WAVES
Technical Report
India
May 2015

Accounting for Forests in Himachal Pradesh

Feasibility and Planning Study

Technical Report

WAVES

Wealth Accounting and the
Valuation of Ecosystem Services
www.wavespartnership.org

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Acknowledgments

This report was written by Haripriya Gundimeda (Professor, Indian Institute of Technology, Mumbai) as part of a technical assistance program on Forest Accounts with the Government of Himachal Pradesh which was led by Urvashi Narain (Senior Environmental Economist, Global Practice for Environment and Natural Resources, World Bank). The team is grateful to Charles Cormier (Practice Manager, Global Practice for Energy and Extractives, World Bank) and Pyush Dogra (Senior Environmental Specialist, Global Practice for Environment and Natural Resources, World Bank), successive Task Leaders of the Development Policy Operation—Support Inclusive Green Growth and Sustainable Development in Himachal Pradesh—under which umbrella this technical assistance was undertaken.

The team would like to thank the Government of Himachal Pradesh for their partnership on this program. The report benefitted immensely from the guidance, suggestions, and assistance of officers from Department of Forests, Environment, Science, and Technology, Finance Department, and Department of Economics and Statistics, including Tarun Shridhar (Additional Chief secretary, Forests, Fisheries, Environment, Science, and Technology, GoHP), Shrikant Baldi (Principal Secretary, Finance, Planning, Economics and Statistics, GoHP), Sharad Negi (previous Director, Department of Environment, Science, and Technology), R.K. Gupta (retired Principal Chief Conservator of Forests, Forest Department, GoHP), Surinder Kumar (Additional Principal Chief Conservator of Forests, Forest Department, GoHP), Anil Vaidya (Chief Conservator of Forests, Forest Department, GoHP), and Pradeep Chauhan (Director, Department of Economics and Statistics, GoHP). While this report has been discussed with the Government of Himachal Pradesh, it does not necessarily bear their approval for all its contents.

The reported also benefitted from comments provided by Glenn-Marie Lange (Program Manager, Wealth Accounting and Valuation of Ecosystem Services (WAVES) Global Partnership), and feedback received from participants at the Forest Accounts Workshop held in Shimla, Himachal Pradesh in January 2014. The team would also like to thanks Jane Sunderland for editorial services.

The generous financial contributions of the Austrian Development Agency, Australian Agency for International Development, and the WAVES Global Partnership are gratefully acknowledged.

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Abbreviations and Acronyms

CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CAT	catchment area treatment
CCF	Chief Conservator of Forests
CF	Conservatorof Forests
CICES	Common International Classification of Ecosystem Services
CSO	Central Statistical Organization
DCF	Deputy Conservator of Forests
DoLR	Directorate of Land Records, Himachal Pradesh
DoEST	Department of Environment, Science and Technology
DoES	Department of Economics and Statistics, Himachal Pradesh
FCA	Forest Conservation Act, 1980
FDA	Forest Development Agency
FSI	Forest Survey of India
GDP	gross domestic product
GIM	Green India Mission
GIS	Geographical Information System
GIST	Green India States Trust
GSDP	gross state domestic product
HIS	Hydrological Information System
HP	Himachal Pradesh
HPFD	Himachal Pradesh Forest Department
HPSFDCL	Himachal Pradesh State Forest Development Corporation Limited
HPTDC	Himachal Pradesh Tourism Development Corporation
HRD	Human Resource Development
IFA	Indian Forest Act
IFS	Indian Forest Service
IIFM	Indian Institute of Forest Management
JFMC	Joint Forest Management Committees
LPA	Land Preservation Act
MDF	moderately dense forest
MoA	Ministry of Agriculture

MoEF	Ministry of Environment and Forests
MoSPI	Ministry of Statistics and Program Implementation
MSUT	Monetary supply and Use Table
NCA	Natural Capital Accounting
NPV	Net Present Value
NSDP	Net state domestic product
NSO	National Statistical Organization
NSSO	National Sample Survey Organization
NTFP	Non-timber Forest Product
PAN	Protected Area Network
PCCF	Principal Chief Conservator of Forests
PES	payment for ecosystem services
PF	protected forests
PFM	Participatory Forest Management
PSUT	physical supply and use tableREDD Reducing Emission from Deforestation and Forest Degradation
RF	reserved forests
SEEA	System of Environmental-Economic Accounting
SFR	*State of Forest Report*
SNA	System of National Accounts
SoER	*State of Environment Report*
TOF	trees outside forests
VDF	very dense forest
WAVES	Wealth Accounting and the Valuation of Ecosystem Services
WP	working plan

All monetary amounts are in rupees (Rs).

Executive Summary

Forests are the most important natural resource of the state, legally comprising nearly 66 percent of the geographical area. The state's contribution in sustaining the life-support system of the local as well as the national economy is quite undisputed. The state has a challenge to make use of its unique resource endowments and at the same time prioritize economic and social development and poverty eradication while maintaining ecological balance. The state has accorded high priority to the power sector and tourism, for which the abundant natural resource base is crucial. The state government, very conscious of the ecological sensitivity of the region, has resolved to protect and enhance its natural resources and to follow the path of sustainable development in all sectors, as seen from the state's hydropower policy, sustainable tourism policy, sustainable forest management policies, and environment master plans. The state also plans to encourage investors who see sustainability as a viable economic venture.

The state of Himachal Pradesh has recorded a real growth rate of gross state domestic product (GSDP) at a constant of about 7.44 percent in 2011–12. On average, per the Department of Economics and Statistics, the state witnessed a GSDP growth rate of 8 percent in the period 2005–06 to 2012–13. With increasing growth, it is pertinent that the amount of economic activity is also increasing. Therefore, it is essential to assess whether this growth rate has come as a cost of depletion of natural assets or as a benefit of increasing stock of the state's natural resources. The state needs a yardstick to measure whether it is following the path of sustainable development as laid out in different sectoral plans of the state. A way to measure this is through natural capital accounting. Although the System of National Accounts (SNA) can give detailed information about the economy and help policymakers assess economic performance, support policy analysis, and inform decision making, when it comes to measuring environmental sustainability, the SNA has a number of short comings. These shortcomings mainly arise because of the inconsistencies between produced and natural capital. The forest sector—the most significant sector of all the state's natural resources, covering 66.52 percent of the total geographical area—can benefit extensively from systematically collecting information on the stock and changes in these assets along with their economic contribution and the impacts of non-forestry policies on forest resources and services. The state forestry sector officially contributes only about 4.8 percent of total GSDP because of omission, underestimation, or wrong assignment of a number of forest goods and services. As a result, the total benefits from sustainable forestry are underestimated, and other sectors are not fully aware of their dependence on healthy forests. These factors are likely to bias decisions away from sustainable management of forests and prevent policymakers from fully leveraging forest resources to realize their contribution to economic growth.

Developing forest accounts can help inform policy in a number of ways. For example, forest accounts linked with tourism accounts can help inform government policy on nature-based tourism, and ecosystem accounts for watersheds can help design payment for ecosystem services schemes. Developing non-timber forest product (NTFP) accounts can assist in realizing the goal of sustainable forest management as well as that of poverty alleviation.

The objective of this report is to look at the feasibility of developing forest accounts for the state of Himachal Pradesh. It describes an approach to link environment with the economy by

developing the forest resource accounts for Himachal Pradesh and proposes a set of accounts to address these links. The approach followed mainly comprises the following stages:

1. **Physical asset accounts for forestland, timber, carbon, and ecosystems** - This account provides the estimates of areas and volumes of Himachal Pradesh stock of forestland, timber, carbon, and ecosystems in physical units.
2. **Valuation of forest goods and service s** - This account provides accounts for the total value of forest ecosystem goods and services.
3. **Monetary asset accounts for forest land, timber, carbon, and ecosystems** - Once the value of different forest goods and services are established, the asset value of forests can be determined by using appropriate methods to value environmental assets.

An intensive review of data sources and institutional capability has been done and comprehensively presented in the report. The report identifies few key data sources for the state of Himachal Pradesh. The Himachal Pradesh Forest Department (HPFD), Forest Survey of India (FSI), and Himachal Pradesh Department of Economics and Statistics (DoES) have been identified as the key official data sources. The prevailing structure and governance of the HPFD indicates that a lot of capacity already exists for collecting and compiling data sets at the district level, with a purpose to develop forest ecosystem accounts. The report also identifies the capacity gaps, taking into consideration the current commitments to implement aspects of natural capital accounting. A draft work plan to move toward a complete set of accounts has been suggested for developing the forest accounts.

Accounting for forest resources and wealth is an essential component in analyzing policy trade-offs. Estimating the "true" value of economic activities on forest resources and wealth requires the periodic availability of required data sets. Coordination between the HPFD and the DoES can help build the forest account, contributing to realizing the sustainable development vision of the state. As a complete set of forest ecosystem accounting requires time and resources, it initially may be most feasible to consider a limited, rather than comprehensive, set of ecosystem services for inclusion in ecosystem accounting exercises. Based on the policy priorities of the state of Himachal Pradesh, the report suggests first developing physical asset accounts for forested land, timber, and carbon along with monetary accounts for timber, non-timber forest products, and carbon. In the medium term, the state can develop ecotourism accounts and water accounts. The rest of the ecosystem accounts follow in the next three to five years. Besides developing these accounts, the key challenges are to monitor and measure adjusted economic growth and to efficiently use the accounts to effect policy initiatives for the welfare of the society and to maintain intergenerational equity.

1| Introduction

Himachal Pradesh has an immense wealth of natural resources and biodiversity and is one of the most ecologically fragile Himalayan regions. Forests are the most important natural resource of the state, legally comprising nearly 66 percent of the geographical area. However, with only 26 percent tree cover, they are the repositories of 3,295 species, out of which 95 percent are endemic to the state and 5 percent (that is, 150 species) are exotic. The state's contribution in sustaining the life-support system of the local as well as the national economy is quite undisputed. Most of the people in rural areas of the state depend directly or indirectly on forests for their livelihood and use a significant quantity of forest goods and services, such as non-wood forest products, fodder, timber, and so forth.

The state has a challenge to make use of its unique resource endowments and at the same time prioritize economic, social development, and poverty eradication while maintaining ecological balance. The state has also emerged as an ideal destination for investment in the tourism and hydropower sectors. High priority has been accorded by the state to these two sectors, as they are seen as power engines for the overall development of the state in addition to being fiscal resources. There is considerable untapped hydropower potential in the state: only 32 percent is potentially developed. Because of the state's environmental, climatic, and natural heritage advantages, the tourism sector has a lot of potential to promote growth and jobs.

However, it is important to realize that the Himachal economy (including the priority sectors of the states) is closely tied to its abundant natural resources base. Hydropower development strategy cannot ignore the role of source management of water resources through sustaining and reducing the variations in water flow and the treatment of catchment areas for improved soil and water conservation. The sound water management is in turn dependent on sustainable forest management. The tourism sector is largely dominated by nature tourism, for which forest management is crucial. Each priority sector, too, has a high environmental footprint as well as involves a considerable volume of activity. This necessitates careful management of the fragile environment. Moreover, one priority sector could interfere with another sector. For example, the hydropower sector can interfere with the nature-based tourism sector if it disregards the natural resources and the impacts the hydropower sector creates on the environment. The tourism sector can be a threat to maintaining 60 percent of the geographical area under forests in the hill states as stipulated by the National Forest Policy of India. Development of the tourism sector or the building of dams involves developing infrastructure, which involves the diversion of forest resources for these projects. This in turn can influence forest uses and users. Unsustainable conversion of forests can affect the forest watersheds influencing the hydropower production. The development priorities encompass both positive and negative aspects. It is important to develop a clear understanding of such impacts, and negative impacts if any should be compensated, mitigated, monitored, and managed. Another significant threat that could potentially impinge on power production, ecotourism, agriculture, horticulture, and so for this climate change. Climate change may alter the distribution and quality of natural resources of Himachal Pradesh, thus adversely affecting the livelihoods of its people. Climate change will also negatively affect the water resources, with increased water scarcity in hill stations. The immediate repercussions of climate change on the forests are visible in the shifting of the tree line to higher altitudes and the movement of pine species to higher altitudes. As per the state action plan on climate change, by 2100, under the most probable scenario, the temperature of the state is likely to increase by 3ºCand precipitation will decrease by 20 percent—and in that situation, the effects will be more visible and alarming also.

Thus, it is evident that the key priority sectors of Himachal Pradesh depend primarily on taking care of its rich forest resources. Forests also have a key role to play in Himachal Pradesh's commitment to low-carbon growth and a carbon-neutral economy. Forests also act as a complementary life-support system to agriculture and horticulture in hills, as they are often interspersed with forests.

Despite the significant role played by forests, policymakers do not have the information they need to manage this critical economic asset. This includes information about not only the extent of forest resources and how it is changing, but also equally vital information about the economic contribution of forests and impacts of non-forestry policies on forest resources and services. Nature-based tourism development, for instance, will require mapping the areas with the greatest potential—that is, areas rich in forest resources—and understanding how this potential

can be tapped. The hydropower sector requires the management of forest resources so that their catchments are free of any sediment.

The state government is very conscious of its strategic location in the Himalayan regions and has expressed its resolve to protect and enhance its natural resources and to follow the path of sustainable development in all sectors. One can see this from the state's Hydropower Policy, which has earmarked 1.5 percent of the project cost for the development of local areas through the Local Area Development Committees (LDACs), which involves involving local people in the development of the "project affected area."The tourism policy clearly indicates its vision to position the state as a leading destination by 2020. The strategy recognizes creating a tourism sub-plan, which integrates and coordinates with other state departments. The forestry sector has also seen a paradigm shift. Sustainable forest management is now seen as meeting societal concerns: improve biological diversity, enhance water supplies, make possible carbon sequestration, meet recreation needs and provide for the forest dependent communities through improved non-wood forest products, while at the same time protect and restore the forest ecosystem. The focus has now shifted to multifunctional landscapes. The second commitment of sustainable forest management is to encourage profitable enterprises, attracting the investor who sees sustainability as a viable economic venture. Thus, there is movement away from the conventional, commodity production orientation toward a holistic, people-centered ecosystem-level approach.

With the long-term perspective of achieving environmentally sustainable development, the state has vowed to prepare an environment master plan. One of the key objectives of this is to simultaneously address issues of ecological and environment restoration, bring convergence with the development activities taking place in the state, and ensure close coordination with all concerned development departments at both the state and national levels. The state government has also recognized the importanceof balancing development and the maintenance of natural resources; it is in the process of reorienting and restructuring the environment policy of the state to ensure sustainable development.

The state needs a yardstick to measure whether the sectors and the development is sustainable. The SNA provides detailed information about the economy to help policymakers assess economic performance, support policy analysis, and inform decision making. However, when it comes to measuring environmental sustainability, the SNA has a number of short comings. The SNA delivers only limited information for sustainable forest management. For one, the SNA treats cultivated and natural forests differently: with regard to cultivated forests, it only records production and changes in the stock; for natural forests, it only records production. In addition, the value of forest degradation and depletion is not recorded as a cost against the income earned by enterprises (be it state or private) extracting forest resources.

More important, forests have long been a major natural resource available to people living in their vicinity, being a significant source of wood and other non-wood products, such as edible items, fodder, fuelwood, medicinal plants, roofing materials, fiber for ropes, and so forth. Historically, this dependence has been for both consumption and a source of income. Barring a few NTFPs of high commercial values, a substantial amount of such dependence provided by both cultivated and natural forests is often not included in national accounts. On the other hand, many non-market services are wrongly attributed to other sectors of the economy.

In Himachal Pradesh, the economic contribution of forests is captured under the forestry and logging category of industries. This includes **forestry** (for example, planting and conservation of forests, and so forth), **logging** (for example, felling and rough cutting of trees, hewing or rough shaping of poles, blocks, and so forth), **transportation** of forest products to the sale depots/

Table 1: Do HP State Income Accounts Capture the Economic Contribution of Forests?

Forest product/service	Services provided	State income accounts
Industrial wood	Provisioning	Depletion of forests not included in net value added or net domestic product
Fuelwood and charcoal	Provisioning	**Underestimated,** NSSOconsumption expenditure surveys (every five years)
Minor forest products	Provisioning (resin)	Production estimates from HPSFDCL
	Others	**Underestimated,** only royalty value available from HPFD
Forest services		
Livestock grazing	Provisioning	Attributed to agriculture
Pollination services of wild bees	Supporting	Attributed to agriculture
Recreation and tourism	Cultural	Attributed to trade, hotel, and restaurant, or other services
Carbon storage	Regulating	Omitted
Biodiversity protection	Supporting	Omitted
Soil protection	Supporting	Omitted
Water regulation	Supporting	Omitted

Source: Himachal Pradesh GSDP (1999–2000 to 2006–07), Department of Economics and Statistics.

assemble centers, and **farmyard wood,** which includes industrial wood and fuelwood collected by the primary producers from trees outside regular forests. Forest products, on the other hand, are classified into two major groups: (a) major products, comprising industrial wood (timber, roundwood, match and pulpwood) and fuelwood (firewood and charcoal wood), and (b) minor products, comprising a large number of heterogeneous items, such as bamboo, fodder, lac, resin, bhabbar grass, medicinal herbs, and so forth.

The HPFD supplies annual production figures for each species of industrial wood/timber. After applying a conversion ratio separately for each variety of timber, converted volumes for different varieties are arrived. These are then evaluated at the average wholesale prices of various species of timber prevailing at various Himachal Pradesh State Forest Development Corporation Limited (HPSFDCL) sale depots in the state. The estimated fuelwood data are available from the results of National Sample Survey Organization (NSSO) consumption expenditure surveys. The production of firewood is estimated indirectly from the consumption side. The data on consumption of firewood are available from NSSO consumer expenditure surveys that occur every five years.

With regards to minor forest products, the exploitation of resin is entirely in the hands of the HPSFDCL. The HPFD supplies the quantity extracted and the prices, which are used for the

valuation of resin. The value is then adjusted by deducting 5 percent of the value as trade and transport margin. For minor forest products other than resin, only the royalty value is available from the HPFD. As per ratio decided at the national level, the economic value of these products is ten times the royalty value. In the past, the output of fodder from forest sources was not included in the national accounts compilation. Recently, considering the huge dependence of livestock population on forest areas for fodder/roughages, this item has been included, in consultation with the Ministry of Environment and Forests (MoEF), as part of minor forest products.

However, forests benefit other sectors as well through a wide range of products and services, which are not considered in the forest accounts, as they do not come under the production boundary of the SNA. As a result, although forests in Himachal Pradesh provide multiple benefits and cover about 66.52 percent of the geographical area of the state, the sector officially accounts for only about 4.8 percent of the GSDP. This is because, as indicated in table 1,a number of forest goods and services are underestimated, omitted, or wrongly assigned to other sectors in the state accounts. Thus, net value added estimate alone does not reflect whether the sector is growing sustainably.

The only way through which Himachal Pradesh can assess the sustainability of various priority sectors is through natural capital accounting (NCA). NCA, the compilation of detailed statistics (using a framework like the System of National Accounts) to help monitor the interactions between the state of forest resources and the state of the economy, can help fill this information gap.NCA includes (a) asset accounts to monitor changes in the stock of natural resources and (b) flow accounts to monitor the use of natural resources, impacts of economic activity on the environment, and so forth.

1.1| How Can Forest Accounts Help State Policy?

Forest accounts can help inform policy on how the economic contribution of forests to the state economy can be maximized. Forest accounts linked with tourism accounts, for example, can help inform government policy on nature-based tourism, and ecosystem accounts for watersheds can help design payment for ecosystem services schemes. Because existing state accounts do not fully capture the economic contribution of forests, total benefits from sustainable forestry are underestimated, and other sectors are not fully aware of their dependence on healthy forests. These factors are likely to bias decisions away from sustainable management of forests and prevent policymakers from fully leveraging forest resources to realize their contribution to economic growth.

Such an initiative has been given shape by the government of India as well. A number of national- and state-level strategies and policies are already in place, with a view to inculcate the sustainability practice. While it is anticipated that the initiatives taken by the government will significantly contribute to the green base of India's national accounts, there is no doubt about the intricacies encountered in capturing a diverse set of variables in a statistical framework and assembling the accounts from an accurate green outlook. *Green National Accounts in India: A Framework,* the report of an expert group convened by the National Statistical Organization (NSO), under the Ministry of Statistics and Program Implementation (MoSPI), describes India's obligation to develop the green national accounts, and it accounts for the contributions of natural resources in India's economic growth. Natural capital accounting initiatives also exist at the global level.

The World Bank, too, has undertaken the initiative of Wealth Accounting and the Valuation of Ecosystem Services (WAVES). WAVES is a global partnership that aims to provide technical

Table 2: Natural Capital Accounting and Policy Links for Himachal Pradesh

Accounts	What it does	Which key information does this account provide?	Which key policy does this feed into?
Forest timber asset account	Identify and measure changes in stock of forest timber	Monitor the status of timber resources and the impact of various policies on forests (green felling, tree distribution rights, etc.)	Forest Conservation Policy of Himachal, which imposed ban on green felling
Forest area (NTFP accounts)	Account for the asset value of forests due to non-timber forest products	Inform the magnitude and level of dependence on NTFPs and opportunities	HP Forest Sector Strategy Rural Development Policies
Carbon accounts	Identify the carbon sequestered by HP forests	Inform potential for carbon sequestration in state forests and thereby HP's policy on low-carbon growth	HP State Action Plan on Climate Change
Ecotourism accounts	Identify the potential gain or loss in tourism due to forests and impact of tourism on forests	Inform the tourism strategy (to what extent does current tourism depend on forest resources and what is the potential for increasing this revenue?). (This would require tourism accounts as well.). Inform the damage caused due to forests as well as tourism.	HP sustainable tourism policy
Forest ecosystem accounting	Identify and measure the changes in ecological value of forest asset	Inform potential for hydropower generation and impact of land use patterns on hydropower potential (this would require land accounts as well as forest accounts) Inform the policy whereby HP gets compensated by the central government for provision of environmental services	HP hydropower policy 13th Finance Commission for fiscal transfers from the center for contribution to environmental services Payment for ecosystem services

support to countries within the World Bank group, through related programs and funding instruments, to bring natural capital into economic decision making and promote sustainable development.

1.2| Priorities for the Implementation of Natural Capital Accounting in Himachal Pradesh

Conforming to a Supreme Court ruling, the Himachal Pradesh government has imposed a ban on green felling from government forests managed under working plans for commercial harvest since 1987. Hence, forests in Himachal are seen for conservation rather than commercial exploitation. Some timber is extracted, but that is restricted to felling under Tree Distribution Pattas (or allotment) and the removal of dead and damaged trees. Moreover, the management of forests for

timber production may not be a long-term sustainable option for Himachal, as the regeneration rates in higher altitudes are slow and logging creates serious disturbances to local ecology.

With around 66 percent of the geographic area legally under forests, the state has a very large potential to strengthen the NTFP resource base. A wide range of non-timber forest products is available in the forests, which cannot be cultivated outside of forests because of long gestation periods. Right now, the NTFPs do not generate high returns to gatherers because they are mostly traded in local markets. However, there is a great potential for value addition from NTFPs, thereby enhancing the livelihoods of the rural people. Managing the forests for NTFPs can be a cost-effective means of conserving forests in addition to supplementing cash income for rural economy. The government of Himachal Pradesh is also keen to develop NTFPs, as seen in the state's forest sector strategy.

In addition to strengthening the NTFP base, a new ecotourism policy was adopted by the state government in 2001. The policy seeks the involvement of local communities to support their livelihoods and as a result promote the conservation of local culture, ecology, and environment.

Table 3: Prioritization Criteria of Ecosystem Services for Accounting Purposes

Criteria	Brief explanations
Environmental concerns	
Based on sensitivity of service to changes in the environment	Priority should be given to services that are sensitive to environmental change and will reflect changes in natural capital stocks
Likelihood of irreversible loss of ecosystem services, the supply of which might be at a significant threshold and "out of safe operating range"	Consideration may be given to ecosystem services that are close to significant environmental thresholds
Policy context	
Possibility to significantly influence environmental economic policy and decision making	Priority should be given to those services that can easily influence decision making and have maximum relevance for policy making
Economic importance of the ecosystem service	Priority should be assigned to those services that generate highest economic benefits
Data and methods	
Availability of broadly accepted methods for analyzing ecosystem services supply in physical terms at a high aggregation level	Priority should be given to services for which broadly accepted modeling and quantification techniques are available
Availability of data for measuring ecosystem services in physical terms	Producing accounts at the national level requires scaling up estimates of ecosystem services to a national level based on underlying spatial data (e.g., land cover, soils, water tables, ecosystem productivity, etc.)
Availability of data for measuring ecosystem services in monetary terms	Monetary estimates require availability of prices of ecosystem service

The state has a huge potential for ecotourism because of its beautiful landscape, opportunities for trekking and skiing, and rich forests and wildlife. The HPFD is the nodal agency for the promotion of ecotourism in the state. However, most of the value added by tourism in the state is attributed to the Tourism Department.

Himachal Pradesh has comparative advantage in hydropower and, hence, the state has given thrust to the development of hydropower. However, according to the *State of Environment Report: Himachal Pradesh* (2012), the development of large and medium hydroelectric schemes has, in the past, caused deforestation, submergence of the area, rehabilitation of the population, and impacted the population adversely. The impact of hydropower projects on the catchment area, water supply and quality, floods, siltation, and erosion are well recognized. The hydropower policy of Himachal was formulated in 2006, and has been further amended to safeguard the interests of the people and the delicate ecology and environment. The amended hydropower policy mandates that 1.5 percent of the estimated project costs be spent on the socioeconomic development of the area. The policy also mandates that a loss in forests has to be addressed through compensatory afforestation as per the plan and provision of catchment area treatment plans and environmental management plan of the projects.

For the implementation of ecosystem accounting at the state level, it may be most feasible initially to consider a limited, rather than comprehensive, set of ecosystem services for inclusion in ecosystem accounting exercise. The potential feasibility to measure ecosystem services at the state level, both in physical and in monetary terms, varies between different ecosystem services. These differences occur because of differences in data availability, different methodological constructions, and different complexities related to scaling up and aggregating physical and monetary units associated with ecosystem services. Moreover, policy priorities for analyzing ecosystem services may also differ. The System of Environmental-Economic Accounting (SEEA) proposes that the prioritization for selecting ecosystem services for accounting purposes should be based on the criteria mentioned in table 3.

Based on the policy priorities of the state, we suggest the development of physical area, timber, and carbon accounts. For monetary accounts, we suggest valuing forests for timber, non-timber forest products, and carbon in the short run. Even managing forests for NTFPs alone would ensure sustainable conservation of forests. Pathway for the physical asset accounts for the selected assets has been demonstrated in table 4.

Table 4: Pathway for the Physical Asset Accounts for the Selected Assets

Accounts	Rationale	Approach	Key policy issues	Stakeholders involved
Forest timber asset account	Identify and measure changes in stock of forest timber	Changes in area/volume of standing timber due to economic uses, other accumulation, and other volume changes Physical (area and volume) and monetary accounts of timber and fuelwood and carbon accounts	Measure the value of depletion and degradation of forest resources Examine ways to retain the forests intact Gauge the sustainability of future use	Government of HP, HPFD, HPSFDCL, FSI, DoLR, DoEST

(*continued on next page*)

Table 4: Pathway for the Physical Asset Accounts for the Selected Assets *(continued)*

Accounts	Rationale	Approach	Key policy issues	Stakeholders involved
Forest NTFP asset account (other than timber)	Account for the use values of forests, such as value of NTFPs	Extend the forest accounts to include non-produced economic assets (NTFPs, fodder) Account for the changes in value/depreciation of non-marketed forest services	Analyze whether forest users are paying appropriate rents Understand the role of NTFPs in providing livelihoods and conserving forests	Government of HP, HPFD, HPSFDCL, FSI, Tourism Department, DoLR, DoEST
Carbon accounts	Account for the carbon sequestration benefits of forests	Compute the total value of carbon lost (harvested), including carbon transferred to forest products, release of carbon from forests into atmosphere, release to soil pool	Measure whether the forests are net sources or sinks of carbon and their exact contribution to climate change mitigation Look at ways to link them with REDD and other carbon management options	FSI, HPFD, DoEST, MoEF
Ecosystem accounts	Account for the regulating, supporting, and cultural values of forests and change in value of assets due to these values	Find indicators for biodiversity, soil quality, hydrological parameters,and so forth, and examine how these are changing over time due to economic activities and the worth of the loss of these services to economy	Examine how forest biodiversity and quality is being impacted. Examine ways to conserve forests by linking with PES, REDD+, etc.	State biodiversity authorities, State Technical Council, DoEST, HPFD, MoEF, HP Energy Department
Ecotourism accounts	Account for the role of forests in providing cultural services	Find indicators of contribution of forests in providing cultural services	Ensure that a fair share of value is attributed to forests for the tourism services it provides	Tourism Department, DoES, HPFD

2| Building Forest Resource Accounts for Himachal Pradesh

Natural capital accounting entails evaluation of the national income accounts of a country or state by adjusting for the relationship between the values of environment and various economic activities. An accounting framework to identify links between nature and economy enables the stock of ecosystems—ecosystem assets and flows of ecosystem services—to be explained in relation to each other and the economic activities. Ecosystem accounting entails systematic integration of the true contribution of the ecosystem assets and the impact that economic activities impinge on them with the national accounts. The relation between economics activities and environment can be captured through the SEEA Central Framework, while the SEEA ecosystem accounts entail systematic integration of the true contribution of the ecosystem

assets and economic activities. The SEEA Central Framework and the ecosystem accounts are complementary to each other. The SEEA Central Framework has already been accepted as a statistical standard, whereas the ecosystem accounts are still experimental and are being tested in different countries.

The SEEA Central Framework intends to organize and integrate the information on various stocks and flows of the economy and the environment in a series of tables and accounts. The three broad areas of measurement in the SEEA Central Framework are (a) physical flows between the environment and the economy, (b) stocks of environmental assets and changes in these stocks, and (c) economic activities and transactions related to the environment. The Central Framework comprises the following types of accounts:

1. Supply and use tables in physical (for example, cubic meters of timber) and monetary terms (for example, million rupees) showing flows of natural inputs, products, and residuals. The supply and use tables represent a comprehensive flow accounts for products, natural resources, ecosystem inputs, and residuals from economic activity during a period—that is, during a year. **Physical supply and use tables** (PSUTs) are recorded by compiling supply and use tables in physical units of measurement. The **monetary supply and use table** (MSUT) flows recorded in monetary terms relate to the use of natural inputs from the environment and expenditures associated with the environment. Simple forms of MSUT and PSUT are presented in tablesC.3 and C.4 in appendix C.
2. Asset accounts (table C.5) for individual environmental assets in physical and/or monetary terms showing the stock of environmental assets at the beginning and end of each accounting period and the consecutive changes in stock.
3. Sequence of economic accounts (table C.6) that highlight the depletion adjusted economic aggregates. These accounts clearly demonstrate flows in monetary transactions pertinent to environment protection.
4. Functional accounts that record transactions and other information about economic activities undertaken for environmental purposes. These accounts take into consideration ecosystem services and other ecosystem flows, especially ecosystem degradation.

2.1| SEEA Experimental Ecosystem Accounts

The basic framework for ecosystem accounting can be based on SEEA Experimental Ecosystem Accounts. SEEA ecosystem accounting provides the basic stature for building up the ecosystem accounts under a common set of terms, concepts, accounting principles and classifications. The framework presents an integrated accounting structure of ecosystem services and ecosystem condition in both physical and monetary terms. The basic focus for measurement is the spatial areas. The types and general structure of the accounts presented in the SEEA Central Framework provide the starting point for the SEEA Experimental Ecosystem Accounts. Following on from this would imply at least four types of ecosystem accounts:

1. Physical accounts for the supply and use of ecosystem goods and services
2. Monetary accounts for the supply and use of ecosystem goods and services
3. Physical accounts of the environmental assets that supply the ecosystem goods and services
4. Monetary accounts of the environmental assets that supply the ecosystem goods and services

Because of the range of concepts involved in the measurement of ecosystem assets, a number of tables may be constructed. Some information concerning indicators of ecosystem condition

may be compiled in basic resource accounts—for example, accounts for metric tons of timber resources and metric tons of carbon. These accounts can provide information related to quantitative changes in ecosystem condition (for example, increase in tree cover) and are generally more straightforward to compile than information on more qualitative aspects of ecosystem condition. The relevant accounting for timber and other resources includes the measurement of opening and closing stocks and changes in stocks; it is described in detail in the SEEA Central Framework, while accounting for carbon and biodiversity is discussed in section 4 of *SEEA: Experimental Ecosystem Accounts*. The extension for ecosystem accounting is that the information on the stocks of resources should be attributed to ecosystem assets (that is, spatial areas), and flows between ecosystem assets (inter-ecosystem flows) should be recorded.

The following sections elaborate the SEEA framework, which could be followed for developing forest accounts for Himachal Pradesh.

2.2| Flow Accounts (Supply and Use of Forest Resource Account)

Natural resources form the productive base of an economy and provide flow of goods and services from the environment into the economy. Flows within the economy comprise either products or residuals, while flows from the economy to the environment are in the form of residuals. The basic structure of the flow accounts in physical and monetary units as proposed by SEEA are explained in appendix C. Table 5 shows the supply and use table for forest products and services.

Table 5: Forest Resource Account—Supply and Use of Forest Assets and Services

Units: Physical/ monetary	Industries	Households	Government	Accumulation	Flows from/ to the rest of the world	Flows from/ to the environment	Total
Supply table							**Total supply**
Timber							
NTFP							
Forest environmental services							
Use table							**Total use**
Timber							
NTFP							
Forest environmental services							

Table 6: Framework for Physical Asset Account for Forest Resource: Area Accounts for Timber, Fuelwood (ha)

	Reserved forests			Protected forests			
	VDF	MDF	Open forest	VDF	MDF	Open forest	Unclassed forests
Opening stock (1)							
Disturbance of tree (2)= (2a+2b+2c)							
Logging/harvest + illegal logging (2a)							
Logging damage (2b)							
Forest fires (2c)							
Disturbance of forest land (3)= (3a+3b+3c)							
Shifting cultivation (3a)							
Animal grazing (3b)							
Forest encroachments (3c)							
Disturbance of forest area (4) = (4a)							
Transfer of land to other activities (4a)							
Addition of stumpage tree (5)= (5a+5b)							
Afforestation (5a)							
Regeneration (5b)							
Net disturbances (6)= (5–2-3–4)							

The top half of table5—that is, the supply table—indicates the flows of production and supply of forest products (timber and NTFPs) and services by different economic units involved (industries, households, government) or the environment. The bottom half of the table is the use table, which shows flows relating to consumption and use of forest products and services by different economic units or the environment.

The sixth column—that is, flows from/to the rest of the world—identifies the exchanges between the national/state boundaries. The so-called transboundary flows of forest products are an essential element of the supply-use tables, as they are key to determine whether the forest resource of Himachal Pradesh is being managed sustainably, and if not, what are the consequences of it to the state and its neighboring states.

Table 7: Framework for Physical Asset Account for Forest Resource: Volume Accounts for Timber, Fuelwood (m^3)

	Reserved forests			Protected forests			
	VDF	MDF	Open forest	VDF	MDF	Open forest	Unclassed forests
Opening stock(1)							
Changes due to economic activity (2)= (a+b+c)							
Logging/harvest+illegal logging (a)							
Logging damage (b)							
Afforestation (c)							
Other volume changes (3)= (d+e+f+g+h)							
Forest fires(d)							
Stand mortality (e)							
Animal grazing (f)							
Shifting cultivation (g)							
Forest encroachment (h)							
Other accumulation (4) = (i+j+k)							
Natural growth (i)							
Regeneration (j)							
Losses due to degradation/ transfer of land to other activities (k)							
Net volume changes (5) = 3-(2+4)							
Closing stock (6) = (1+5)							

It is possible for the Department of Economics and Statistics to develop the supply use of forest resources both in physical and monetary terms, as preparing these set of accounts requires detailed input-output tables by industries, which are already compiled by the department.

2.3| Physical Accounts for Timber and Fuelwood

The physical asset accounts can be measured both in area(in hectares) and volume (in cubic meters) accounts. The basic structure of the physical asset account for timber resource proposed

by SEEA (see appendix C) distinguishes between types of timber resource—most importantly, between cultivated and natural timber resource. For natural timber resource, SEEA further distinguishes between timber resources available for wood supply and those unavailable for wood supply. The focus of asset accounts, as presented by SEEA, is on timber resources found in areas of forest and other wooded land. However, depending upon country- or state-specific data availability of forest classifications, the physical accounts for timber for Himachal Pradesh would be developed based on the framework described below. Table6 gives the basic framework for developing physical accounts for forest timber and fuelwood in terms of area for Himachal.

An area account for timber measured in hectares is an alternate physical measure of timber resource. The underlying framework for volume accounts for timber is the same as for the area accounts; it is shown in table 7.

Opening stock and closing stock: These represent the stock of forest resources—that is, total standing volume of timber, volume of growing stock or area under forest resources—present at the beginning and end of the accounting period. Changes in opening stock take place because of changes due to economic activity, other accumulations, and other volume changes.

Changes due to economic activities: This refers to human activities associated with production, which affects area, volume, and stock of carbon in forest resources. These activities include logging/harvest, logging damage, illegal logging, and afforestation that affect (decrease/increase) the stock of forests.

- *Logging/harvesting (exploitation of forest products both recorded and unrecorded):*Forest harvesting/exploitation works in Himachal Pradesh include major forest products and minor forest products (resin tapping, timber extraction, and so forth), which are primarily done by the HPSFDCL. A set amount of standing volume of timber is earmarked to right holders and free grantees, however, for which they make their own arrangements for exploitation. In addition, right holders extract a small quantity of firewood, and a set amount of timber is extracted and charcoal is prepared for departmental use by the HPFD. Regarding the felling of trees, owners are allowed to cut only three coniferous trees (an exception is made forchil trees) for bonafide domestic and agricultural purposes. In the case of chil and other trees, five trees are allowed to be cut without permission, and up to 10 trees with prior permission from the concerned Range Officer and more than 10 trees with permission from the Divisional Forest Officer, as allowed under the Himachal Pradesh Land Preservation Act of 1978. Felling of trees for sale should be in accordance with the 10-year felling program formulated by the HPFD and approved by the government, except for the areas falling within the limits of municipal councils, nagar panchayats, and cantonment boards.
- *Afforestation:* The stock of forested land may increase because of economic activity, such as afforestation, resulting in the establishment of new forest on land that was previously not classified as forested land.

Other volume changes: This comprises reductions due to forest fires, stand mortality and insect infestation, natural calamities, forest encroachments, shifting cultivation and damage due to heavy grazing.

- *Forest fires:* Forest fires can be of two types: surface fires (non-stand replacing) and crown fires (stand-replacing). Because surface fires are non-stand replacing fires, they are not considered under other volume changes.
- *Animal grazing:* Grass cutting and grazing is allowed in the state forests to right holders as well as to non-right holders.

- *Forest encroachment and shifting cultivation:* Forests are illegally encroached every year, despite the fact that the land is legally classified as forest. In reality, the forestland is occupied by humans or put to use for some human activity. This results in loss of tree cover in that area. Similarly, in some states, forests are cleared for agriculture, and after few years, the land is left for trees to grow.

Other accumulation: This consists of accumulation of timber due to natural growth (mean annual increment) and natural regeneration, and losses due to degradation and the transfer of forestland for non-forest purposes, such as agriculture or residential or industrial purposes.

- *Natural expansion:* The stock of forested land may increase because of silvicultural measures, or natural expansion (natural regeneration).
- *Losses due to degradation/transfer of land for non-forest purposes:* Forestland may be lost when transferred to non-forest purposes or due to shifting cultivation (a specific form of land transfer). When the forested land is degraded to a point where tree cover falls below 10 percent, the classification of the land changes. Although the total area of forestland may not change, some closed forests may become open forests because of excessive harvesting.

2.4| Monetary Asset Accounts for Timber and Fuelwood

Monetary asset accounts for timber resources involve measuring the value of the opening and closing stock of timber resources and the changes in value of the stock over an accounting period. The monetary accounts are derived from the physical accounts by applying monetary unit values—that is, market prices or estimated market values—to the physical stocks and stock changes of timber resources. Most of the changes in the stock of timber are directly related to changes recorded in the physical asset account, but there are also entries relating to the revaluation of timber resources, which are recorded due to changes in prices of timber in an accounting period. The framework for monetary asset accounts for timber is presented in table 8.

It is probable that not all timber resources are available for harvest because of forest legislation and/or environmental or economic reasons. In Himachal, by order of the Honorable Supreme Court, the state government has banned green felling of trees and timber is removed only under timber distribution rights. Therefore, SEEA recommends that the volume of timber resources that cannot be harvested be separately identified and not be part of the overall calculations of the value of timber resources.

Estimates are made for the value of natural growth and the value of removals. For cultivated timber resources, the natural growth is considered an increase in inventories and the removal of trees is treated as a decrease in inventories. Following the SNA, only the change in inventories would normally be recorded, but in the SEEA, the entries are recorded on a gross basis.

For natural timber resources, the natural growth is not considered an increase in inventories because the growth in the trees is not considered part of a production process. The removal of the timber resources represents the point at which the timber resources enter the economy, and output is recorded at that point. Different approaches for valuing the stock of timber resources are explained in appendix C.

2.5| Forest Asset Accounts (NTFP)

Forests provide a range of non-timber forest goods and services that should also be valued while accounting for forest resources. Himachal Pradesh forests provide a variety of minor forest products, such as resin, bamboo, bhabbar grass, fodder grazing, and medicinal herbs.

Table 8: Monetary Asset Account for Timber (Rs, millions)

	Reserved forests			Protected forests			
	VDF	MDF	Open forest	VDF	MDF	Open forest	Unclassed forests
Opening stock (1)							
Changes due to economic activity (2)= (a+b+c)							
Logging/harvest+illegal logging (a)							
Logging damage (b)							
Afforestation(c)							
Other volume changes (3)= (d+e+f+g+h)							
Forest fires(d)							
Stand mortality (e)							
Animal grazing (f)							
Shifting cultivation (g)							
Forest encroachment (h)							
Other accumulation (4) = (i+j+k)							
Natural growth (i)							
Regeneration (j)							
Transfer of land to other activities (k)							
Net volume changes (5) = 3-(2+4)							
Closing stock (6) = (1+5)							

Accounting for the values of NTFPs indicates the level of dependence of rural communities on forests for their livelihood. However, only the HPSFDCL does exploitation of resin in the state. In addition, bhabbar grass is commercially extracted and a certain royalty is paid for this. With regards to bamboo, there is no restriction on the number that can be felled for bonafide domestic purposes or for use in cottage industries.

Extending the forest accounts to include non-produced forest assets such as NTFPs, fodder, bioprospecting values, and so forth will help in accounting for the changes in value of these assets. Forest services already recognized in Himachal forests are the activities considered under

the payment for ecosystem services (PES) program. Developing NTFP accounts can help analyze whether payments for these ecosystem services, paid by forest users, are appropriate or not. As forests yield NTFPs in addition to timber, the value accounts of NTFPs are derived from the area accounts discounted for the value per hectare of the products.

2.6| Forest Carbon Accounts

Carbon has a central place in ecosystem and other environmental processes and economic and other human activity. Therefore, the extensive role of carbon in the environment and the economy requires a comprehensive approach to measurement. While accounting for timber, fuelwood, and non-timber forest products is simple, accounting for carbon requires careful study, as disturbances in forests involve flux of carbon between the atmosphere, soils, and forest products. When forests are subjected to various disturbances, some of the carbon remains in the biomass itself, some remains in situ, and a part of it is transferred to the atmosphere as CO_2, CO, and CH4. Some of the carbon enters the forest product market, and carbon that is left on-site enters the soil carbon pools. Forests as net sources or sinks of carbon can only be identified after taking into account the net flux of carbon between the forest sector and the atmosphere.

The carbon account for timber resources can be developed based on the physical asset account for timber resources. Accounting of carbon sequestration and other carbon stocks and flows, estimates of the amount of carbon bound in timber resources, and the changes in these amounts over an accounting period can be derived using information on opening and closing volume of standing timber and the changes in volume. The basic suggested structure for preparing carbon accounts suggested by SEEA Experimental Ecosystem Accounting is explained in appendix C and the proposed framework for Himachal Pradesh forests is presented in table 9.

An indicator that can be derived from the carbon stock account is the "net carbon balance." This is indicative of the total value of carbon lost, including carbon transferred to forest products, release of carbon from forests into the atmosphere, and release of carbon to soil pool. Forest carbon accounts show whether the forests are net sources or sinks of carbon and their exact contribution to climate change mitigation. Carbon accounts may help when looking at ways to link forest management with REDD and other carbon management options.

2.7| Framework for Physical Accounts for Biodiversity/Ecosystem

A basic resource account for biodiversity, focusing on the measurement of changes in species, provides useful information for assessing the ecosystem condition. Biodiversity accounts are imperative in analyzing the ecosystem services, particularly in terms of assessing expected ecosystem service flows. For provisioning services, species are harvested directly for food, fiber, timber, or energy. Changes in the abundance of species due to human extractive activities would be reflected in the species abundance and status. Harvesting in excess of a species' capacity to regenerate (that is, unsustainable harvesting) would result in lower yields, reduced economic profit, and a higher risk of extinction, and it would be reflected in moving to higher risk categories in an account focused on species status. Species that provide regulating ecosystem services, such as bees (pollination), can also be linked to the species biodiversity and land cover accounts. For bees, the level of pollination service would be a function of the abundance of bees, which could be drawn from an account focused on species abundance.

Because of the complexities in measurement of biodiversity, the accounting focus is only on selected indicators rather than on all aspects of biodiversity. According to SEEA, there are four indicators considered for accounting for state of biodiversity:

Table 9: Framework for Physical Asset Account for Carbon

	Protected forests	Reserved forests	Unclassed forests
Opening stock of carbon			
Net release due to changes in economic activity			
Release to atmosphere due to logging			
Afforestation			
Other volume changes			
Release to atmosphere due to forest fires			
Release to atmosphere due to stand mortality			
Release of carbon due to animal grazing			
Release of carbon due to shifting cultivation			
Release of carbon due to forest encroachments			
Other accumulation			
Natural growth			
Regeneration			
Carbon lost due to transfer of land to other activities			
Net carbon change			
Closing stock of carbon			

- Trends in extent of selected ecosystem
- Trends in abundance and distribution of selected species
- Trends in status of threatened species
- Change in genetic diversity

The basic structure for developing a biodiversity account for species abundance based on SEEA arrangement is described in table 10. Some more details on biodiversity accounts are mentioned in appendix C.

Biodiversity accounts can be useful indicators of species richness, species abundance, and threatened species. These accounts can help in assessing the loss of species to the economy, whose values have to be estimated by suitable methods. This can help in policy formulation by examining ways to protect biodiversity by linking with biodiversity offsets, payment for ecosystem services, and REDD+. Building biodiversity accounts will primarily depend upon availability of data, as only limited information is available with the HPFD and the state

Table 10: Biodiversity Account: Framework for Species Abundance by Kingdom for an Environmental Accounting Unit

	Animals									
	Mammals	Birds	Amphibians	Insects	Fish	Invertebrates	Subtotal	Fungi	Protista	Plants
Opening population										
Closing population										
Net change										
Reference population										
Opening population as proportion of reference population										
Closing population as proportion of reference population										

Source: SEEA Experimental Ecosystem Accounts.
Note: The selection of classes and kingdom shown in the table is indicative only. It may vary according to the availability of data at a more disaggregated level.

biodiversity authorities. The status of area under forests, the quality of the forests, and biodiversity are general indicators of the health of a forest ecosystem and they can be linked with other regulating and supporting services.

3| Assessment of Data and Information Sources for Compiling Forestry Accounts for Himachal Pradesh

In the implementation of ecosystem accounting at the national scale, it initially may be most feasible to consider a limited, rather than comprehensive, set of ecosystem services for inclusion in ecosystem accounting exercises. The potential feasibility to measure ecosystem services at the national scale, both in physical and in monetary terms, varies between different ecosystem services. These differences occur because of differences in data availability, methodological constructions, and complexities related to scaling up and aggregating physical and monetary units associated with ecosystem services. Moreover, policy priorities for analyzing ecosystem services may also differ. SEEA proposes that the prioritization for selecting ecosystem services for accounting purposes should be based on the criteria mentioned in table 3.

The feasibility of developing forest accounts for Himachal Pradesh primarilydepends on regular availability of data. Gaps in data availability may strictly constrain the results of the accounts. Therefore, it is crucial to assess data from all possible authentic sources to build an exhaustive account covering all forest resources and services in line with the SEEA framework.

3.1| Forest Classification System

Forests in India are defined based on two principal classification systems: (a) land use, that is, the recorded forest area, and (b) canopy density or the forest cover as per the Forest Survey of India (FSI) classification system. In India, land use is classified into nine classes:

1. Forests
2. Area under nonagricultural uses
3. Barren and uncultivable land
4. Permanent pastures and other grazing lands
5. Land under miscellaneous tree crops, and so forth
6. Culturable wasteland
7. Fallow lands other than current fallows
8. Current fallows
9. Net area sown

This land use classification system is defined in the appendix B. The Indian classification of land use varies from the SEEA classification of land use. The SEEA distinguishes between land use and land cover. The classifications for land use and land cover are described in the SEEA Central Framework, a brief overview of which is mentioned in the appendix C.

Forest area (or recorded forest area), as per the land use classification, refers to all geographic areas recorded as "Forests" in government records. Recorded forest areas comprise reserved forests (RF) and protected forests (PF), constituted under the provisions of the Indian Forest Act of 1927. Besides RF and PF, forests may also include areas that may have been recorded as forests in the revenue records or constituted so under the state act or local law. Table 11 shows the amount of forest area under various legal classifications for Himachal Pradesh.

On the other hand, forest cover refers to all lands more than 1hectare in area with a tree canopy density of more than 10 percent. Thus, forest area denotes the legal status of land, whereas forest cover indicates the presence of trees on any land irrespective of legal ownership. The FSI classifies forests based on the internationally adopted norms of classification. The FSI assesses forest cover of the country biennially, using satellite data through the application of remote sensing technology. The main objective is to present the information on forest resources of the country at the state and district level. According to the FSI assessment, forest cover is broadly classified into four classes: very dense forest (VDF), moderately dense forest (MDF),open forest, and scrub (as defined in table 12). The classification of the cover into dense and open forest is based on internationally adopted norms of classification. Mangroves are separately classified because of their characteristic tone and texture and inimitable ecological functions.

Although the majority of recorded forest areas have vegetation cover, there may be some blank areas or areas with a tree density of less than 10 percent. These may include wetlands, rivers, and river beds, creeks in the mangroves, snow-covered areas, glaciers, alpine pastures, cold deserts, grasslands, and so forth. On the other hand, there are areas outside the recorded forests with tree patches of one hectare and a canopy density beyond 10 percent. These may include plantations on the community lands, roadsides, railways, and canals; eucalyptus, rubber, tea, and coffee plantations; and so forth. Such areas are also considered under the forest cover and are included in the forest cover assessment by FSI.

Table 11: Forest Area under Various Legal Classifications

	Area in hectares		
Classes of forests	March 31, 2007	March 31, 2008	Variation
A. Forests managed by the HPFD			
Reserved forests	189,786	189,786	0
Protected forests			
a) Demarcated forests	1,184,040	1,191,180	(+) 7,140
b) Undemarcated	2,120,623	2,120,478	(–)145
c) Strip forests(road/railway)	1,310	1,312	(+) 2
Unclassed forests	97,668	88,634	(–) 9,034
Total A	**3,593,427**	**3,591,390**	**(–) 2,037**
B. Private forests managed by the HPFD			
Area under Section 38 IFA	10,867	10,867	0
Area managed under LPA	26,002	26,002	0
Area under HP Private Forest Act	80	80	0
Total B	**36,949**	**36,949**	0
C. Forests not managed by the HPFD			
Municipal forests	1,037	1,037	0
Cantonment forests	1,340	1,386	(+) 46
Shamlat & Mustarqua Forests	14,960	16,997	(+) 2,037
Other forests (private)	55,584	55,538	(–) 46
Total C	**72,921**	**74,958**	**(+) 2,037**
Grand total	**3,703,297**	**3,703,297**	**0**

Source: Himachal Pradesh Forest Department, 2008.

Forest inventory: The forest inventory data comprises data for tree cover, forest cover, and growing stock of forests. Tree cover comprises tree patches outside the recorded forest area, which are not captured by remote sensing satellite during the forest cover assessment, having areas less than the minimum map area of 1hectare. They comprise block and linear patches having areas between 0.1 hectare and 1hectare. Trees outside forest (TOF) and tree cover are two different entities but closely related to each other. TOF refers to all trees growing outside the

Table 12: FSI Classification Scheme

Classes	Description
Very dense forests (VDF)	All lands with tree cover (including mangrove cover) of canopy density 70% and above
Moderately dense forest (MDF)	All lands with tree cover (including mangrove cover) of canopy density between 40% and 70%
Open forest	All lands with tree cover (including mangrove cover) of canopy density between 10% and 40%
Scrub	All land with poor tree growth, chiefly of small or stunted trees with canopy density less than 10%
Non-forest	Any area not included in the above classes

Source: Ministry of Environment and Forests, Forest Survey of India, SFR2011.

Table 13: Forest Cover in Himachal Pradesh Based on FSI Assessment

Forest cover	Area in km^2
Geographic area	55,673
Very dense forest	3,224
Moderately dense forest	6,381
Open forest	5,074
Total	14,679
% of geographic area	26.37
Scrub	328

Source: Ministry of Environment and Forests, Forest Survey of India, SFR2011.

recorded forest area irrespective of patch size. For estimating growing stock from TOF, the entire TOF area is taken into account. For the purpose of the forest cover assessment, only TOF patches of 1hectareand more are included in the forest cover. However, for the purpose of the tree cover estimation, the TOF patches that are less than 1hectarein extent and the scattered trees in the rural and urban areas are also taken into consideration. Thus, trees included in the tree cover constitute only a part of TOF; therefore, tree cover becomes a subset of TOF. Assessing the inventory of forest/tree resources is essential for formulating appropriate strategies for the forest sector. Accurate data and latest information on forest cover and volume of growing stock of forests/trees and trends of changes therein are crucial for policy and planning purposes. For a comprehensive assessment of forest resources inside and outside forest areas, vegetation survey and estimation of soil carbon in forest are considered by stratifying the country into physiographic zones. The information on forest inventory (as illustrated in table 14) is part of the biennial *State of Forest Report (SFR)* published by the FSI.

Table 14: Forest Inventory of Himachal Pradesh

Category	Area (ha)	% Geographicarea	Growing stock (million m^3)
Tree cover	62,300	1.12	21.146
Forest cover	1,467,900	26.37	321.314
Total	1,530,200	27.49	342.460

Source: Ministry of Environment and Forests, Forest Survey of India, SFR 2011.

3.2| Forest Data Systems

Himachal Pradesh Forest Department: A wide variety of data is available from the HPFD that can be used to compile forest resource accounts for the state. The department compiles extensive data sets at the district level in its Forest Statistics Report, annual administrative reports, and working plans.

- *Forest Statistics Report:* The report provides district and circle wise data sets, which can be compiled to formulate the timber accounts and other forest resource accounts.
  - District wise forest cover of HP
  - Land classification according to altitudinal zones and river basins
  - Land utilization of HP
  - Human population in HP district wise
  - Livestock census of HP by district
  - Circle/division wise river basin wise area, growing stock and annual yield of important species in various forest divisions
  - District and division wise forest area by legal status
  - Circle division wise area by different legal status
  - Abstract wise species wise plantation raised
  - Division and species wise plantation raised
  - Outturn of major products
  - Total timber removed
  - Quantity of timber removed by different agencies
  - Outturn of minor forest products
  - Division wise detail of resin exploitation works by HPSFDCL
  - Volume granted under timber distribution rights
  - Forest fires—their causes and area burned
- *Annual administrative reports:* These publications contain updated statistics of the forest area, its management, silviculture, harvesting of forest products, physical and financial achievements of forestry development works, and organizational setup of departments.
  - Area of reserved, protected, and unclassed forest
  - Demarcation and maintenance of boundaries

- Area surveyed
- Area under working plan
- Area protected from forest fires
- Area closed and opened to grazing
- Progress of regeneration and afforestation
- Outturn of timber and fuelwood
- District and division wise area by legal status
- Scheme wise physical and financial achievement (forest and soil conservation)

- *Working plans:* The HPFD prepares circle wise working plans for a period of about 10 years. These data can prove to be useful for preparing detailed forest accounts for the state. The types of information provided by working plans are listed below:
  - General description of growing stock
  - Average rainfall data
  - Reserved forest, demarcated forest, unclassed forest
  - Volume of species
  - Value granted to right holders per year
  - Existing and normal growing stock per hectare
  - Natural regeneration
  - Forest fire
  - Logging
  - Resin tapping
  - Fuelwood requirement
  - Fodder requirement
  - Cost of felling
  - Major forest products
  - Cost, price, and royalties for standing and salvage trees
  - Royalty rates for resin and timber
  - Concessional rates and market rates
  - Diameter at breast height (DBH) and age (total value and value table adopted)
  - Capital value of forest (growth of different species)
  - Total growing stock for main species by different working circles
  - Annual yield of different species
  - Pasture area
  - Extent of area encroached
- *Himachal Pradesh Forest GIS Bhuvan:* The Himachal Pradesh Forest Department recently launched a Geographical Information System (GIS) application on Bhuvan (a Google Earth–like satellite mapping tool). It gives best insights on Himachal forests based on GIS mapping. It provides information on land use, land cover, wasteland, watersheds, villages (kangra), and village locations—circle wise, division wise, and range, block, and beat wise. The GIS Bhuvan

provides information on forest management by forest fire, location, forest fire regimes, and fire risk zonation for the years 2003–12. The average number of fires in a year, average area burned in a year, and numbers of fire years are combined to arrive at fire risk zonation at multiple levels—that is, compartment, forest, and beat levels. The GIS Bhuvan system also makes it possible to viewthe HPFD's assets based on boundaries—that is, beat boundary, Joint Forest Management Committees (JFMC), and Green India Mission plantation. Currently, only plantations and entry point activities have been added, the Forest Department is planning to add more.

- *Green India Mission:* Under the prime minister's National Action Plan on Climate Change initiative, the Green India Mission (GIM) intends to increase the green cover of India by more than5 million hectares over the next decade. Landscapes identified for GIM activity by proposed activities—that is, the entry point of JFMC and GIM plantation in the state—can be viewed with the help of the GIS system.
- *Climate vulnerability:* This gives level wise information on climate vulnerable landscapes as well as other selected landscapes that require special attention, such as ravine areas, predominantly scrub areas, and areas with high biodiversity outside the Protected Area Network (PAN). The climate vulnerability of level 2 (L2) landscapes (approximately 10,000–15,000hectares each) is evaluated using the methodology proposed by the GIM Advisory of the Ministry of Environment and Forests. Social, economic, and forest vulnerabilities are combined with climate change projections to derive the relative vulnerabilities of these landscapes. The Local Landscape Index is developed by providing weightage to various contributing factors, such as biodiversity, forest cover dynamics, predominance of rural population, caste structure, and so forth. The climate-vulnerable landscapes are obtained by ranking the relative vulnerability values and also stratifying them with the major landscapes (L1) of the state for the purpose of representation.
- *Wildlife:* There is also a provision of information for wildlife, which is covered by different categories, such as area under wildlife wing outside PAN, conservation reserves, national parks, and wildlife sanctuaries. So far, 5 national parks, 26 wildlife sanctuaries, and 3 conservation reserves covering an area of 8,358 square kilometers (15 percent of the geographic area) have been constituted in the state.

Hydrological Information System: Himachal Pradesh also has a Hydrological Information System (HIS), which provides hydrological information on surface water, groundwater, water quality, and hydro meteorological data. The HIS is not simply a data collection or archive, although it incorporates an archive. It is a logical and structured system to collect data, which are subsequently entered into the computer, checked, and stored, and where data may be compared, associated, related, and combined to provide information in a form suitable to users.

Forest Survey of India: Forest Survey of India is a premier national organization under the Ministry of Environment and Forest that is responsible for regularly assessing and monitoring the forest resources of the country. The major activities performed by FSI are forest cover assessments, assessing the inventory of forest areas, developing thematic maps, monitoring the inventory of TOF in rural and urban areas, inventory data proceedings, designing methodology, and providing services of training, research and extension. The FSI is a valuable source of the information required to build forest resource accounts for Himachal Pradesh. For example, the *India State of Forest Report* gives valuable information on forest/tree resources, forest inventory, and forest cover at the state and district levels. The report is based on interpretation of satellite data on a biennial basis.

The FSI has been the major contributor on forest biomass estimation and carbon stock. The FSI's carbon reports furnish forest type and density wise carbon stock under different carbon pools. The different carbon pools considered for estimating carbon stock are the following:

- Above ground biomass
- Below ground biomass
- Dead organic matter
- Dead organic matter
- Soil organic matter

Himachal Pradesh State Forest Development Corporation Limited: The HPSFDCL is an undertaking of the Himachal Pradesh government that deals with the marketing of mainly timber, fuelwood, pulpwood, bamboo, khair, resin, turpentine oil, and other subsidiary products. The department provides key data on the rate list of different forest products sold at different sale depots of the state.

Department of Environment, Science and Technology, HP: The DoEST works toward improving the effectiveness of environmental management, protecting vulnerable ecosystems, and enhancing sustainability of development. The State Pollution Control Board; State Council for Science, Technology and Environment; Environment Division; Biotechnology Division; and Science and Technology Division come under this department. The Society for Environment Protection and Sustainable Development comes under the Environment Division. The DoEST prepares the *Environment Master Plan, State Strategy and Action Plan on Climate Change HP, State of Environment Report (SoER),* and GHG emissions inventory of HP. These reports provide useful information on sustainable forest management and development.

Department of Economics and Statistics, HP: The DoES is the nodal agency for collection, compilation, and analysis of statistics related to various sectors of the state's economy. The main function of the department is to prepare a broad database to help in the planning and policy formulation for developmental activities of the state. The database is used to estimate GSDP/ state income/district income, capital formation, and economic growth rate.

- District wise decadal population
- Sex wise rural urban population (district wise 2011 census)
- District wise decennial population
- District wise area and density of population
- District wise land utilization
- District wise consumption of fertilizers
- District wise livestock population
- District wise poverty line
- Tourist arrival
- GSDP/NSDP at current and constant prices
- GSDP/NSDP by industry of origin at current and constant price
- Value added from agriculture and allied activities (agriculture, vegetables, horticulture, floriculture, backyard, livestock, inputs)
- Value added from forestry and logging (includes industrial wood, TOF, fuelwood, minor forest products, fodder

- Value added from fishing activities (inland, subsistence and trout fish)
- Value added from mining and quarrying activities
- Value added from manufacturing activities (registered & unregistered)
- Value added from electricity, gas and water supply activities
- Value added from transport other means & storage activities
- Value added from trade hotels and restaurants

The DoES values the contribution of forests in GSDP/NSDP of Himachal Pradesh by accounting for the value of forestry and logging. For the purpose of estimation of state domestic product from "Forestry and Logging," forest production is broadly classified into two groups: major and minor forest products. Major forest products include industrial wood, fuelwood, and charcoal, while minor forest products include resin, bamboo, bhabbar grass, grass, medicinal herbs, and other miscellaneous items.

The production figures of industrial wood/timber for each species are supplied by the HPFD annually. After applying a conversion ratio separately for each variety of timbers, converted volumes for different varieties are reached. These are then evaluated at the average wholesale prices of selected species of timber prevailing at various HPSFDCL sale depots. The estimated fuelwood data are available from the results of NSSO consumption expenditure surveys, which are taken every five years. The production of firewood is estimated indirectly from the consumption side.

In the case of minor forest products, the exploitation of resin is entirely in the hands of the HPSFDCL. The quantity extracted and the prices are supplied by the HPFD, and the same are used for the valuation of resin. The value is then adjusted by deducting 5 percent of the value as trade and transport margin. In the case of minor forest products other than resin, only the royalty value is available from the HPFD. As per ratio, decided at the national level, ten times theroyalty value is taken to be the economic value of these products. In the past, output of fodder from forest sources was not included in the national accounts compilation. Recently, considering the huge dependence of livestock population on forest areas for fodder/roughages, this item has been included in consultation with MoEF as part of minor forest products.

The above discussion clearly indicates the types of forest products and services considered for accounting of GSDP and NSDP. It is evident that forest services such as pollination, recreation and tourism, carbon storage, biodiversity protection, soil protection, and water regulation are left unaccounted. Therefore, in order to account for the "true value" of forest products and services, it is essential to account for these services.Appendix D represents some district-level data sets available from key data sources. Data sources and information on available data for building forest accounts has been broadly reviewed in tables presented in appendix E. The data sets available for Himachal Pradesh, as pointed out in tables 15and 16, show that the data are quite diverse and need to be refined to make them symmetric.

4| Review of Institutional Capability for Developing Forest Resources Accounts and Capacity Building

Successful development and implementation of green national accounts necessitates that all possible data sources, be they primary or secondary, are completely exploited. Therefore, it is important that the capacity and training of the officers of all relevant sectors to forest accounting are enhanced. Some data exist and some data gaps need to be filled. The environmental issues

Table 15: Details of Data Availability and Non-availability (*continued*)

Data needs	Sources	Unit	Availability	Nonavailability
District wise forest cover of Himachal Pradesh	FSI, *State of Forest Report*	Area in square kilometers	Data is available as per FSI assessment for the years 2001, 2003, 2005, 2009, 2011, density wise, forest scrub	
Land classification according to altitude zones and river basins	HPFD, HP Forest Statistics	Area in square kilometers	Forest circle, division wise	Forest Statistics 2005 andForest Statistics 2010 do notcover this data
Land utilization of Himachal Pradesh	DoLR; HP Forest Statistics; DoES; Ministry of Agriculture; Land Utilization Statistics at a glance	Area in square kilometers	Land utilization under the nine-fold classification for years 2002–03 and 2006–07 from Forest Statistics. Data available for 2001–02 to 2010–11 from MoA	Data from both sources do not tally. There is confusion regarding which data are more suitable for compiling the accounts for HP. Moreover, different HPFD reports consider different classes of land utilization.
Area under different management working circles in various working plans	HPFD, HP Forest Statistics 2005	Area in hectares	Division wise, working plan wise data as on December 31, 2004	Forest Statistics 2010 does not provide any detail under this head
Area, growing stock, and prescribed annual yield of important species	HPFD, HP Forest Statistics 2005, 2010	Area in square kilometers; growing stock in 000 cubic meters	Division, circle, river basin wise	Specific year of the data not mentioned. Forest Statistics gives the data for 2006, but only important species wise—not circle wise, division wise, or river basin wise
Prescribed annual yield of important species from state forests in various forest divisions	HPFD, HP Forest Statistics 2005	Yield in cubic meters	Species wise circle/ division wise	Specific year of the data not mentioned. Forest Statistics 2010 does not furnish this data.

(*continued on next page*)

Table 15: Details of Data Availability and Non-availability *(continued)*

Data needs	Sources	Unit	Availability	Nonavailability
District and division wise area in HP by different legal classification **Circle and division wise forest area of HP by legal classification**	HPFD, HP Forest Statistics 2005	Area in hectares	For year 2002–03	HP Forest Statistics 2010 gives the data for 2008–09, but district wise and division wise detail is not mentioned
Area planted under various species	HPFD, HP Forest Statistics 2005, 2010	Area in hectares	Species wise area planted from 1950–51 to 2006–07, Plantation raised during 2000–01 to 2003–04, 2007–08, 2008–09. Total area of plantation as on March 31, 2004, and March 31, 2009	
Plantation planted, survival rate	HPFD, Plantation Brochures	Area in hectares; number of plantations in no.; survival rate in %	Division, range, block wise, circle wise	
Species wise plantations raised according to Five Year Plans	HPFD, HP Forest Statistics 2005	Area in hectares	Available from 1st Five Year Plan to 10th Five Year Plan	
Division wise, species wise plantations raised	HPFD, HP Forest Statistics, 2005	Area in hectares	Available for years 2000–01, 2001–02, 2002–03, 2003–04	
Physical achievements of soil conservation	HPFD, HP Forest Statistics 2005	Rs lakh	State and central sector	Data speaks about physical achievements but figures are in Rs lakh. Clarity is required on whether it is physical or financial achievement, and on the units.
Quantity of timber removed	HPFD, HP Forest Statistics 2005	Volume in cubic meters	Removal in decades from 1950–1960 to 1990–2000	Latest data required

(continued on next page)

Table 15: Details of Data Availability and Non-availability (*continued*)

Data needs	Sources	Unit	Availability	Nonavailability
Resin exploitation	HPFD, HP Forest Statistics 2005, Working Plan	Resin blazes in 000 No.; quantity extracted in quintal (100 kg);royalty in 000 Rs	Division/circle wise no. of blazes tapped, resin extracted, royalty, average yield per 000 blazes for 2001–02, 2002–03, 2003–04	
Timber and fuelwood exploitation	Administrative Report	Timber in cubic meters; firewood in metric tons; charcoal in metric tons	Standing volume of timber and fuelwood exploited by various agencies, circle wise and division wise	
Timber distribution	HPFD, HP Forest Statistics 2005, Working Plan		Volume granted under timber distribution rights at subsidized rates in relation to market rate and subsidy for 1998–99 to 2003–04	
Sources of forest revenue	HPFD, HP Forest Statistics 2005, 2010	Rs in 000	Product/source wise	
Area of reserved forests, protected forest, unclassed forest, leased forest	HPFD, Administrative Report, Working Plan	Area in hectares	Circle wise division wise area under the category	
Forest settlement	HPFD, Administrative Report	Area in square kilometers; cost in Rs	Circle wise Settlement area, cost of settlement	
Area subject to forest fires	HPFD, Administrative Report 2005–06; Data also available from working plans		Area of forests protected from fires, protection costs, causes of fires and extent of area burned for the year 2005–06	Administrative Report of years other than2005–06 do not give data on forest fires
Animal grazing	HPFD, Administrative Report; data also available from working plans		Area closed and opened for grazing, return on grazing on payment at full rates, grazing fees	Area and volume of forest cover lost due to heavy grazing not mentioned
Regeneration **(mean annual increment)**	HPFD, Administrative Report; data also available from working plans		Area regenerated (natural, artificial), cost of regeneration	Volume of forest cover regenerated not available

(*continued on next page*)

Table 15: Details of Data Availability and Non-availability *(continued)*

Data needs	Sources	Unit	Availability	Nonavailability
Afforestation	HPFD, Administrative Report		Area afforested during a year	Volume of afforestation not available
Transfer of forest land to other activities	HPFD	Area in hectares	Year wise detail of proposals approved under FCA up to January 1, 2013, purpose wise	
Loss in timber volume due to insects, pests, and disease				Data not available. Species wise and year wise data required
Shifting cultivation	Wasteland Atlas, Directorate of Land Records	Area in square kilometers	District wise data available from different publication of wasteland atlas	Division wise/circle wise data for shifting cultivation required
Encroachments	Working plans	Area in hectares	Extent of area encroached is available forest wise for the working plan period	
Carbon stock	FSI, MoEF	000 metric tons of carbon, metric tons per hectare	FSI now publishes state wise carbon stock in different carbon pools and changes in carbon stock in forests (forest type and density wise) in India	District wise/circle detail of carbon stock is required
Tourism	Tourism Department	In numbers	No. of tourists arrived (domestic & foreign), district wise from 2004–2012	
Volume of timber handed for harvesting	HPSFDCL	Not mentioned	Circle wise, species wise volume, royalty rate and average rate for years 2011–12 and 2012–13	Unit of the data not mentioned; previous year not available
Allowed removal of wood and NTFPs				Species wise detail not available

Table 16: Details of Data for Developing Specific to Values

Data needs	Sources	Unit	Availability	Nonavailability
Outturn of major products from state forest	HPFD, HP Forest Statistics 2005,2010	Standing volume in cubic meters	Timber extracted, firewood, charcoal species wise, agency wise 1999–2000 to 2003–04	Value not available
Outturn of minor forest products from state forest	HPFD, HP Forest Statistics 2005, 2010	Quantity in metric tons; value in 000 Rs	Products wise 1999–2000 to 2003–04 with detail of medicinal herbs Used by different agencies (value and quantity)	Forest Statistics 2010 does not present detail on medicinal herbs
Sale rates for supply of timber	HPSFDCL	Rates in Rs per cubic meters	Size (length, width, height) wise, species wise	
Price index for main forest products				Not available
Value of loss in timber volume due to insects, pests and disease				Data not available. Species wise and year wise data required
Value of timber and other products at sale depots	HPFD, Administrative Report	Volume in cubic meters; value in 000 Rs	On hand in the beginning and end of year (value and quantity)	
Financial achievements of forestry and wildlife schemes	HPFD, HP Forest Statistics 2005	In Rs lakh	Forestry and wildlife (state and central sector)	
Financial achievements of Soil Conservation Schemes	HPFD, HP Forest Statistics 2005	In Rs lakh	State and central sector	
Return of grazing in the state forest	HPFD, Administrative Report	Value in Rs	Grazing on payment at full rates and grazing fee	Loss in value due to overgrazing

are usually not a part of annual training plans of most of the departments. The primary focus is on technical training, not on a conceptual understanding of environmental issues and how they impact the environment as a whole. Trainings related to insect and pest management, marketing of products, fodder development, role of forestry in watershed development, disaster management, and understanding climate change are presently of prime importance.

The state has expertise in innovative ways of managing the forests. The HPFD does have some expertise as a result ofthe Compensatory Afforestation Fund Management and Planning Authority (CAMPA), an instrument setup for compensatory afforestation, forest resource management, preservation of natural forest, management of wildlife, infrastructure development in the sector, and allied activities. The CAMPA funds are also used for catchment area treatment (CAT) plans for various hydroelectric projects and irrigation projects under implementation. The state also has evolved an incentive-based mechanism for the protection, management, and conservation of natural resources for sustained production of ecosystem services. In 2008, the HPFD announced a unique scheme for payment of ecosystem services. Ten percent of the outlay for CAT plans is mandatorily set aside for implementing PES with local communities. The HPFD is also in the process of developing a community-based biocarbon project in 177 Panchayat that envisages payments to the community group for carbon sequestered in plantations.

The Department of Environment, Science and Technology can act as the overall coordination unit, given how close the department's knowledge, experience, and organizational capacity is to the mandate. Along with the DoEST, the Department of Planning and the HPFD can each play a critical role in mainstreaming forests into the national accounts. The HPFD has three administrative levels. The Principal Chief Conservator of Forests (PCCF) and the Chief Conservator of Forests (CCF) forms the top strategic level. The Deputy Conservator of Forests (DCF) and the Ranges form the middle/technical level. Blocks and beats comprise the frontline staff at the executive level. At present, the HPFD has nine Forest Circles (Territorial) and three Wildlife Circles under the PCCF. Appendix G has a detailed organizational chart of the Forest Department and explains the powers and duties of the various offices.

The HPFD along with the HPSFDCL provides key information to the DoES for compiling the GSDP/NSDP. The HPFD also provides information to the DoEST for preparing the environment master plan, state strategy and action plan on climate change, state of environment report, and GHG emission inventory of the state. These reports and the estimates of GSDP/NSDP are further used for policy formulation for environmental management and sustainable development.

An interdepartmental steering committee can be established involving the relevant departments (tourism, power, energy, rural development, forests, planning, economics and statistics, environment, finance, state biodiversity boards, panchayats, agriculture, animal husbandry) with the overall oversight function for implementing and supporting data collection for natural resources accounting in the state. Academic experts, who can be part of the steering committee, can provide technical advice.

4.1| Gaps in Training and Capacity Building

1. The seriousness of increasing population pressure and developing the state and its impact on environment and natural resources are not clearly spelled out in policy documents. Hence, there is a serious need to identify these links clearly.
2. Training courses are more linked to sectoral approach than ecosystem approach.
3. The state should aim at measures to make forests self-sustainable and also ensure that local employment is provided through various natural resource sectors.

4. Designated officers for environment are too few—usually there's only one, located at the headquarters, not in the field or implementation area.
5. The central government's scheme "Training of IFS Officers" provides for the sponsoring of short-term refresher courses of one-to-three-week duration for Indian Forest Service officers in the premier training institutions/organizations of the country, in order to advance their knowledge and skills in managing the natural resources of the country and foster a change in attitude.
6. The capacities of the Department of Panchayati Raj should be built to demonstrate stronger commitment to public participation in forest management and ecotourism-related activities. The Department of Panchayati Raj also needs to be educated on how to present forests as a lucrative option for locals.
7. More important, different sectors have to recognize that natural resources are the key for their own sustainability and that they are not exogenous factors. Various officers have to be given training on the systems perspective rather than the sectoral perspective.

Figure 1 gives the short-run implementation of forest accounts in the next 14 months (short term).

Figure 1: Short-Term Pathway to Develop Forest Accounts for Himachal Pradesh

5| Appendixes

5.1| Appendix A. Glossary

Canopy: The cover of branches and foliage formed by the crowns of trees.

Canopy density: The relative completeness of canopy, usually expressed as decimal coefficient, taking closed canopy as unity.

Change matrix: It presents change in forest cover classes for a given region (state) during the period of two consecutive FSI assessments in a matrix form by showing the changes of area from one class to another.

Forest area: The area recorded as a forest in the government records, also referred to as "recorded forest area."

Forest inventory: The measurement of certain parameters of forests to assess the growing stand and stock and other characteristics of forests.

Growing stock: The sum (by number or volume) of all the trees growing/living in the forest or a specified part of it.

Land cover: Broad land use classes interpreted from satellite data. It includes very dense forest, moderately dense forest, open forest, scrub, and non-forest.

Non-forest land: Land without forest cover.

Scrub: Degraded forestlands having a canopy density of less than 10 percent.

Tree: A large woody perennial plant having a single,well-defined stem (bole or trunk) and a more or less definite crown. Included are bamboos, palms, fruit trees, and so forth;excluded are non-perennial non-woody species like banana and tall shrubs or climbers.

Tree cover: It comprises tree patches outside the recorded forest area exclusive of forest cover and less than the minimum mapping area (1ha).

Trees outside forest: Trees growing outside recorded forest area.

5.2| Appendix B. Land Use Classification in Himachal Pradesh

1. **Forests:** Includes all lands classed as forest under any legal enactment dealing with forests or administered as forests, whether state owned or private, and whether wooded or maintained as potential forestland. The crops raised in forest and grazing lands or areas open for grazing within the forests should remain included under the forest area.
2. **Area under non-agricultural uses:** Includes all lands occupied by buildings, roads, and railways or under water—for example, rivers and canals and other lands put to use other than agriculture.
3. **Barren and uncultivable land:** Includes all barren and uncultivable land like mountains, deserts, and so forth. Land that cannot be cultivated except at an exorbitant cost should be classified as uncultivable, whether such land is in isolated blocks or within cultivated holdings.
4. **Permanent pastures and other grazing lands:** Includes all grazing lands, whether they are permanent pastures and meadows or not. Village common grazing land is included in this category.

Table B.1: Land Utilization of Himachal Pradesh 2006–07 (km^2)

1. Geographic area (by professional survey)	**55673**
2. Area by village paper (revenue record)	45444
3. Forest area (as per forest records)	37033
4. Land put to nonagricultural uses	4716
5. Net area sown	5414
6. Fallow lands (current and other fallows)	752
7. Culturable wastelands	1280
8. Land under miscellaneous tree crops not included in cultivation	611
9. Permanent pastures and other grazing lands, including alpine pastures, barren and uncultivable lands, etc.	83

Source: HP Forest Statistics 2010.
Note: The data are based on figures collected from the Directorate of Land Records HP Shimla, except for items 3 and 9. Item 3 is per the HPFD record, and the figure given for item 9 is the balance area—that is, total geographic area (by professional survey)—minus the sum of the areas given in items 2 to 8.

5. **Land under miscellaneous tree crops, and so forth:** Includes all cultivable land not included in "net area sown" but put to some agricultural use. Lands under *Casuarina* trees, thatching grasses, bamboo bushes and other groves for fuel, and so forth that are not included under "Orchards" should be classed under this category.
6. **Culturable wasteland:** Includes land available for cultivation, whether not taken up for cultivation or taken up for cultivation once but not cultivated during the current year and the last five years or more in succession for one reason or other. Such lands may be either fallow or covered with shrubs and jungles, which are left unused. They may be assessed or unassessed and may lie in isolated blocks or within cultivated holdings.
7. **Fallow lands other than current fallows:** Includes all lands that were taken up for cultivation but are temporarily out of cultivation for a period of not less than one year and not more than five years.
8. **Current fallows:** Cropped areas that are kept fallow during the current year. For example, if any seeding area is not cropped against the same year it may be treated as current fallow.
9. **Net area sown:** Represents the total area sown with crops and orchards. Area sown more than once in the same year is counted only once.

5.3| Appendix C. System of Environmental-Economic Accounting

The United Nations Statistical Commission at its 44th Session welcomed the System of Environmental-Economic Accounting 2012 – Experimental Ecosystem Accounting (SEEA Experimental Ecosystem Accounting) as a crucial first move toward the development of a statistical framework for ecosystem accounting. SEEA Experimental Ecosystem Accounting offers a starting point for the development of ecosystem accounting at the national and sub national level. It provides the basic structure for (a) building up the ecosystem accounts under a

common set of terms, concepts, accounting principles, and classifications; (b) an integrated accounting structure of ecosystem services and ecosystem condition in both physical and monetary terms; and (c) the identification of spatial areas as forming the basic focus for measurement.

The framework and the related accounts illustrated in *SEEA: Experimental Ecosystem Accounting* are complementary to the conceptual framework and accounts described by the international statistical standard for environmental-economic accounting: *SEEA: Central Framework*. The United Nations Statistical Commission (UNSC) adopted the SEEA Central Framework as the first international statistical standard for environmental-economic accounting at its 43rdSession in 2012.The Central Framework is built on the previous editions of the SEEA, namely the *Handbook of National Accounting: Integrated Environmental and Economic Accounting 1993(SEEA 1993)* and the *Handbook of National Accounting: Integrated Environmental and Economic Accounting 2003(SEEA2003)*. The Central Framework lays down the multipurpose conceptual outline to identify the interactions between the economy and the environment and for explaining the stocks of environmental assets and its changes. SEEA Experimental Ecosystem Accounting describes approaches to account for ecosystem assets and services separately in both physical and monetary terms.

Box C.1: SEEA's Definition of Ecosystem Assets and Services

Ecosystem assets, according to SEEA, are spatial areas containing a combination of biotic and abiotic components and other characteristics that function together. Depending on the spatial diversity and heterogeneity of an ecosystem, the assets accounts generally need to be developed with context to a Geographical Information System. The basic framework for developing these accounts is described in the SEEA Central Framework.

Ecosystem services: Ecosystem services form the central part in the ecosystem accounting framework, as they offer a link between the ecosystem and economic and human activities. SEEA considers three types of ecosystem services: provisioning services, regulating services, and cultural services. However, supporting services such as soil formation, pollination, and so forth are not considered by SEEA because of difficulties associated with the compilation of these accounts.

Provisioning services: They describe the material outputs from ecosystems—for example, food, raw materials, freshwater, medicinal herbs.

Regulating services: Regulating services of ecosystems result from the capacity of ecosystems to regulate climate, hydrological, and biochemical cycles, earth surface processes, and a variety of biological processes—for example, flood control services of an upper watershed forest, local climate and air quality regulation, carbon sequestration and storage, moderation of extreme events such as storms, and wastewater treatment.

Cultural services: These include the nonmaterial benefits people obtain from contact with an ecosystem. They include aesthetic, spiritual, and psychological benefits.

Supporting services: These underpin almost all other services—for example, erosion prevention and maintenance of soil fertility, pollination, biological control of vector-borne diseases, and so forth.

Table C.1: Physical Flows of Ecosystem Services for an Ecosystem Accounting Unit

	Type of land cover/ecosystem functional unit			
Type of ecosystem services (by CICES)	Forest tree cover	Agricultural land	Open wetlands	Other functional units, such as water, air, minerals, etc.
Provisioning services	e.g. metric tons of timber, fuelwood, charcoal, NTFP	e.g. metric tons of wheat		
Regulating services	e.g. metric tons of CO_2 stored/ released, protection from disasters, air filtration	e.g. metric tons of CO_2 stored/ released	e.g. metric tons of P absorbed	
Cultural services	e.g. number of visitors/hikers, spiritual values, aesthetic values, educational values		E.g., hectares of bird/animal habitat	
Supporting services	e.g. soil formation, photosynthesis, nutrient recycling, pollination			

Source: SEEA.

The SEEA Central Framework intends to organize and integrate the information on various stocks and flows of the economy and the environment in a series of tables and accounts. The Central Framework comprises the following types of accounts:

1. Supply and use tables in physical (for example, cubic meters of timber) and monetary terms (for example, million rupees) showing flows of natural inputs, products, and residuals. The supply and use tables represent a comprehensive flow account for products, natural resources, ecosystem inputs, and residuals from economic activity during a period—that is, during a year.
2. Asset accounts for individual environmental assets in physical and/or monetary terms showing the stock of environmental assets at the beginning and end of each accounting period and the consecutive changes in stock.
3. Sequence of economic accounts that highlights the depletion adjusted economic aggregates. These accounts clearly demonstrate flows in monetary transactions pertinent to environment protection.
4. Functional accounts that record transactions and other information about economic activities undertaken for environmental purposes. These accounts consider ecosystem services and other ecosystem flows, especially ecosystem degradation.

SEEA Land Classification

Land use: Land use reflects both the activities undertaken and the institutional arrangements put in place, for a given area for the purposes of economic production or the maintenance and restoration of environmental functions. In effect, an area that is "used" implies the existence of some human intervention or management. Land in use, therefore, includes areasthat are under the active management of institutional units of a country for the purpose of excluding economic or human activity from that area (for example, protected areas).

SEEA land use classification

1. Land

1.1 Agriculture

1.2 Forestry

1.3 Land used for aquaculture

1.4 Use of built up and related areas

1.5 Land used for maintenance and restoration of environmental functions

1.6 Other uses of land n.e.c.

1.7 Land not in use

2. Inland waters

2.1 Inland waters used for aquaculture or holding facilities

2.2 Inland waters used for maintenance and restoration of environmental

2.3 Other uses of inland waters

2.4 Inland waters not in use

Table C.2: SEEA Land Cover Classification

Category
1. Artificial surfaces (including urban and associated areas)
2. Herbaceous crops
3. Woody crops
4. Multiple or layered crops
5. Grassland
6. Tree covered areas
7. Mangroves
8. Shrub-covered areas
9. Shrubs and/or herbaceous vegetation, aquatic or regularly flooded
10. Sparsely natural vegetated areas
11. Terrestrial barren land
12. Permanent snow and glaciers
13. Inland water bodies
14. Coastal water bodies and intertidal areas

Land cover: Land cover refers to the observed physical and biological cover of the Earth's surface and includes natural vegetation and abiotic (nonliving) surfaces. At its most basic level, it comprises all of the individual features that cover the area within a country. For the purposes of land cover statistics, the relevant country area includes only land and inland waters. The area of coastal waters is excluded.

Main Accounts and Tables of the SEEA Central Framework

Monetary supply and use tables: MSUTs record all flows of products in an economy between different economic units in monetary terms. These tables describe the structure of an economy and the level of economic activity. The flows recorded in monetary terms relate to the use of natural inputs from the environment and expenditures associated with the environment. The flows are classified by type of product in the rows and by type of economic unit (enterprises, government, and households) and the rest of the world in columns. The basic framework for the monetary supply use table is explained in table C.3.

Physical supply and use tables: Physical flows are recorded by compiling supply and use tables in physical units of measurement. These tables are commonly known as physical supply and use tables, or PSUTs. PSUTs are used to assess how an economy supplies and uses several assets, including natural resources, and they are also used to examine changes in production and consumption patterns over time. The PSUT structure (see table C.4) is based on the MSUT, with extensions to incorporate a column for environment, and rows for natural inputs and residuals.

Within the PSUT, the supply and use identity that applies in monetary terms also applies in physical terms (for example, cubic meters of timber). Thus, the quantity of output and imports (total supply) must equal to the quantity of intermediate consumption, household final consumption, gross capital formation, and exports (total use of products).

Asset accounts: According to the SEEA Central Framework, the intent of the asset account is to record the opening and closing stock of environmental assets and the different types of changes in the stock cover over an accounting period. Information from asset accounts (as shown in table C.5) can be used to assist in the management of environmental assets and valuations of natural resources and land can be combined with valuations of produced and financial assets to provide broader estimates of national wealth.

Table C.3: Basic Form of Monetary Supply and Use Table – SEEA Central Framework

	Industries	Households	Government	Accumulation	Rest of the world	Total
Supply table						
Products	Output				Imports	**Total supply**
Use table						
Products	Intermediate consumption	Household final consumption expenditure	Government final consumption expenditure	Gross capital formation (including changes in inventories)	Exports	**Total use**

Table C.4: Basic Form of Physical Supply and Use Table – SEEA Central Framework

	Industries	Households	Accumulation	Rest of the world	Environment	Total
Supply table						
Natural inputs					Flows from the environment	Total supply of natural inputs
Products	Outputs			Imports		Total supply of products
Residuals	Residuals generated by industries	Residuals generated by final household consumptions	Residuals from scrapping and demolition of produced assets			Total supply of residuals
Use table						
Natural inputs	Extraction of natural inputs					Total use of natural inputs
Products	Intermediate consumption	Household final consumption	Gross capital formation	Exports		Total use of products
Residuals	Collection and treatment of wastes and other residuals		Accumulation of waste in controlled landfill sites		Residual flows direct to environment	Total use of residuals

Note: Blank cells may contain relevant flows.

The preparation of asset accounts depends upon availability of data sets on a country basis; however, there are a number of basic resource accounts that are fundamental to ecosystem accounting and are typically needed to develop in each country or at subnational level. These, among others, include(a) land accounts,(b) carbon accounts,(c) water accounts,(d) soil and nutrients accounts,(e) forest accounts, and (f) biodiversity accounts.

The relationship between economy and environment has close links between the supply and use and the asset accounts. These connections emphasize that the Central Framework is an integrated system.

SEEA sequence of economic accounts: The sequence of economic accounts starts with the production account that is formed using the entries of output and intermediate consumption from the monetary and supply use table. The balancing item in the production account is value added—that is, output less intermediate consumption. Next in the sequence comes the distribution and use of income accounts. These accounts contain information on the manner of

Table C.5: Basic Form of Asset Account – SEEA Central Framework

Opening stock of environmental assets
Additions to stock
Growth in stock
Discoveries of new stock
Upward reappraisals
Reclassifications
Total additions of stock
Reduction of stock
Extractions
Normal loss of stock
Catastrophic loss
Downward reappraisal
Total reductions in stock
Revaluation of stocks*
Closing stock of environmental assets

*Only applicable for asset accounts in monetary terms.

value addition—that is, allocation of income directly obtained from production to economic units as either compensation of employees or gross operating surplus and on flows of other income and related payments such as flows of taxes, subsidies, interest, and rent for the use of land or other environmental assets. The balancing item for the income accounts isoperating surplus (that is, value added) less compensation of employees and taxes less of subsidies and savings (that is, disposable income less final consumption expenditure). The next account is the capital account, which records how saving is used to acquire assets, including produced assets and environmental assets. The sequence of accounts (table C.6) ends with the financial account, which records the transactions involved in lending and borrowing. The balancing item for the financial account is net lending/borrowing, the same as the balancing item for the capital account.

In monetary terms, monetary supply and use tables and asset accounts record much of the information of interest in the assessment of the interactions between the economy and the environment. However, there are a range of other monetary transactions and flows that are of interest, such as payments of rent for the extraction of natural resources and subsidies and grants from government units to other economic units to support environmental protection activity.

The key objective behind the construction of a sequence of economic accounts in the Central Framework is that balancing items can be defined that take into account the depletion of natural

Table C.6: Basic SEEA Sequence of Economic Accounts

Production account (elaborated in supply and use table)	
Main entries	Output, intermediate consumption, consumption of fixed capital, depletion
Balancing items/Aggregates	Gross value added, gross domestic product, depletion adjusted net value added, depletion adjusted net domestic product
Distribution and use of income accounts	
Main entries	Compensation of employees, taxes, subsidies, interest, rent, final consumption expenditure, consumption of fixed capital, depletion
Balancing items/Aggregates	Depletion adjusted net operating surplus, depletion adjusted net national income, depletion adjusted net saving
Capital account	
Main entries	Acquisitions and disposals of produced and non-produced assets
Balancing items/Aggregates	Net lending/borrowing
Financial account	
Main entries	Transactions in financial assets and liabilities
Balancing items/Aggregates	Net lending/borrowing

Source: SEEA Central Framework.

resources. The key balancing items include value added, operating surplus, saving, and net lending/borrowing. The detail of sequence of accounts is discussed in section 6 of *SEEA Central Framework*.

Functional accounts: Functional accounts identify flows relating to environmental activity undertaken for a particular function or purpose in monetary terms. The two functional accounts included in the Central Framework are Environmental Protection Expenditure Account (EPEA) and statistics on the Environmental Goods and Services Sector (EGSS).

Monetary Valuation of Goods and Services – SEEA

Forests provide a variety of goods and services that are rarely traded in an operative market. Since markets for forest goods and services are often missing, forests are best valued based on their total economic value. It may be difficult to value each component. Different valuation methods are used to place a monetary value on the impacts imposed to the environmental assets covered. Table C.7presents different approaches for the valuation of ecosystem services, as recognized by SEEA. Finally, the monetary estimates are integrated with the main national accounting aggregates.

Valuation of provisioning services: Understanding the value of these ecosystem services necessitates that the contribution of provisioning services to GDP is recognized. For instance, in the case of private land, the owner harvests timber or crops by employing labor and produced

Table C.7: Approaches to Valuation of Ecosystem Services – SEEA

Services	Approach
Provisioning services	Unit resource rent, market prices
Regulating services	Replacement cost method, cost of treatment method, payment for ecosystem services
Cultural services	Hedonic price method, travel cost methods, contingent valuation method
Supporting services	Averting behavior method, contingent valuation method

assets to modify the ecosystem and to harvest the resource. This involves costs involved in harvesting and costs associated with modification of the ecosystem.

Valuation of regulating services: For valuation of regulating services, in the absence of markets for ecosystem services, there is a need to reveal the consumers' willingness to pay for the services involved.

Valuation of cultural services: For the monetary value of cultural services for recreation and tourism purposes, it is necessary to estimate the relative importance of recreational and tourism activities within the ecosystems by determining the number of tourists who visit certain areas.

Valuation of Changes/Degradation in Assets

After the aggregate value of expected ecosystem services flows is derived, the degradation in ecosystem can be measured as the change in value of expected ecosystem service flow over an accounting period. Valuation approaches for changes/degradation of assets is discussed in table C.8.

Valuing Stock of Timber Resources

According to SEEA, resource rent on timber resources can be derived as the gross operating surplus from the harvest of timber resources (after taking into account specific taxes and subsidies) less the value of the user costs of produced assets used in the harvesting process. In this way, the resource rent will implicitly include a share that should be attributed to the land on which the timber stands. This reflects the composite nature of the overall asset (as described in section 5.6 of *SEEA Central Framework*). In many cases, because of the location

Table C.8: Approaches to Valuation of Ecosystem Degradation – SEEA

Approach	Description
Restoration cost	Estimated expenditure required to return the ecosystem asset to the condition that existed at the beginning of the accounting period
Damage-based and cost-based value of ecosystem degradation	Damage-based assessments focus on the value of the reduction in the capacity to generate ecosystem services; cost-based assessments focus on the cost of avoiding or modifying the human activity that is leading to degradation of ecosystem (avoidance cost)

of the land or the quality of the soil, the return to the land may not be large compared to the return to the timber resource. However, where relevant (for example, where the land may be potentially of value for other purposes), SEEA suggests that an estimate of the resource rent attributable to land should be deducted to derive the estimate of resource rent on timber resources.

Another estimate of resource rent that SEEA suggests is using estimates of stumpage price. Stumpage price is the amount paid per cubic meter of timber by the harvester to the owner of the timber resources. The stumpage price itself may also be derived by deducting various harvesting costs from roadside pickup prices (also called wood-in-the-rough or raw wood prices). The harvesting costs should include felling costs as well as costs of thinning (net of any receipts), other management costs, and rent on land. For natural timber resources, these additional costs may be very low or even zero. Where timber resources are sold prior to felling, relevant contract prices may also be used, with appropriate adjustments for the scope and coverage of the prices to align with the concept of resource rent.

Stumpage prices can then be multiplied by estimates of the expected volume of standing timber per hectare at the expected harvesting age to give estimates of future receipts. These future receipts are then discounted (over the time from the current period to the expected harvest period) to estimate a value per hectare for each age class. In turn, these values are multiplied by the total area of each age class and added to give the value of the total stock of standing timber. This approach should ensure that trees harvested after reaching maturity are separately accounted for. A simplifying assumption is to use the current age structure and assume that each tree of a particular age grows to maturity and is harvested at maturity.

Valuation Techniques for Net Accumulation

Estimating the value of changes in stock of assets necessitates monetizing the physical accounts for which valuation is essential. Valuation of assets is calculated using different approaches depending upon whether the asset is renewable or nonrenewable. Because timber is a renewable asset, any of three methods of valuation could be used: present value method, net price method, or user cost method. The three methods are described briefly below:

Present value method: The present value Vt of natural resources is the sum of expected net revenue flows N_tQ_t, discounted at nominal or real interest rates 'r' for the life n of the asset:

$$V_t = \sum_{i=0}^{n} N_t Q_t (1+r)^t$$

Where N_t is defined as the total unit value of the resource less the cost of extraction, development, and exploration and $Q_t$is the quantity exploited during the period t and T is the total lifetime of the resource.

Net price method: The value of the resource at the beginning of the period t, given by Vt is the volume of the resource Rt multiplied with the difference between the average market value per unit of the resource Pt and the per unit marginal cost of extraction, development and exploration, including a normal return to the capital, C_t.

$$V_t = (P_t - C_t) R_t$$

User cost method: The user cost, that is, the discounted net revenue from the sale of the resource, is

$$R - X = R / (1+r)^{n+1}$$

where R is the annual net revenue from the sale of the resource, assumed to be constant over its lifetime (of n years), and X is the "true income" element calculated so that R–X represents a capital element whose accumulated investment at an interest rate r during the n years would create a permanent stream of income of X.

The choice of valuation technique to obtain the value accounts for timber, fuelwood, and carbon largely depends on the type of data available for the value/prices of the forest assets. The most common form of revenue generation is through royalties or auctions. The resource rent is obtained after deducting the logging, pre-logging and post-logging, transportation and overhead costs, some of which may differ by the extractable log volume and the logging methods. Once the value of opening and closing stocks are attained, net accumulation can be calculated by subtracting the value of the opening stock from the value of closing stock.

5.4| Appendix D. Valuation Studies in India

Accounting for environment and forest resources has been conducted by different institutional organizations and agencies. The Central Statistical Organization (CSO), the Energy and Research Institute (TERI), and the Green India States Trust (GIST) are all actively involved in valuation of environment and ecosystem services in India. The government of India, through CSO, has conducted a few studies on accounting for natural resources, such as air, water, land, forestry, minerals, and valuation of biodiversity. For Himachal Pradesh, the Forest Department commissioned the study *Ecosystem Services Valuation and Accounting of Himachal Forests*. The study, carried out by the Indian Institute of Forest Management, valued the key ecosystem services from Himachal Pradesh forests based onthe Millennium Ecosystem Assessment Classification. The study found the total economic value of provisioning, regulating, and cultural ecosystem services to be Rs 10,873 crores, Rs77, 067crores, and Rs5,012 crores, respectively. Thus, the total economic value of selected ecosystem services from the forests of Himachal Pradesh was estimated to be Rs 92,952 crores. Another study, *Natural Resource Accounting of Land and Forestry Sector (Excluding Mining) for the States of Madhya Pradesh and Himachal Pradesh,* executed by the Indian Institute of Forest Management (IIFM) for the CSO, MoSPI, used the SEEA framework to estimate the total direct benefits from Himachal Pradesh forests at Rs 1,128.653 crores and the total indirect benefits at Rs98,475.45 crores.

GIST conducted two studies on accounting for India's forest products and services. In one study, Gundimeda and others (2006) incorporated the value of biodiversity in India's forests using the benefit transfer and net present value (NPV) method. Results showed the NPV of ecotourism at Rs 65,193 per hectare and the NPV of bioprospecting at Rs22,646 per hectare. The second study, *Accounting for Ecological Services of India's Forests: Soil Conservation, Water, Augmentation, and Flood Prevention*(Kumar and others 2006), valued nutrient loss from forests at Rs 95,895 million, water recharge value at Rs 18,578.70 million, and flood prevention value at Rs 111,030 million.

Anevaluation of the above studies clearly illustrates that only limited studies exist on accounting for natural resources, especially for forests in India. The scope of functions of forests so far

covered is wide and valuation techniques vary from market prices to travel cost methods to contingent valuation methods. This raises additive concerns across the various estimates.

5.5| Appendix E. District Forest Data

Agro-ecological Zones and Vegetation Types in Himachal Pradesh

The state has been divided into four agro-ecological zones, based on altitudes associated with different forest types with tree, shrubs, and herbs species.

Sub-tropical forests: This zone consists of foothills and valleys up to an elevation of about 915 meters above mean sea level with an annual rainfall of 70 to 100 centimeters. The maximum temperature goes up to 40ºC. It comprises mainly dry deciduous, chir pine, sal, and thorny forest mostly of xerophytic species.

Sub-temperate forests: These forests extend from 916 meters to about 1,523 meters above mean sea level with an annual rainfall of 90 to 120 centimeters. Some upper hills also receive mild snowfall during winter, and the maximum temperature in summer remains around 30ºC. This zone type contains species like pines, oaks, and broad-leafed species and has good pasturelands.

Wet-temperate forests: These forests extend from 1,524 to 2,472 meters above mean sea level and are predominantly covered with forests and pasturelands. The annual rainfall varies between 100 and250 centimeters, with rain turning to snowfall during winter when the temperature falls to minus 10ºC. During summer, the maximum temperature ranges between 15ºC and 20ºC. These forests have further been categorized as (a) lower western Himalayan temperate forests, consisting of conifers, oaks, and various deciduous trees; and (b) western Himalayan temperate forests, consisting of firs, oaks, and other species found in alpine zones.

Table E.1: Forest Types with Dominant Tree Species Occurring in Himachal Pradesh

Forest types	Area (km^2)	Important tree species
Tropical dry deciduous	2,140	*Shorearobusta, Acacia catechu, Anogeissuslatifolia, Boswelliaserrata, Laneacoromandelica, Aeglemarmelos, Mallotusphilippensis*
Tropical thorn	43	*Prosopisspicigera, Salvadora spp., Acacia spp., Azadirachtaindica*
Sub-tropical pine	3,853	*Pinusroxburghii, P.wallichiana, Cedrusdeodara, Quercusincana, Lyoniaovalifolia, Pyruspashia, Crataeguscremulata, Rhododendron arboreum*
Sub-tropical dry evergreen	470	*Olea cuspidate, Pinusroxburghii*
Himalayan moist temperate	4,064	*Quercusincana, Q. dilatata, Q. semicarpifolia, Cedrusdeodara, Pinuswallichiana, P. roxburghii, Rhododendron arboretum, Lyoniaovalifolia, Litsiaumbrosa, Piceasmithiana, Abiespindrow*
Subalpine and alpine	2,512	*Abiesspectabilis, Pinuswallichiana, Piceasmithiana, Rhododendron companulatum, Taxusbaccata*

Source: HP DoEST 2012c.

Dry-temperate forests: These forests occur above 2,472 meters. The mean annual temperature is around 10ºC and the mean annual precipitation is about 25 centimeters. The area contains scattered trees and bushes, such as chilgoza, willow, robinia, ailanthus, and poplars, and alpine pastures with bushes such as ephedra.

Table E.2: Species-wise Area, Growing Stock, and Yield of Important Species (2006)

Name of species	Forest area (km^2)	Growing stock (m^3, thousands)	Prescribed annual yield (m^3, hundreds)
Deodar	890	16,517	1,736
Kail	698	13,365	1,320
Chil	1,346	12,481	981
Fir andspruce	1,029	39,364	2,430
Sal	190	4,852	280
Ban oak	596	5,949	156
Mohru oak	32	201	Not provided
Kharsu	118	1,717	21
Maple	Not available	298	12
Walnut	Not available	126	2
Bird-cherry	Not available	15	Not provided
B.L. species	533	5,217	30
Total	5,432	100,102	6,968

Source: Forest Statistics 2010.

Table E.3: District-wise Forest Cover in Himachal Pradesh (km^2)

District	Geographic area	Very dense forest	Moderately dense forest	Open forest	Total	% Geographic area	Change with respect to FSI 2009 Assessment	Scrub
Bilaspur	1,167	24	171	167	362	31.02	0	0
Chamba	6,522	853	773	811	2,437	37.37	1	38
Hamirpur	1,118	39	91	114	244	21.82	–1	0
Kangra	5,739	310	1,221	533	2,064	35.96	2	11

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Table E.3: District-wise Forest Cover in Himachal Pradesh (km²) *(continued)*

District	Geographic area	Very dense forest	Moderately dense forest	Open forest	Total	% Geographic area	Change with respect to FSI 2009 Assessment	Scrub
Kinnaur	6,401	82	262	256	600	9.37	–2	70
Kullu	5,503	586	785	588	1,959	35.06	1	23
Lahaul and Spiti	13,841	15	32	147	194	1.40	1	31
Mandi	3,950	373	735	567	1,675	42.41	2	29
Shimla	5,131	739	1,037	610	2,386	46.50	2	32
Sirmaur	2,825	130	568	687	1,385	49.03	2	56
Solan	1,936	55	404	391	850	43.90	1	38
Una	1,540	18	302	203	523	33.96	2	0
Total	**55,673**	**3,224**	**6,381**	**5,074**	**14,679**	**26.37**	**11**	**328**

Source: Ministry of Environment and Forests, Forest Survey of India, SFR 2011.

Table E.4: Forest Cover Change Matrix (ha)

	2011 Assessment					
2009 Assessment	VDF	MDF	OF	Scrub	NF	Total 2009
VDF	322,400	0	0	0	0	**322,400**
MDF	0	637,700	200	0	400	**638,300**
OF	0	400	505,100	100	500	**506,100**
Scrub	0	0	0	32,700	0	**32,700**
Non-forest	0	0	2,100	0	4,065,700	**4,067,800**
Total 2011	**322,400**	**638,100**	**507,400**	**32,800**	**4,066,600**	**5,567,300**
Net change	0	–200	1,300	100	–1,200	

Source: Ministry of Environment and Forests, Forest Survey of India, SFR 2011.

5.6| Appendix F. Statistical Assessment of Data Availability

Resource account	Data required	Physical unit	Source	Monetary values	Source	Remark
		Volume in cubic meters		Rupees		
1. Supply use	Timber/ fuelwood	Volume in cubic meters	HPFD/ DoES			
	NTFP	Volume in cubic meters	HPFD	Rupees	HPSFDCL	Including medicinal plants
	Services			Rupees	DoES	Includes PES
	Industrial use			Rupees	HPFD/ DoES	Input/ output tables
	Imports/exports	Volume in cubic meters		Rupees	DoES	
	Output			Rupees	DoES	
2. Timber resource		Area in hectares;volume in cubic meters		Rupees		
	Opening stock	Volume in cubic meters	HPFD/ FSI	Rupees		
	Logging/ harvest+illegal logging	Volume in cubic meters	HPFD	Rupees		
	Logging damage					Data not available
	Forest fires	Volume in cubic meters	HPFD	Rupees		
	Stand mortality					Data not available
	Shifting cultivation	Volume in cubic meters	HPFD			
	Animal grazing	Volume in cubic meters	HPFD	Rupees		
	Forest encroachments	Volume in cubic meters	HPFD			

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(*continued*)

Resource account	Data required	Physical unit	Source	Monetary values	Source	Remark
	Transfer of land to other activities	Volume in cubic meters	HPFD			
	Natural growth	Volume in cubic meters	HPFD			
	Regeneration	Volume in cubic meters	HPFD			
	Afforestation	Volume in cubic meters	HPFD			
	Closing stock	Volume in cubic meters	HPFD/ FSI	Rupees		
3. Forest carbon account		Volume in metric tons				Monetary valuation of carbon is done using prevailing prices in carbon markets.
	Opening stock	Volume in metric tons	FSI/ HPFD			Only FSI compiles carbon data at national level. There is no direct data on carbon for the state; however, it can be estimated.
	Increase in carbon	Volume in metric tons	FSI/ HPFD			
	Decrease in carbon	Volume in metric tons	FSI/ HPFD			
	Closing stock	Volume in metric tons	FSI/ HPFD			
4. Biodiversity account		Number of species				
	Opening population	Number of species	State Biodiversity Authority/ HPFD			Adequate data not available
	Closing population	Number of species	State Biodiversity Authority/ HPFD			Adequate data not available

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Resource account	Data required	Physical unit	Source	Monetary values	Source	Remark
	Net change	Number of species	State Biodiversity Authority/ HPFD			Adequate data not available
	Reference population	Number of species	State Biodiversity Authority/ HPFD			Adequate data not available
	Opening population as proportion of reference population	Number of species				Adequate data not available
	Closing population as proportion of reference population	Number of species				Adequate data not available

5.7| Appendix G. Organizational Structure and Powers Conferred to the Officials

Principal Chief Conservator of Forests (PCCF): At the topmost level of the Himachal Pradesh Forest Department, the PCCF is empowered to deal on aspects such as working plans, silvicultural operations, and fire protection.

1. ***Additional Principal CCF (Finance and Planning):*** APCCF (Fin & Plan.) acts as the Finance Commission of the department and is mainly responsible for financial planning, allocation and distribution of budget.

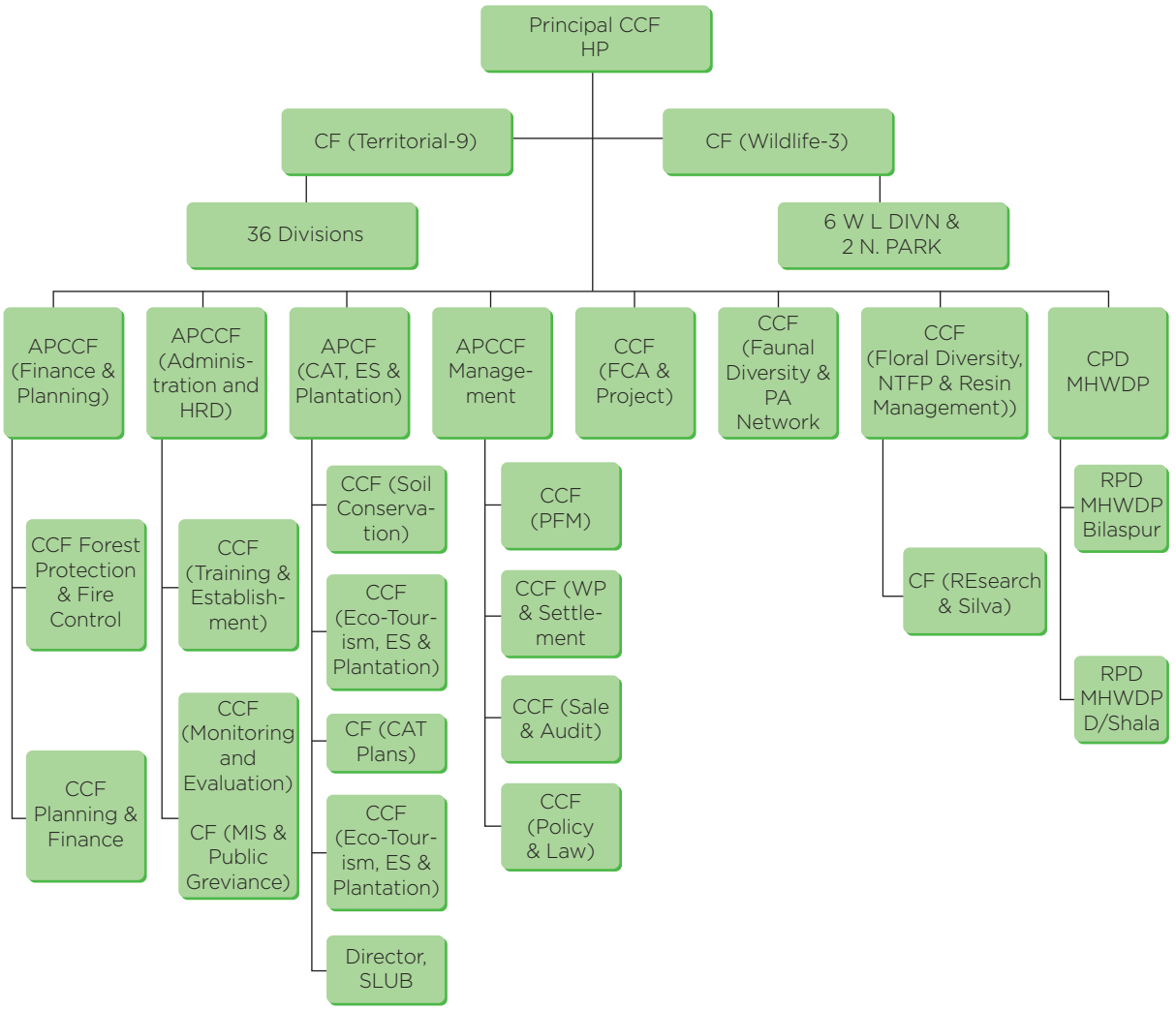
   b. ***Chief Conservator of Forests (Forest Protection and Fire Control) Bilaspur:*** The CCF is responsible for fire protection, planning, budgeting, fire control measures, equipment, and fire lines. He has steering involvement of JFMCs in fire prevention and control through IBMs and is also accountable for the development and running of the HPFD Fire Database and the monitoring and evaluation of state fire management schemes.

   c. ***Conservator of Forests (Planning andFinance) Shimla:*** TheCF is the one responsible for budget monitoring at the headquarter level. He is also responsible for developing a database on the Forest Development Agency (FDA), monitoring the expenditure and progress of the FDA.

2. ***Addl. Pr.CCF (Admin. and HRD) Shimla:*** The person is the Chief Vigilance Officer of the department and deals with responsibilities relating to human resource management.

   a. ***Chief Conservator of Forests (Training and Establishment) Shimla:*** The CCF handles mainly the establishment work, including court matters, and the Registrar (Establishment

Figure 2: Organizational Chart of Himachal Pradesh Forest Department



Source: Himachal Pradesh Forest Department.
Note: CCF = Chief Conservator of Forests; APCCF = Additional Principal CCF; CF = Conservator of Forests; CPD = Continuous Professional Development.

and Vigilance) works through him. He is also responsible for training and maintaining the training database of the workforce.

b. ***Chief Conservator of Forests (Monitoring and Evaluation) Shimla:*** This person is responsible for monitoring and evaluation of forestry, evaluation of plantations, soil, pasture development, nursery and plantation returns, analysis and database. He is also responsible for database management on illicit felling and encroachment.

3. ***Addl. Pr.CCF (CAT and Plantations) Shimla:*** This person is responsible for all catchment area treatment plan matters regarding outsourcing and formulation, compensatory afforestation, NPV, CAMPA, payments for environmental services, environment management plans, Eco-Task Force, monitoring of nursery and plantations in the state, climate change, REDD, global warming, and disaster management.

   a. ***Chief Conservator of Forests (Soil Conservation) Shimla:*** This CCF is mainly accountable for soil and water conservation matters, land resource management, watershed management, soil work plans, GIS and remote sensing cells.

b. ***Chief Conservator of Forests (Ecotourism and Plantations) Shimla:*** This person is the chief executive officer of Eco-tourism and ex-officio Member Secretary EcoSoc. He is responsible for ecotourism development and management, ecotourism policies, public-private partnership, and issues related to Environmental Impact Assessments (EIA) and Environment Statements (ES).

c. ***Conservator of Forests (CAT Plans) Shimla:*** This person is responsible for CAT plans scrutiny and implementation, scrutiny, development and finalization of new CAT plans/revision of old ones, compensatory afforestation and NPV schemes, CAMPA, and Eco-Task Force.

d. ***Conservator of Forests (Ecotourism and Plantations) Shimla:*** This CF is accountable for ecotourism development and management, and coordination with HP Tourism Development Corporation (HPTDC), Director Tourism.

4. ***Addl. Pr.CCF (Management) Shimla:*** This person is responsible for biofuels species propagation, Timber Distribution System, Land Preservation Act and Private Sale, Monitoring Sale, Audit, and Participatory Forest Management (PFM) work in the state, working plan and settlement issue. He handles issues relating to policy and law and is the controlling officer for CCF (PFM), CCF(WP) and CCF(SA).

   a. ***Chief Conservator of Forests (PFM) Shimla:*** This person mainly handles grazing and related matters, Grazing Advisory Review Committee, development and monitoring of OFM processes.

   b. ***Chief Conservator of Forests (WP and Settlement) Mandi:*** This person is in charge of preparation and monitoring of working plan implementation, scrutiny and approval of felling programs, settlement and demarcation, entries in revenue records, and custody and database of survey maps in HPFD.

   c. ***Chief Conservator of Forests (Sale and Audit) Shimla:*** He handles all HP State Forest Development Corporation Limited matters—pricing committee issues and so forth. He looks after all sale and industry matters, forest-based industries, policy and law related to it, saw mills, and fuelwood supply to Tribal Areas.

   d. ***Conservator of Forests (Policy and Law) Shimla:*** He mainly manages national and state forest policies, Resin and Timber Trade Acts and Forest Rights Act, legal matters concerning forest working and management, New Acts and Statute of State and GOI and revision of acts and laws.

5. ***Chief Conservator of Forests (FCA and Projects) Shimla:*** He is the nodal officer for forest clearance cases, FCA 1980. He handles road and hydro project (whether on forest land, other government land, or private land) matters under FCA 1980, FCA 1980 violations cases, mining and related matter, and land transfer cases and related matters.

6. ***Chief Conservator of Forests (Faunal Diversity and Protected Area Network) Shimla:*** He is conferred with the power to formulate, monitor, and evaluate all wildlife areas.

7. ***Chief Conservator of Forests (Floral Diversity, NTFP,and Res. Mgmt.)Sundernagar:*** He is responsible for conservation and propagation of NTFP on governmental and private lands, NTFP and all related matters, National and State Medicinal Plant Boards, and fund-raising for NTFP projects and schemes. He also monitors NTFP schemes and programs, Bamboo Mission, disease epidemics and quarantine, invasive alien plant species and their management, and so forth.

The forest officers mentioned above may also have some additional duties as per their respective positions. Only the duties of the officers that contribute toward building the forest accounts have been mentioned above.

5.8| Appendix H. Government Officials and Agencies Interacted with in Preparation of this Report

Name	Designation/Department
R. K. Gupta	PCCF (HoFF)
Surendra Kumar	APCCF (Fin. &Plg.)
SanjeevaPandey	APCCF (PFM)
G.S. Goraya	APCCF (FM,NTFP)
Dr. S.S. Negi	IFS, Director
Sh. BasuSood	Joint Director (Planning)
Tejinder Singh	AOCCF (WP & S)
Anil Vaidya	Conservator of Forest (CAT Plan)
Hemant Gupta	Chief Scientific Officer, Council for Science and Technology (Training School)
Dr. BhanuNeopaney	Principal Scientific Officer
Sanjay Verma	Senior Scientific Officer (Planning)
Dr. Sanjay Sharma	Scientific Officer

List of Institutions Working on Assessing Forest Ecosystem of Himachal Pradesh

Names	Address
ENVIS Centre: Himachal Pradesh, State Council for Science, Technology& Environment, Himachal Pradesh	34-SDA Complex,Kasumpti, Shimla-171009
Aryabhatta Geo-informatics & Space Application Centre (AGiSAC)	Shree Niketan, Beolia Road, Lower Panthaghati, Shimla-171009
Himalayan Forest Research Institute	Conifer Campus Panthaghati, Shimla-171009
Indian Institute of Forest Management, Bhopal	P.O. Box 357, Nehru Nagar, Bhopal MP, 462003, India
Forest Research Institute	P.O. New Forest - Dehradun (India)

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http://envfor.nic.in/

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http://www.worldbank.org/

Wealth Accounting and the Valuation of Ecosystem Services

Wealth Accounting and the Valuation of Ecosystem Services (WAVES) is a global partnership led by the World Bank that aims to promote sustainable development by ensuring that natural resources are mainstreamed in development planning and national economic accounts.

www.wavespartnership.org