quantity of fodder in the area.

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. To address the shortage of fodder, an initiative is being carried out at Nauni, in Solan district of Himachal Pradesh by Dr. Yashwant Singh Parmar University of Horticulture and Forestry to promote the cultivation of *Grewia Optiva*, commonly known as '*Beul*'. This project has been sanctioned by the National Mission on Himalayan Studies, and is expected to run for five years with an aim to make high yielding and nutrient rich varieties of *Beul* easily available to the farmers of Himachal Pradesh.

A study carried out in relation to this initiative found that in Himachal Pradesh, the grasslands are poor in respect of their productive potential and carrying capacity; and there is also an imbalance in human cattle population (1:1.25) which indicates heavy pressure on natural forest for fodder, small pole, timber and fuel wood etc (Khanna, 2019).

8.1.4 Lessons from Best Practices

While reviewing the literature related to Community Fodder Bank, two models existing in India come to light.

- a. **Model 1:** CFB model in surplus fodder from good season is purchased and stored to be sold out to communities during seasons of shortage. **Example:** Fodder Bank Model proposed by Kutch Nav Nirman Abhiyan¹¹ to be established in Varnu village of Kutch.
- b. **Model 2:** CFB model in which fodder is planted, harvested and stored to be used during the time of shortage of fodder. **Example:** CFB in Ratadia village of Kutch, Green Fodder Bank proposed in Vellore and Vallipuram districts of Tamil Nadu.

In order to understand the concept of Community Fodder Bank, the following relevant lessons and experiences from global and local experiences should be noted.

Table 6.3: Global Lessons and Local Experiences for CFBs

S. No.	Place where CFB was established	Project details and governance structure	Experiences and Lessons
1.	Maikhanda village, Uttarakhand State, India	<p>Initiation: G.B. Pant Institute of Himalayan Environment and Development (GBIHED)</p> <p>Governance: Governed by GBIHED but heavily managed by <i>Mahila Mangal Dals</i> (MMDs), with support from the Panchayat. Project intends to shift entire management to MMDs in three years.</p>	<p>Fodder Banks can relieve women from drudgery in collecting fodder from distant forests, by empowering local women's governance bodies.</p> <p>Active involvement of local governance bodies and their engagement is necessary to develop the community's trust and cooperation. The village's women and men have immensely supported the programme because they were empowered through trainings and capacity building programs.</p>
2	Ratadia, Taluka Mandvi, Kutch (India)	<p>Initiation: Yuvak Mandal of Village Mota (Local Governance Body of Village)</p> <p>Governance: Local Governance Body – Yuvuk Mandal, later registered as Ratadiya Gram Vikas Manda.</p>	<p>The local governance body raised funds through innovative means like street plays, dramas, and entertainment programmes in surrounding villages; and through contribution from the villagers.</p> <p>This was supported by the government as eventually the organisation was registered. Their main source of income is through selling of surplus fodder, other cultivated crops and government subsidies. In drought years, the Mandal feeds 40 mounds of dry fodder and 150 mounds of green fodder daily to 350 cattle of the village.</p>
3	Vellore, Tamil Nadu (India)	<p>Initiation: Joint Venture: Department of Animal Husbandry, Rural Development and Panchayati Raj and Tamil Nadu Veterinary and Animal Sciences</p>	<p>Sustainability of fodder bank ensured by providing subsidy for farmers for five years, before handing over the project to the Panchayati Raj Institution. In these 5 years, training and empowerment conducted for the PRI.</p>

¹¹ Kutch Nav Nirman Abhiyan is a network of 27 non-government organizations spread across Kutch. This network emerged as a response to the 1998 Kandla Cyclone where it became a coordinating point between NGOs, a forum for advocacy and policy recommendations to the government and a platform for collective implementation.

S. No.	Place where CFB was established	Project details and governance structure	Experiences and Lessons
		University. Plantation of fodder grass engaged MGNREGA staff.	
Global Lessons			
1	Nigeria, West Africa	<p>Initiation: International Livestock Centre (ILCA), Nigeria</p> <p>Governance: ILCA managed costs and governance, but agropastoralists were routinely consulted for governance and decision making</p>	<p>The focus of the project was on a “low-input supplementary feed innovation”, where legume fodder banks were developed to improve the nutrition of the cattle.</p> <p>Searches for other productive, disease-tolerant and competitive legume species were undertaken to maximise productivity of livestock.</p>
2	Uganda	<p>Initiation: National Livestock Resources Research Institute under The National Agricultural Research Organization, Uganda</p> <p>Governance: The National Agricultural Research Organisation and government ministry; but with active participation from farmers and livestock owners.</p>	<p>Focus has been on partnership building to combine skills between farmers, policy makers, service providers and institutions for maximum impact and giving greater strength to scale up the fodder bank innovations</p> <p>Participants were guided around the demonstration plots by the extension staff and the researchers.</p>
3	Ghana	<p>Initiative: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) in collaboration with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and The Council for Scientific and Industrial Research-Animal Research Institute (CSIR-ARI)</p> <p>Governance: Same agencies as above</p>	<p>This project is implemented with the ambition to improve fodder availability and nutritional quality for ruminants during dry periods in the Ghana Climate-Smart Villages. The aim was to establish a multi-species fodder bank with farmers to demonstrate efficacy for climate-smart livestock production (the process that increases productivity, and enhances resilience (adaptation), reduces/removes greenhouse gases (mitigation)). To produce climate-smart livestock, it is important to improve the diet of the livestock so that animals produce more proteins with less feed and lower emissions.</p>

Source: Compiled by the Authors from various sources¹²

¹² Dhyani, Maikhuri & Dhyani (2013); Girdher (2010); PTI (2015); Saleem and Kaufmann (1995); Blog (Changemakers.com); <https://ccafs.cgiar.org/index.php/research/projects/multispecies-fodder-bank-climate-smart-option-improved-livestock-nutrition>

Important Lessons

It is noteworthy that the success of CFBs has been dependent on active involvement of local communities. Empowerment of local communities through rigorous training develops trust and cooperation, which is necessary for the smooth functioning of this model. Partnership building for effective governance and coordinated efforts are the backbone of a CFB, as inferred by studying the best practices worldwide.

The model proposed for SECURE Landscape is inspired by the project in Maikhanda village, Uttarakhand.

6.1.5 Technical Requirements of setting up a CFB

The technical requirements of establishing a CFB can be divided into a Pre-Establishment Process, and a Post-Establishment Process (Venugopalan et al 2016). These have been illustrated below.

Pre-establishment process

1. Site Selection: Common property resources (CPRs), including wasteland, grazing lands, uncultivated lands and land not suitable for growing crops can be selected. For establishing a fodder bank, an area of 6 ha is needed, along with an area of 250 sq. m. to set up a nursery.

2. Bunding: To retain rainwater (unexpected rains) in the soil, at least 30 cm high bunds are needed. On light soils, grasses should be planted on bunds to make them stable. On sloppy lands, bunds are formed along the contour or across the slope.

3. Planting Material: A mixture of tree, grass and legume fodder species of both annual and perennial nature suitable for rainfed condition is highly preferable to meet the nutritional demand of livestock and ensure supply of fodder throughout the year. Fodder crops with the following characters are ideal for this purpose: establish easily; grow quick; out-compete weeds; produce high-quality fodder; remain productive under repeated harvest; withstand dry season with limited water sources; survive on poor soils. The plants should be chosen with the help of scientific institutions as well as traditional communities.

4. Spacing: Choice of spacing depends on the soil and fodder components chosen. Total biomass yields per area increase at higher densities. Wider spacing are generally used when both fodder and small diameter wood, for fuel or poles, are desired. Closer spacing maximizes fodder production, but may make access for harvest or grazing difficult. Spacing of 1x1 meter is common for many species. Fodder production and accessibility can be improved by using double rows of fodder trees at wider spacing. Rows are established about 50 cm apart with 1-1.5 meters between double rows. Once the fodder bank is well established, grass should be allowed to grow in the area between double rows. Competition between bank trees and grass will not be as severe as during the establishment period. Tree roots will feed from deep in the soil, grass from near the surface. Their difference in height will also decrease competition for sunlight. This two-tiered system produces more fodder per area than either plant type alone. The grass grown in the inter-row area should be an excellent fodder species.

Post Establishment process

1. Weed Management: Their initial growth is often slow. In general, perennial fodders take about six months to establishment) sustain itself and compete with weeds. Proper care should be taken to keep the fodder bank weed free. Weeds should be controlled from the very beginning through use of pre-emergence herbicides, clean and pure seeds and inter cultivation practices. Weed menaces reduce with the establishment of perennial fodder component.

2. Fertilization: Fodder banks are long-term crops that must be properly maintained to continue high productivity. Nitrogen, phosphorus and potassium are important nutrients. Application for these and other nutrients should be determined locally. Availability and costs of fertilizers may restrict their use. The nitrogen requirement may be self-provided if the species used are nitrogen-fixing.

3. Irrigation: Most of the fodder crops require enough soil moisture to establish. Efficient and low-cost system like rains gun is a good option. Experience of CRIDA-KVK showed that rain-gun system in fodder crops is cost effective with higher water productivity.

4. Harvesting: Actual age at first harvest depends on environmental conditions and bank growth. In case of perennials, it takes about 12 months for establishment. However, if it is an annual it can be harvested within 3-4 months. The aim is to allow fodder bank species to establish deep roots and thick trunk diameters. This is an important consideration in arid and semi-arid environments.

5. Methods of feeding livestock

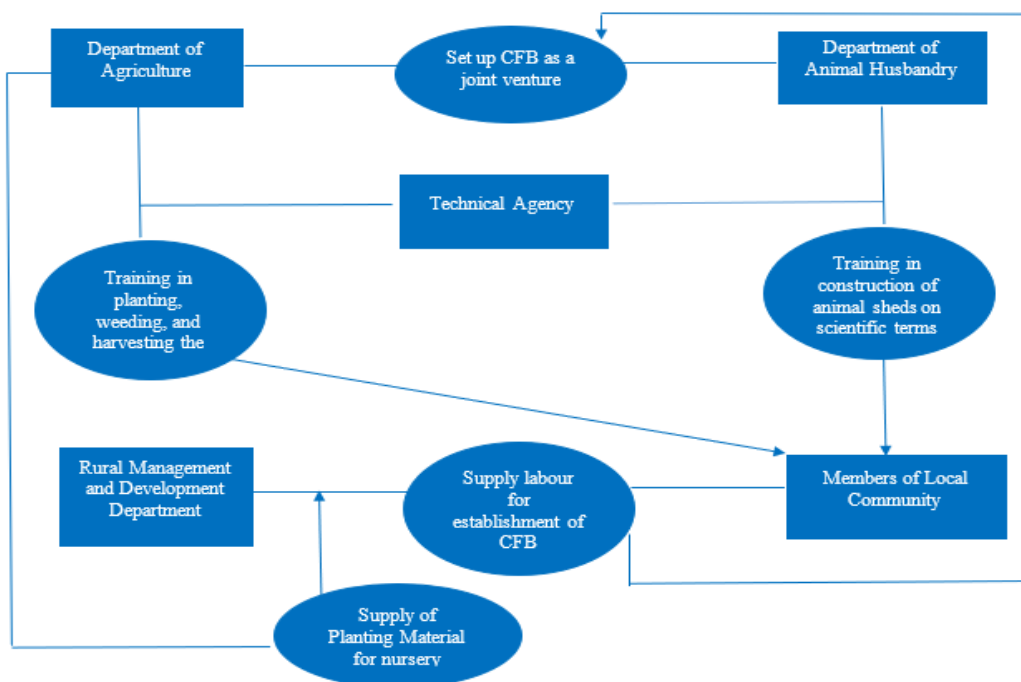
- **Grazing:** Fodder banks can be directly grazed by livestock. However, it can cause permanent damage to plant and fodder waste from trampling. The key to direct grazing is subdivision of the fodder bank into paddocks. Livestock should be restricted to one paddock until the available fodder resource is fully utilized. Animals should then be moved to the next paddock.
- **Cut and carry approach:** Most fodder banks are managed through a cut-and-carry system in which the fodder is harvested and then 'carried' to the livestock. A cut-and-carry system decreases fodder waste from animal damage and the necessity to monitor animals. However, labour inputs may be greater than with direct grazing systems.

Important management factors to consider for a cut-and-carry system are cutting height, cutting frequency, and dry season management. These factors are all influenced by precipitation, temperature, soils, species, plant spacing, as well as each other.

6. Cutting Frequency: The most common cutting frequencies are 6-18 weeks. Generally, longer cutting frequencies, 12-18 weeks, generate more total biomass but increase the proportion of small wood production. Shorter cutting frequencies, 6-12 weeks, favour fodder yields and fodder quality. Younger foliage tends to have a higher nutritive value and palatability. However, repeated cutting after short frequencies decrease longevity. Under arid, sub-humid or temperate conditions regrowth may take longer to reach this height, cutting frequencies may need to be extended.

6.1.6 The Model for Community Fodder Bank

Figure 6.1: Model for Community Fodder Bank



Source: Compiled by NIPFP

Notes:

A. Technical Agencies for Training:

According to the guidelines for implementation of National Livestock Mission, under the sub mission of fodder and feed development, the following agencies are eligible to impart training to farmers, researchers, academicians and officials on production, conservation, and efficient utilization of feed and fodder:¹³

Department of Animal Husbandry Dairying & Fisheries, Agriculture Department, Krishi Vigyan Kendras, Indian Council of Agricultural Research, Institutions and Research & Development Organizations, Agriculture and Veterinary Universities. Based on this, the following technical agencies have been identified:

- Indian Grassland and Fodder Research Institute (IGFRI), Jhansi, India
- Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya (CSKHPKV), Palampur, HP
- Dr Y S Parmar University of Horticulture & Forestry, Nauni, Solan, HP
- G.B. Pant Institute of Himalayan Environment and Development, Almora, Uttarakhand
- Himalayan Forest Research Institute, Panthaghati, Shimla

B. Facilitator

Department of Forest and UNDP will act as the facilitator by bringing all the players of the model to the table of negotiation and finalising of the contracts among them.

C. Other Stakeholders

In addition to the stakeholders mentioned in the flow chart, following stakeholders may be consulted time to time for establishing and functioning of the CFB:

- Praja Mandal, Mahila Mandal, Yuvak Mandal (For governance of CFB)
- Panchayat (For governance of CFB)
- Local communities

6.1.7 Capacity Building Framework for the Community Fodder Bank

For the success of the project, the various departments have to take up some functions and for execution of those functions, some skill sets are required. The following table shows the responsibilities of the different departments and the skill set required to execute those responsibilities.¹⁴

Box 6.1: Fodder species for Lahaul-Pangi Landscape

Beul (*Grewia oppositifolia*)
Grewia Optiva
Poplar tree (*Populus* spp.)
Willow (*Salix* spp.)
Himalayan Birch (*Betula utilis*)
Sea-buckthorn (*Hippophae*)
Bichhu Booti (*Urtica dioica*)
Astragalus rhizanthus
Cicer microphyllum
Desmodium elegans
Hedera nepalensis
Impatiens sulcata
Lonicera quinquelocularis
Morus serrate
Origanum vulgare
Rumex acetosa
Silene vulgaris
Smilax aspera
Ulmus wallichiana
Source: Consultation in Kilar, Rana et.al 2014; Rawat and Vishvakarma 2010

¹³ Guidelines for implementation of National Livestock Mission, Annexure C-V, Available at: <http://dahd.nic.in/sites/default/files/REVISED%20GUIDELINES%20OF%20NLM%2027.04.16.pdf>;

¹⁴ Adapted from Final Report on Developing a Capacity Development Framework for Strengthening State Medicinal Plant Board in Uttarakhand by IDCG, 2012; Available at: http://smpbuk.org/document/capacity_dev.pdf

Table 6.4: Responsibilities, Actions and Skill Sets Required for Community Fodder Bank

Department	Desired Function of the Department	Activities	Skill Sets Required at the Department
Department of Forest and UNDP	Planning, Thought, Leadership and Strategizing	Coordination with all stakeholders for maintaining desired direction	Strong coordination and persuasive skills with strong sector expertise to command respect.
Department of Agriculture		Establishing itself as a nodal agency leading the effort for success of the project	Experience of dealing with multiple stakeholder agencies and coordinating for excellence
Department of Agriculture	Advisory to all stakeholders Departments/Agencies on formulation of policy, project and schemes for fodder production	Technical Assistance in formulation of projects, schemes and policy	Experience of providing technical assistance and backstopping support for formulation of projects, schemes and policy
Department of Agriculture, and Department of Animal Husbandry and Veterinary Services	Documentation of knowledge in fodder production and making it available in public domain	Documentation of best practices	Very good Knowledge Management & Documentation experience and maintain digital knowledge repository for dissemination and knowledge building in the sector
		Documentation of case studies	Strong Documentation Skills and exposure to the ecology/biodiversity/participatory management domain.
Department of Rural Development (Block Development Officer)	Building capacities of grass root level stakeholders	Identification of the cultivators to work in the fodder bank by coordinating with local bodies like Praja Mandal, Mahila Mandal.	Coordination with stakeholders, with strong experience in livelihood domain, training and community mobilisation experience. Strong experience in Communication, Knowledge Management and Knowledge sharing
Department of Agriculture, and Technical Agency		Facilitating training of cultivators on right techniques for cultivation, post-harvest management	
Department of Agriculture, and Technical agency		Training to cultivators for soil and water management	
Department of Agriculture, and Technical Agency		Facilitating course material and course curriculum development for training of cultivators	

Department	Desired Function of the Department	Activities	Skill Sets Required at the Department
Department of Animal Husbandry, and Technical Agency		Training for construction of animal houses and sheds on scientific lines provided with cost-effective feeding and watering systems and proper ventilation using locally available materials	
Department of Agriculture	Monitoring and Evaluation	Monitoring the implementation of the project at the earlier stages, before it is handed over to the community	Strong experience with M&E frameworks, methods and approaches (including quantitative, qualitative and participatory) in community-based natural resource management projects

In addition, the members of the community need to be trained so that they acquire skills and knowledge base to ensure proper functioning of the community fodder bank. Thus, the training programme should focus on inculcating following skills and knowledge base within the members of the community. Table 6.5 shows the teaching aids that may be used during the training sessions to impart the training to the community members, and the departments with which the technical agencies need to coordinate for the purpose of imparting training.

Box 6.2: Skills and knowledge base that needs to be inculcated within the community members for CFB

<p>Skills:</p> <ol style="list-style-type: none"> 1. Plan forage supply for scarcity periods 2. Prepare land for sowing or planting/ Sow/ plant/ weed/ apply herbicides and pesticides/ cut or harvest forages at the right growth stage 3. Make hay and silage and Urea Molasses Mineral Block 4. Treat crop residue with urea to improve nutritional value
<p>Knowledge:</p> <ol style="list-style-type: none"> 1. Explain various forage production strategies 2. Explain principles of plant growth 3. Explain the difference between grasses and legumes 4. Explain the difference between annual and perennial species 5. Explain the use of inoculants in legumes 6. Explain how to grow most common forage species 7. Explain how to make hay and silage 8. Explain how to treat crop residues with urea 9. Explain how to make UMMB (Urea Molasses Mineral Block)

Source: Adapted from literature¹⁵

Table 6.5: Teaching aids for imparting training

Training to be given on	Teaching Aids	Responsible Department
Techniques of planting fodder crops; Forage production strategies on small farm holders including preparation of land for planting of fodder	Training Manual Presentation Video Aids Field Demonstration Exposure visits	Department of Agriculture
Calculation of forage requirements during the year and scarcity periods	Training Manual Presentation	Department of Agriculture
Factors influencing the growth of fodder crops	Training Manual Presentation Video Aids	Department of Agriculture
Use of fertilizers and manure/compost; Maintaining the soil fertility	Training Manual Presentation Video Aids Field Demonstration	Department of Agriculture
Weed management	Training Manual Presentation Video Aids Field Demonstration	Department of Agriculture
Sustainable harvesting of fodder and cutting frequency	Training Manual Presentation Video Aids Field Demonstration Exposure Visits	Department of Agriculture
Conservation and preservation of forage including hay making	Training Manual Presentation Video Aids Field Demonstration	Department of Agriculture
Treatment of crop residue with urea	Training Manual Presentation Video Aids Field Demonstration	Department of Agriculture

¹⁵ Dhyani et al (2013), and Forage Production and Management: Training Package for Extension Management, 2017 by SNV Ethiopia; Available at: https://snv.org/cms/sites/default/files/explore/download/eth_fomap.pdf

Training to be given on	Teaching Aids	Responsible Department
Making of UMMB, make recipe/ weigh out quantities/ mixing of ingredients/ prepare moulds/ make blocks/ put them in place for drying	Training Manual Presentation Video Aids Field Demonstration	Department of Agriculture
Construction of animal houses and sheds on scientific lines provided with cost-effective feeding and watering systems and proper ventilation using locally available materials	Training Manual Presentation Video Aids Practical Demonstration	Department of AH & VS

Source: Author's Construct

6.1.8 Management of CFB

After the initial monitoring by the Department of Agriculture, when the fodder bank will be handed over to the community, it is proposed that it is managed by the community members in the following ways:

1. Typically, the CFB will be managed by a Committee consisting of 8-12 people, with at least 2 people from the Panchayat.
2. All community members will register their names, and number of cattle with the committee
3. The CFB Committee will prepare a budget and put up the proposal to Panchayat
4. On approval, a CFB account with one Panchayat member, one member from traditional governance body (Praja or Mahila Mandal) and 2 CFB Committee members as signatories will be opened
5. On receiving funding, the committee will form sub-committees for cultivation of fodder, storage of fodder and procurement of material
6. After selecting type and quality of fodder, the CFB members will decide price and procurement of material

For the sustainability of the model in the long-run, periodic review of the functioning of the model should be done by the Department of Agriculture.

6.1.9 Components of Cost for Establishment of CFB

The following components of cost for a CFB have been identified. These have been classified as fixed, and variable costs, and an estimate¹⁶ of the cost per hectare has been given.

Box 6.3: Components of Cost for setting up CFB

Fixed Costs	Variable Costs
<ul style="list-style-type: none"> • Fencing (demarcation of boundary)- Rs. 7500/ha 	<ul style="list-style-type: none"> • Labour Cost (hired or contributory)- Rs. 2000

¹⁶ Estimates generated from the guidelines of National Livestock Mission, Annexure C-I(B)-
<http://dahd.nic.in/sites/default/files/REVISED%20GUIDELINES%20OF%20NLM%2027.04.16.pdf>

<ul style="list-style-type: none"> • Land development- Rs. 10,000/ha • Farm Shed- Rs. 15000/ha • Creating irrigation facility like well, pump or rainwater harvesting tank- Rs. 37500/ha • Purchase of equipment – Rs. 5000/ha 	<ul style="list-style-type: none"> • Seeds, fertilizer/ manure, insecticides – Rs. 4000/ha • Electricity charges – Rs. 3000/ha • Cultivation charges – Rs. 10,000/ha • Maintenance of Store- Rs. 3000/ha • Miscellaneous Expenses- Rs. 3000/ha
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Source: Guidelines of National Livestock Mission

The total would amount to Rs. 1 Lakh/ha. This is an estimated figure.

Two fodder banks have been proposed, one in Lahual and one in Pangri. For establishment of one community fodder bank, an area of 6 ha is needed along with an area of 250 sq. m to set up a nursery where a poly house and a net house will be constructed to sow the seeds and germinate them by providing appropriate environment. Thus, the total cost of setting up 2 fodder banks is Rs. 12 lakh. Since, these are remote areas with high infrastructure costs, we propose that a separate budget of Rs. 3 lakh be kept for unforeseen events and unexpected occurring. **The total cost of the project comes out to be Rs. 15 Lakh.**

6.1.10 Budgetary Sources of Finance

The finance for establishment of CFB can be drawn from the following schemes, which are being run the state.

1. Development of Fodder and Feed: This scheme is implemented by the Department of Animal Husbandry. In 2018-19, the state allocated Rs. 22 Lakh to the scheme, but incurred expenditure of Rs. 16 lakhs. For 2019-20, the Government of Himachal Pradesh aimed at distributing 15.02 lakh fodder roots, 68,000 fodder plants in the State. The scheme is an important source of finance for acquiring the planting material for fodder bank.

2. National Livestock Mission: The sub-mission on fodder and feed has three components related to establishment of fodder bank:

- i. Component IV (Fodder seed production/procurement and distribution):
 - a. Seed and planting material production at farmer's field, by seed supplying agencies, cooperatives etc., under a buy back arrangement with the State Government / seed supplying agencies
 - b. Distribution of the seeds to the farmers free of cost or at subsidized rates
- ii. Component V (Conservation of Fodder through post-harvest technologies)
 - a. Value Addition - Making of Hay/Silage
 - b. Establishment of Fodder banks at Panchayat / block / Primary Milk Cooperative level
 - c. Demonstration of value-added forage produce at block level.
- iii. Component VIII (Training and Human Resource Development)

The following table shows the allocation and expenditure for the national livestock mission in HP.

Table 6.6: National Livestock Mission

Budget Code	Department	Actual Expenditure in 2018-19 (In Crore)	Revised Estimate for 2018-19 (In crore)
2403-00-800-02	Animal Husbandry	22.80	22.80
2403-00-796-17	Tribal Development	0.54	0.54

2403-00-789-20	Scheduled Caste sub-plan	2.18	2.18
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Source: State Budget, 2020-21

3. Uttam Chara Utpadan Yojana: It is implemented by Department of Agriculture. With a view to increase fodder production in the state, the state government has launched a scheme; ‘Uttam Chara Utpadan Yojna for fodder development by bringing an area of 25,000 hectare under fodder production. Quality seed of fodder grasses, cuttings, and seedings of improved fodder varieties is supplied on subsidized rates to the farmers. The department is giving 50 percent subsidy to all farmers on seeds of fodder, millet, oats, barseem, and butter grass and fodder maize. In addition, 50 per cent subsidy will also be given to SC/ST and BPL farmers on fodder cutting machines. The state government is also encouraging farmers to cultivate ajola grass. The following table shows the allocation and expenditure for Uttam Chara Utpadan Yojana.

Table 6.7: Uttam Chara Utpadan Yojana

Budget Code	Department	Actual Expenditure in 2018-19 (In Crore)	Budget Estimate for 2018-19 (In Crore)
2403-00-107-05	Agriculture	7.78	8.80
2403-00-796-18	Tribal Development	0	0
2403-00-789-23	Scheduled Caste sub-plan	0	0

Source: State Budget, 2020-21

4. Rashtriya Krishi Vikas Yojana: It has a component of Accelerated Fodder Development Programme. This component is focused upon increasing the access and availability of fodder along with increasing its quality. The Centre has allocated an amount of Rs. 3700 crores to RKVY during the financial year 2020-21.

5. Rainfed Area Development: A component of NMSA, RAD will adopt an area-based approach for development and conservation of natural resources along with farming systems. Creation and development of common property resources/assets/utilities like grain bank, biomass shredders, fodder bank, group marketing etc. will be encouraged under this component.

6.2 Financial Solution II: Value Chain Model for Medicinal and Aromatic Plants

6.2.1 Background

The Indian Himalayan Region is a hotspot of biological diversity with approximately 1748 species of medicinal plants. Himachal Pradesh which constitutes 9% of the Indian Himalayan Region has approximately 643 species of medicinal plants, according to a study conducted by Samant, et al. (2007).

The State contributes heavily to the trade of medicinal plants, as almost 130 species that are found in the State are in heavy demand. The state exports almost 2,500 tonnes of medicinal plants and their parts and the legal annual trade is worth about Rs. 10 crore at current market price (Guleria, 2014). The increase in the receipts from the export permit fees, from Rs. 93 lakh in 2011-12 to Rs. 1.22 crore in 2016-17 (State Budget, 2013-14 and 2018-19) indicate the increasing volume of the trade.

The increasing trend in the export of the medicinal plant from the State is expected to continue given the increasing size of the herbal market, in India and around the globe. More than 85% of herbal medicines used in traditional health care systems are derived from medicinal plant. (Phondani et al, 2015). Global herbal industry is estimated at USD 80 billion currently (DIPP, 2019)¹⁷. In 2017, the Indian Herbal Market was worth Rs 13470 Crores and it is expected to grow with a CAGR of 19 percent to Rs. 31660 crore by the year 2022¹⁸.

However, the official figures related to trade are grossly underestimated as the trade in medicinal plants in the State is largely unregulated, secretive and exploitative and takes place in the form of raw material, and therefore, is not documented (HP Forestry Sector Medicinal Plant Policy, 2006; and HPSBB, 2018¹⁹).

Traditionally, the medicinal plants have been extracted from the wild, often smuggled. In such case, the remuneration earned by the gatherers is extremely low. To make for the low earnings, and earn maximum possible income, the gatherers try to increase the volume of their supply, and therefore, they tend to mine the resources, rather than manage those (Kupiers for FAO).

Gundimeda, Sanya, Sinha, & Sukhdev (2006) have estimated state-wise bio-prospecting value of Indian forests. Marginal willingness to pay by the pharmaceutical companies for bio-prospecting has been estimated based upon number of medicinal plants. The **net bio-prospecting value per hectare** for **Himachal Pradesh** has been estimated to be **Rs. 31,758**.

The lack of knowledge about the economic valuation of the bio-resources may be one factor to contribute to the exploitative behaviour of the local communities. The users in bio-resources based production make substantial benefits while only paying a meagre amount to the local suppliers.

This has led to many of the medicinal plant, with great cultural and economic importance face the threat of extinction. In the State, 57 species of MAPs have been identified as threatened (Table A2.1 in Annexure - 2).

The Government of HP has banned the extraction of *Aconitum violaceum*, *Angelica glauca*, *Berberis lycium*, *Inula racemosa*, *Picrorhiza kurroa*, *Podophyllum hexandrum*,

Saussurea costus, *Fritillaria cirrhosa* and *Valeriana jatamansi*. Even then, these species are heavily exploited in the Pangi region (Rana et al, 2014). In Kinnaur, Chawla et al (2012) observed that endangered medicinal plant species viz., *Sinopodophyllum hexandrum*, *Picrorhiza kurrooa*, and *Aconitum heterophyllum* are illegally extracted in very large quantities from alpine meadows. The over extraction of *Fritillaria cirrhosa* (Jungli Lahsun) in Pangi and *Jurinea dolomiaea* in Kinnaur is rampant so much so that it is almost extinct now (Chawla et al, 2012; NIPFP Consultation in Kilar, 2019).

Conservation of medicinal plants is important as not only these plants form the basis of many modern medicines, but collection and marketing of these medicinal plants form the basis of livelihood of the people living in the fringe areas of the forests. In Himachal Pradesh, as many as 500 different plants are used by locals for curing various ailments (HPSBB, 2018).

According to Alam and Belt (2009), there are two ways to conserve medicinal plants:

1. Restriction on their extraction and trade

Box 6.4: Quantity of MAPs extracted from HP during 1995-2000

Aconitum heterophyllum	– 43.6 t
Angelica glauca	– 73.3 t
Berberis spp	– 797.1 t
Betula utilis	– 56.2 t
Centella asiatica	– 170.8
Ephedra gerardiana	– 74.7 t
Picrorhiza kurrooa	– 108.3 t
Podophyllum hexandrum	– 37.3 t
Selinum tenuifolium	– 30.2
Valeriana spp	– 645.2

Source: Singh et al

¹⁷ https://dipp.gov.in/sites/default/files/Final_Report-Working_Group_16012019.pdf

¹⁸ https://nmpb.nic.in/sites/default/files/FPC_final_Guideline_MPPC.pdf

¹⁹ Tradable Bioresources in Himachal Pradesh... Potential and Scope, HPSBB, 2018

2. Sustainable cultivation on large scale

We propose a model for sustainable cultivation of medicinal plants, which results in the livelihood opportunities for the local communities and keeps a check on the overexploitation of the medicinal plants.

6.2.2 Why do communities not take up cultivation of MAPs?

Guleria et al (2014) studied the existing channel of trade to assess economic feasibility of cultivating medicinal plants. The study found that farmers cultivating MAPs without any institutional support earn good economic returns. However, the problems faced during the production and marketing of the products discourage them to continue the production:

- Lack of technical knowhow related to cultivation of MAPs
- Scarcity of quality planting material
- Lack of proper irrigation facilities
- Lack of processing facilities
- Absence of minimum support prices
- Lack of regulated markets
- Lack of technical knowhow about grading

The project Green Gold in Chamba²⁰ observed that most of the people residing in the area which have suitable environmental conditions for cultivation of medicinal plants are unaware of the cultivation process of the medicinal plants, and are too poor to take it up without any institutional support. There is also an issue of late economic returns as compared to other crops due to long gestational periods. The farmers are also not aware of not taking up cultivation of MAPs on their cultivable lands. Every farmer has two types of land under his possession, i.e. one ideal for cultivation and second otherwise not suitable. It is on these unsuitable lands that the cultivation should be taken up.

Local communities in Kilar expressed in the workshop that after knowing the economic value and benefits of jangali lahsun, they tried cultivating it on their fields without any institutional support but were unsuccessful to get a marketable produce. Discouraged by the initial failures, the farmers abandoned the cultivation of MAPs. Long gestational period was also one of the reasons cited.

6.2.3 Case Studies on Value Chains of Medicinal Plants

While reviewing the literature, we have come across three studies, with three different approaches and different set of lessons that should be kept in mind while attempting to set up a value chain for medicinal plants.

Table 6.6: Studies evaluating the value chains for medicinal plants

Study	Location	Approach
Alam and Belt (2009)	Sukhi Top and Jasour in Uttarkashi District, Uttarakhand	Set up a value chain for Kutki. Buyer was the firm from The Netherlands: Ayurveda Health which guaranteed to buy all the cultivated produce. However, the training and extension services, along with the inputs were supplied by the researchers.
Phondani et al (2016)	Champawati District, Uttarakhand	Medicinal plants growers from three village clusters were registered by the Herbal Research and Development Institute (HRDI) in Chamoli, Uttarakhand. Toward better marketing of selected MAP species, a memorandum of understanding was signed between farmers and traders for a buy-back process. An integrated value chain was

²⁰ <http://drdachamba.org/Projects/GreenGold/main.htm#Medical>

Study	Location	Approach
		<p>developed and facilitated to solve problems related to cultivation and marketing trade of MAPs in the selected village clusters.</p> <p>50 cluster level meetings were organized with farmers, traders, herbal healers, public representatives, experts, women self-help groups, and nongovernment organizations and officers from government departments. Exposure visits of 132 progressive farmers were made to various institutions working in MAP sectors</p> <p>For cultivation, 11 MAPs were selected based on cultivation feasibility and market demand.</p>

Important lessons from literature:

1. **Site selection:** Phondani et al (2016) and Alam & Belt (2009) conclude that for the success of any such project, the cultivation of medicinal plants should be carried out on large plots as small plots do not incentivise the farmers to look after the plants properly. Cultivation should be promoted on barren, nonarable, and marginal lands under a participatory management action plan to improve the economy of deprived farmers.
2. **Evaluating the potential economic benefits to the farmers:** Only those plants should be introduced in the project which gives good economic returns to the farmers. Alam an Belt (2009) observed that in their project area in Uttarakhand, the emergence of apple as a profitable cash crop led to shift of interest of the farmers away from cultivation of kutki.
3. **Training and extension activities:** Phondani et al (2016) conclude that it is important to encourage cultivation of MAPs through cost-effective and appropriate rural technologies such as poly-house, net-house, polypit and organic farming. However, the locals still need to be trained in the process of cultivation. Alam and Belt (2009) have proposed that the training should not be limited to workshops and seminars but it needs to be an intensive extension work for successfully introducing new crops which have not been domesticated yet.
4. **Strict laws to protect traditional knowledge:** Strict implementation of laws and rules should be enacted to secure community-based traditional knowledge and intellectual property rights and to ensure equitable benefits sharing among the stakeholders. ABS is a significant step taken by the Government of India in this direction.

8.2.4 Best Practices

A. Back to Nature Project by Dabur India Limited, Lahaul, HP

Dabur India Limited has launched its project “Back to the Nature” in the Lahaul Valley of Himachal Pradesh.²¹ Under this project, Dabur has set up a nursery and demonstration site in Alpine Herbs Research Centre in Beeling, Lahual Valley, to cater specifically to cold desert medicinal plants. Spread over 5 acres, this base serves as a resource centre for planting material. The company has started cultivating some key cold region-specific herbs like Kuth, Atish, Pushkarmool, Jatamansi, Ratanjyot, Kutki, Sugandhbala at this centre.

Dabur has also created a unique collaborative effort between the local communities and is working towards sustaining the livelihood of mountain people, providing them with a source for raw materials as also conserving the natural resources of this fragile ecosystem. The saplings grown at this nursery is

²¹ Business Responsibility Report 2013-14, Dabur India Limited

given to the local farmers and the harvested crop bought back by Dabur at prevailing market prices. The company is also planning to start hosting training programmes at the centre for local farmers.

B. Sikkim IFFCO Organics – A joint venture between Government of Sikkim and IFFCO Ltd.

Sikkim IFFCO Organics, a joint venture between the State of Sikkim and the Indian Farmers Fertiliser Cooperative Limited (IFFCO). It is India’s first joint venture between a state government and a cooperative society in the Organic Value Chain. The shareholding pattern of this JV between IFFCO and the State of Sikkim is 51:49. The joint venture has been established to create an Organic Value Chain across the state to benefit and incentivize its farmers.²² The major commercial crops in which Sikkim IFFCO (SIFCO) will operate are Ginger, Turmeric, Large Cardamom and Buckwheat. The initial cost of the project is INR 50 Crore. The manufacturing would kick start from December, 2020. All SIFCO products will be certified 100% organic hence, non-toxic in nature.²³

SIFCO taken steps towards marketing organic products of Sikkim in international markets by signing two MoU’s: one with Blossoms Biodynamics, USA for the utilizing their marketing & distribution in the North American markets and the other with Centar Dr. Rudolfa Steinera, Croatia for marketing its products in Croatia and the European Union.

C. Project Green Gold in Chamba

The Project “Green Gold” has been implemented in Chamba District, Himachal Pradesh with an objective of livelihood generation for rural farmers²⁴. Cultivation of medicinal and aromatic plants is one of the four key activities of the project. 200 SHGs were linked to this component of project at the cost of Rs. 432 lakh. To provide quality planting material to the farmers, seven nurseries were set up in different locations with an average area of nursery being 1.5 ha.

Four species were selected for cultivation: *Aconitum* (Atis), *Valeriana jatamansi* (Sugandhwala), *Podophyllum* (Bankakdi) and *Picrorhiza kurroa* (Kutki). For cultivation, the “Zero income” land was selected, i.e. the income generated by the farmer is an additional income. Table 8.8 shows the cost-benefit ratio of four selected species under the project.

Table 6.7: The cost- benefit ratio of species cultivated under Project Green Gold in Chamba

S.no.	Species	Duration of crop	Yield (Kg)	Input cost (in Rs.)	Output cost (in Rs.)	Income (in Rs.)
1.	Aconitum heterophyllum	4-5	1500-1700	3,00,000	15,00,000	12,00,000
2.	Picrorhiza kurroa	2-3	900-1000	40,000	1,20,000-1,50,000	80,000-1,10,000
3.	Podophyllum hexandrum	3-4	3000	75,000	3,00,000	2,25,000
4.	Valeriana jatamansi	2	800-1000	10,000	50,000-60,000	40,000-50,000

Source: Project Green Gold, 2002

6.2.5 Medicinal and Aromatic Plants in Lahaul – Pangi Landscape

The landscape is rich in medicinal and aromatic plants. Some of the species that are found in the landscape have been listed based upon consultation workshop organized in Kilar, in consultation with WII as well as secondary literature (Rana, et al. 2014; Singh and Kumar 2017; Dut, et al. 2014).

²² <http://www.sikkimiffco.com/aboutus.html>

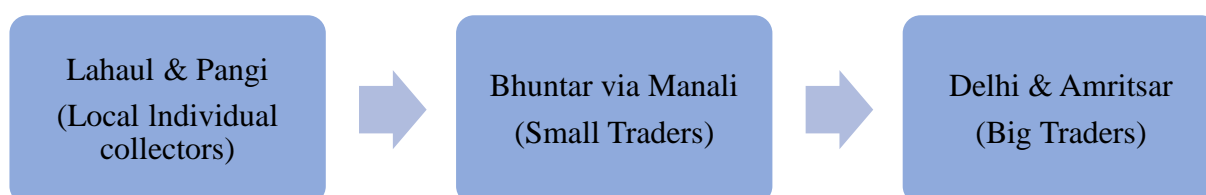
²³ <https://www.hindustantimes.com/business-news/sikkim-iffco-lays-foundation-for-india-s-single-largest-organic-processing-unit-in-sikkim/story-cuiz6tXqwReFMbemq58TmN.html>

²⁴ <http://drdachamba.org/Projects/GreenGold/main.htm#Medical>

Inula racemosa, Saussurea costus, Aconitum heterophyllum, Podophyllum hexandrum, Angelica glauca, Valeriana jatamansi, Picrorhiza kurroa, Aconitum violaceum, Berberis lyceum, Fritillaria cirrhosa, Sinopodophyllum hexandrum, Jurinea macrocephal, Taxus wallichiana, Bunlum perslcum, Rheum spiciforme , Fritillaria roylei, Polygonatum verticillatum, Rheum webblianum, Dactylorhiza hatagirea, Rheum austral, Aconitum deinorrhizum, Arnebia benthamii, Betula utilis, Carum carvi, Corylus jacquemontii, Dioscorea deltoidea, Ephedra gerardiana, Hippophae rhamnoides, Juniperus communis, Pinus gerardiana.

The market channel for trade of MAPs in Lahaul-Pangi landscape was discussed briefly in the consultation workshop²⁵. The locals extract MAPs from wild and the product crosses a line of intermediaries to reach the markets in Delhi and Amritsar.

Figure 6.2: The market channel for MAPs in the Lahaul-Pangi landscape



Source: Consultative workshop organized by NIPFP in Kilar, 25th September 2019

The extraction from wild is unsustainable and impacts the biodiversity negatively in the following way:

- Unsustainable extraction of medicinal plants results in threatening of native MAP species
- Unscientific extraction such as removing of whole plant (without leaving any part of rhizome) causes regeneration failure of plants in their natural habitat (Paul, Gajurel, & Das, 2015)
- Over-extraction of plants lead to soil erosion which result in landslide due to slope.

Based on the demand in the market, suitability of climatic conditions and the past projects in the District Chamba, the **following species are proposed for the project:**

Table 6.8: Species proposed for the project

Species	Local Name	Market Price (Rs. /kg)	Estimated Annual Trade (MT)	Is subsidy provided by the government for cultivation? If yes then how much?	Status (Endangered, Vulnerable, etc.)
Aconitum heterophyllum	Atish	2000 – 4000	200 – 500	Yes, 75% subsidy under the scheme of NMPB	CR
Picrorhiza kurrao	Kadu	220 – 230	200 – 500	Yes, 75% subsidy under the scheme of NMPB	EN
Rheum austral	Chukri	25 – 30	500-1000		
Taxus Wallichiana	Thuner	75 – 90	100-200		EN
Valeriana jatamansi	Musakbala	95 – 100	100-200		VU

Source: Compiled by NIPFP from Tradable Bioresources in Himachal Pradesh... Potential and Scope, 2018 and National Medicinal Plant Board

²⁵ Consultation workshop organized by NIPFP on 25th September, 2019 at Kilar, Pangi

6.2.6 Creation of Value Chain through partnership between industry and local communities

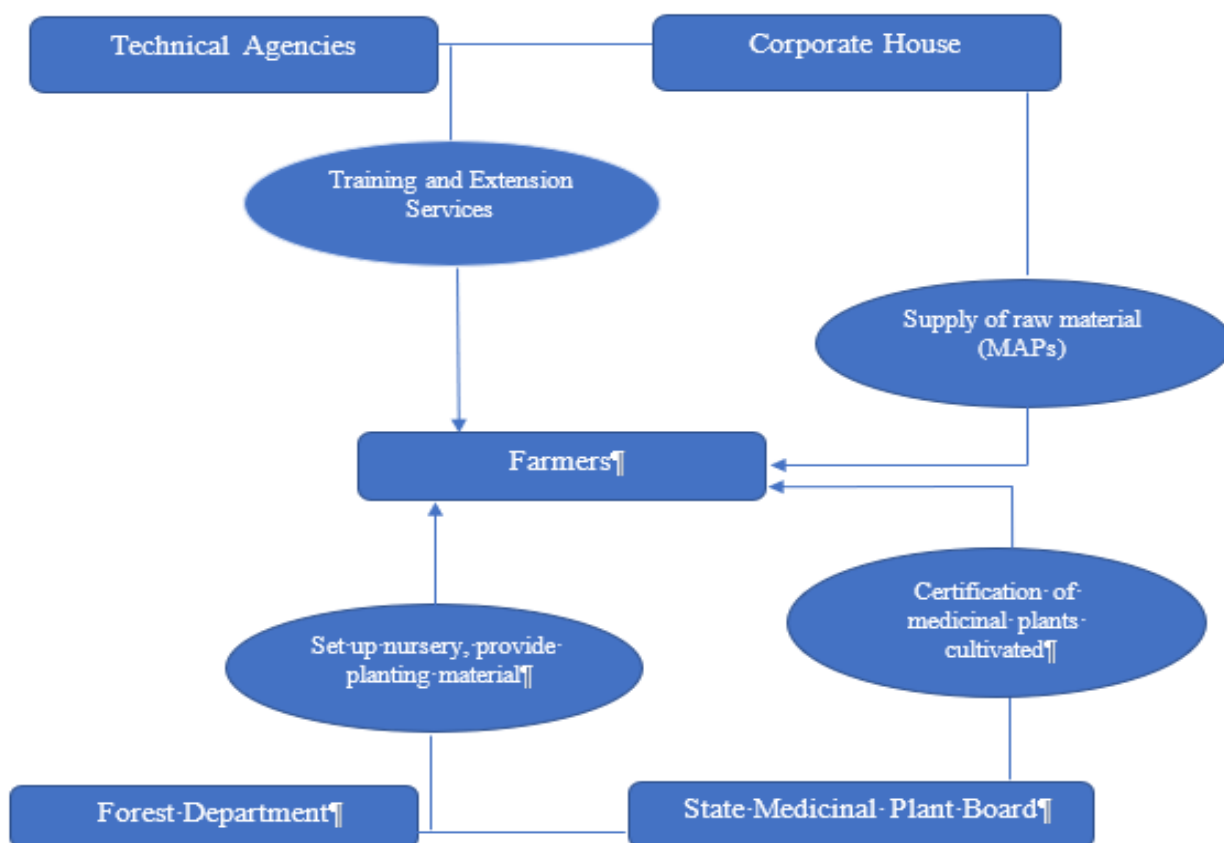
In consultation with the local communities, the experts on the subject, and literature review, for setting up a business model, following requirements need to be met:

Table 6.9: Requirements for setting up a value chain

Selection of Resource Sites and Communities	Wasteland unsuitable for cultivation of agricultural crops
Identification of Institutions and Beneficiaries	Nodal agency, Technical Institute, Governance body
Community Engagement and Training	Engagement through publicity (pamphlets, meetings, advertisements) and training (extensive training involving field demonstrations)
Planting Material and Cultivation	Setting up of nursery to provide quality planting material
Linking with Government Schemes	To ensure continuity of funds and take advantage of the subsidies provided by the government for promotion of cultivation of MAPs.

Based on the above requirements, the following business model is being proposed:

Figure 6.3: Proposed Model for MAP cultivation



Source: Compiled by NIPFP

Notes:

A. Technical Agencies for training:

According to the guidelines set by National Medicinal Plant Board, following agencies are eligible for carrying out training and capacity building in spreading best practices on conservation, cultivation, good agricultural practices, good field collection practices, post-harvest management, marketing etc. activities:

- Central and State Government organizations.
- Recognized Research/ Academic/ Educational institutions
- Registered professional and other philanthropic organizations working on non-profit basis.
- Registered Non-Government Organizations (NGO)/Voluntary Organizations/ Trusts with infrastructure and specific experience in the field of medicinal plants

Based on the above eligibility criteria, following institutes may be contacted for imparting training to the farmers:

- iv. G.B. Pant National Research Institute of Himalayan Environment and Sustainable development, Mohal, Kullu, HP
- v. Dr Y S Parmar University of Horticulture & Forestry, Nauni, Solan, HP
- vi. Institute of Himalayan Bioresource Technology, Palampur, HP

B. Corporate Houses:

- vi. Dabur is already operating in Lahaul (part of SECURE Landscape), therefore, it can be approached for the model.
- vii. Patanjali Ayurveda Limited
- viii. Organic India Private Limited
- ix. The Himalaya Drug Company
- x. Any other pharma company already operating in the State

C. Facilitator:

The Department of Forest along with the UNDP will act as the facilitator by bringing all the players of the model to the table of negotiation and finalising of the contracts among them.

D. Other Stakeholders (other than those mentioned in the figure)

Apart from the stakeholders mentioned above, there will be a need to bring together the following stakeholders for the smooth functioning of the model.

- Rural Development Department (for convergence with MGNREGA)
- Joint Forest Management Committees/Village Forest Development Committees
- Biodiversity Management Committees
- Panchayat, Mahila Mandal, Praja Mandal

Detailed responsibilities of the different stakeholders are mentioned in the Table 6.11 below.

Table 6.10: Responsibilities, Actions and Skills Required for Value Chain Model for MAPs

Department	Desired Function of the Department	Activities	Skill Sets Required at the Department
Department of Forest and UNDP	Planning, Leadership Strategizing	Thought, and Coordination with all stakeholders for maintaining desired direction	Strong coordination and persuasive skills with strong sector expertise to command respect.

Department	Desired Function of the Department	Activities	Skill Sets Required at the Department
Department of Forest		Establishing itself as a nodal agency leading the effort for success of the project	Experience of dealing with multiple stakeholder agencies and coordinating for excellence
Department of Forest	Advisory to all stakeholders Departments/Agencies on formulation of policy, project and schemes cultivation of medicinal plants	Technical Assistance in formulation of projects, schemes and policy	Experience of providing technical assistance and backstopping support for formulation of projects, schemes and policy
Department of Forest, and SMPB	Documentation of knowledge in MAP cultivation and making it available in public domain	Documentation of best practices	Very good Knowledge Management & Documentation experience and maintain digital knowledge repository for dissemination and knowledge building in the sector
		Documentation of case studies	Strong Documentation Skills and exposure to the ecology/biodiversity/participatory management domain.
Rural Development Department, (Block Development Officer)	Building capacities of grass root level stakeholders	Identification of the cultivators by coordinating with local bodies like Praja Mandal, Mahila Mandal.	Coordination with stakeholders, with strong experience in livelihood domain, training and community mobilisation experience. Strong experience in Communication, Knowledge Management and Knowledge sharing
Department of Forest		Facilitating training of farmers for cultivation of MAP with right techniques, post-harvest management, and value addition, including training on field preparation, use of manures, irrigation, soil and water management	
Technical Agency		Provision of good quality raw material to farmers, utilization of traditional knowledge for cultivation, harvest and storage of MAP species	
Corporate House		Facilitating course material and course curriculum development for training of cultivators	

Department	Desired Function of the Department	Activities	Skill Sets Required at the Department
State Medicinal Plant Board	Developing market for MAPs, aiding stakeholder with market intelligence and ensuring market linkages.	Coordination for formulating MAP efficacy parameters and promotion of Quality Certification	Coordinate with AYUSH and Certification Agencies at various levels. Strong experience in Communication, Knowledge Management and Knowledge sharing
Department of Forest	Monitoring and Evaluation	Monitoring the implementation of the project at the earlier stages, before it is handed over to the community	Strong experience with M&E frameworks, methods and approaches (including quantitative, qualitative and participatory) in community-based natural resource management projects

Farmers growing MAP need to be trained for field preparation, sowing and transplanting, suitable soil and climatic conditions, manures and fertilizers as well as irrigation Table 6.12.²⁶

Table 6.11: Training needs of farmers of cultivation of MAPs

Theme	Component	Teaching aids
Soil and climatic conditions	Use of seeds/planting material with complete seed treatment protocol	<ul style="list-style-type: none"> • Training Manual • Presentation • Video Aids • Field Demonstration • Exposure visits
	Methods to make planting material free from pests, inert and foreign matter	
	The process of seedling production for target species, based on the agronomic practices well before the actual schedule for transplantation in the field	
Field preparation, sowing and transplanting	Favourable rhizospheric environment for sowing seed by bringing the soil to the desired tilth	
	Rate of seedling per unit of land and suggested depth of the plant seed	
	Replenishment of plant within the gestation period with an aim to compensate for the mortality losses	
Manures and fertilizers	Use of organic manure such as compost, poultry manure, vermi-compost, green leafy manure	
	Use of microbial fertilizers various purposes like phosphate solubilizing, nitrogen fixing, etc.	

²⁶ Good Agricultural Practices for Medicinal Plants (2009). Accessible at: https://www.nmpb.nic.in/sites/default/files/publications/Good_Agricultural_Practices_GAPs_Booklet-Part-I.pdf

Irrigation	Planning of irrigation cycles to ensure the optimal plant growth	
	Traditional methods of water conservation and water harvesting	

Source: National Medicinal Plant Board (2009)

6.2.7 Components of Cost for setting up of the model

Following components of cost have been identified²⁷:

Table 6.13: Components of Cost for Setting up the MAP Value Chain

For cultivation of MAPs:	Setting up of nursery	Training of farmers²⁸:
a. Development of land – Rs. 10,000/ha	a. If the nursery set up is a model nursery – Rs. 25 Lakh per unit	a. Rs. 2,000 per trainee for a minimum of two days within the State and Rs. 5,000 per trainee outside the State will be provided which will include exposure visit.
b. Fencing of land (demarcation of boundary) – Rs. 7500/ha	b. If the nursery is small nursery – Rs. 6.25 lakh per unit	b. Travel cost will be additional to the above cost.
c. Vermicompost unit – Draw funds from MGNREGA, as required		
d. Irrigation facilities – Draw funds from MGNREGA, as required		
e. Weeding and Harvesting		

Total cost of the project is proposed to be Rs. 26.56 Lakh for including 123 families in the project over 5 years²⁹. The nurseries for the project will require an area of 1.5 ha. The land for cultivation in the landscape will differ depending upon the area in which the participant families are residing.

6.2.8 Budgetary Sources of Finance

1. Van Samriddhi Jan Samriddhi Yojana: Under this scheme, nurseries for medicinal plants will be set up to meet the demands of medicinal plants and other NTFPs for cultivation/plantation. Private entrepreneurs, NGOs/Societies working in this field will be given a seed fund up to Rs. 1 lakh for procurement and branding for which they have to render regular accounts to the department. For capacity building, existing Jadi-buti cell can be utilised, or a similar cell can be set up as part of the project. For capacity building, the main focus shall be cultivation techniques and post harvesting processing skills for value addition.

²⁷ Estimates generated from the guidelines of National Livestock Mission and Framework for Implementation of National Ayush Mission; https://www.nmpb.nic.in/sites/default/files/downloads/4197396897-Charakasamhita_ACDP_english_0.pdf

²⁸ Guidelines for Information, Education and Communication (IEC) Activities by National Medicinal Plant Board;

Available at: https://nmpb.nic.in/sites/default/files/IEC/IEC_Activities-PDF.pdf

²⁹ No. of families to be included and the cost of the project have been calculated from the criteria used in the Project Green Gold in Chamba.

2. **Other Sources:** MGNREGA is an important source of financing the labour costs. Planting materials may be procured from the departmental nurseries of the forest department, which they maintain under the budget head, 'Raising Nurseries for Departmental Planting and Public Distribution' and 'maintenance of plantation and nurseries.

Table 6.14 shows the allocation and actual expenditure undertaken in the relevant schemes for the year 2018-19:

Table 6.14: Budgetary Sources of Finance (Rs. Crore)

Budget Code	Scheme	Actual 2018-19 (in Crore)	BE 2018-19 (In Crore)
2406-01-800-10	Van samriddhi Jan Samriddhi	0.45	1.00
2406-01-102-05	Raising Nurseries for Departmental Planting and Public Distribution	7.90	7.90
2406-01-102-07	Maintenance of plantation and nurseries	3.28	3.10

Note: For maintenance of plantation and nurseries, the revised estimate was raised to ₹ 3.28 crore

Source: State Budget, 2020-21

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Available at: https://nmpb.nic.in/sites/default/files/IEC/IEC_Activities-PDF.pdf

Guidelines of National Livestock Mission; Available at:

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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	14 th 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	14 th 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	16 th May 2019	Himachal Pradesh Forest Department, Talland, Shimla	APCCF-cum-CPD	Department of Forest, Environment and Wildlife Management

S. No.	Particulars	Date	Venue	Participation (Forest Department)	Line Departments/Other Organisations
			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
			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	25 th 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	24 th September	Library Hall, Pangi	Range officer, Pangi	
8.2	One- to One consultations and meetings with Department Officials	24 th September	Library Hall, Pangi	BMC Chairperson, Mindhal	
8.3	One- to One consultations and meetings with Department Officials	26 th September	Agriculture Department, Pangi	Agriculture Development Officer, Kilar	

S. No.	Particulars	Date	Venue	Participation (Forest Department)	Line Departments/Other Organisations
8.4	One- to One consultations and meetings with Department Officials	26 th September	BDO Office, Pangi	Block Development Officer, Kilar	
8.5	One- to One consultations and meetings with Department Officials	26 th September	BDO Office, Pangi	Panchayat Pradhan, Pangi	
8.6	One- to One consultations and meetings with Department Officials	26 th September	BDO Office, Pangi	Panchayat Pradhan, Karyas	
8.7	One- to One consultations and meetings with Department Officials	26 th September	Tehsildar Office	Naib Tehsildar, Kilar	
8.8	One- to One consultations and meetings with Department Officials	26 th September	Pangi	Panchayat Pradhan, Lujh	
8.9	One- to One consultations and meetings with Department Officials	26 th 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 Panchayat Kilar	Pradhan	9459934205
15.	Sarita Sharma	A.P. GDC Pangi		9459040105
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 Bhatari, 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
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