
**Natural Capital Accounting in
Himachal Pradesh – Feasibility
and Planning Study**

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Natural Capital Accounting in Himachal Pradesh – Feasibility and Planning Study

Executive Summary

Forests are the most important natural resource of the state legally comprising nearly 66% of the geographical area. The state's contribution in sustaining 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, social development and poverty eradication while maintaining ecological balance. The state has accorded high priority to power sector and tourism, for which abundant natural resource base is crucial. The State Government being very conscious of the ecological sensitivity of the region and 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 environmental 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 constant of about 7.44% in 2011-12. On an average, the state's GSDP witnessed a growth rate of 8% in the period 2005-06 to 2012-13.¹ 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 yardstick to measure whether it is following the path of sustainable developed as laid out in different sectoral plans of the state. A way to measure this is through natural capital accounting. Though 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 it has a number of shortcomings. These shortcomings mainly arise due to the inconsistencies between produced and natural capital. Forest sector, the most significant sector of all the natural resources of the state, covering 66.52% of the total

¹ Directorate of Economics and statistics, Govt. of Himachal Pradesh

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% of total GSDP due to omission, under estimation 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 NTFP accounts can assist in realizing the goal of sustainable forest management as well as poverty alleviation.

The objective of this feasibility 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 linkages. The approach followed mainly comprises of 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 services-** This account provides accounts for the total value of forest ecosystem goods and services.
3. **Monetary Asset Accounts of forestland, timber, carbon and ecosystems -** Once the value of different forest goods and services are established, 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 State Forest Department, H.P. (HPFD), Forest Survey of India (FSI), Department of Economics and Statistics, H.P. (DoES) has 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 towards 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 'true' value of economic activities on forest resources and wealth necessitates periodic availability of required data sets. Coordination between the HPFD and the DoES can help building the forest account for realizing sustainable development vision of the state. As complete set of forest ecosystem accounting, requires time and resources, it may be most feasible to initially, consider a limited rather than comprehensive set of ecosystem services for inclusion in ecosystem accounting exercises. Based on the policy priorities of the state, the report suggests developing physical asset accounts for forested land, timber and carbon along with monetary accounts for timber, non-timber forest products, and carbon at the initial stage in Himachal Pradesh. In the medium term, the state can develop tourism eco-tourism accounts and water accounts. The rest of the ecosystem accounts follow in the next 3 – 5 years. Besides developing these accounts, the key challenge is to monitor and measure adjusted economic growth and efficiently use the accounts for effective policy initiatives for welfare of the society and to maintain intergenerational equity.

Abbreviations

AGB	Above Ground Biomass
BGB	Below Ground Biomass
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CAT	Catchment Area Treatment
CCF	Chief Conservator of Forests
CF	Conservator Forest
CICES	Common International Classification of Ecosystem Services
CSO	Central Statistical Organization
DCF	Deputy Conservator of Forest
DoLR, H.P.	Directorate of Land Records, Himachal Pradesh
DoEST	Department of Environment Science and Technology
DoES	Department of Economics and Statistics, H.P.
EAU	Environmental Accounting Unit
EIA	Environment Impact Assessment
EDP	Environmentally Sustainable Domestic Product
ES	Environment Statement
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
GSDP	Gross State Domestic Product
GIST	Green India States Trust
HEP	Hydro Electric Power
HIS	Hydrological Information System
HP	Himachal Pradesh
HPFD	Himachal Pradesh Forest Department
HPSFDC	Himachal Pradesh State Forest Development Corporation
HPTDC	HP Tourism Development Corporation
HRD	Human Resource Development
IFA	Indian Forest Act
IFS	Indian Forest Service
IIFM	Indian Institute of Forest Management
IUCN	International Union for Conservation of Nature
JFMC	Joint Forest Management Committees

LCEU	Land cover/ecosystem functional units
LPA	Land Preservation Act
LDAC	Local Area Development Committees
MDF	Moderately Dense Forest
MODIS	Moderate Resolution Imaging Spectroradiometer
MOSPI	Ministry of Statistics and Program Implementation
MSUT	Monetary Supply and Use Table
MoEF	Ministry of Environment and Forest
NAPCC	National Action Plan on Climate Change
NCA	Natural Capital Accounting
NDP	Net Domestic Product
NPV	Net Present Value
NSO	National Statistical Organization
NSSO	National Sample Survey Organisation
NSDP	Net State Domestic Product
NTFP	Non Timber Forest Product
PCCF	Principal Chief Conservator of Forests
PAN	Protected Area Network
PF	Protected Forests
PFES	Payment for Ecosystem Services
PFM	Participatory Forest Management
PSUT	Physical Supply and Use table
RF	Recorded Forests
REDD	Reducing Emission from Deforestation and forest Degradation
SEEA	System of Environmental Economic Accounting
SFR	State of Forest Report
SNA	System of National Accounts
SoER	State of Environment Report
SOM	Soil Organic Matter
TDS	Timber Distribution System
TERI	The Energy and Research Institute
TOF	Trees Outside Forests
UNSC	United Nations Statistical
VDF	Very Dense Forest
WAVES	Wealth Accounting and the Valuation of Ecosystem Services
WP	Working Plan
WWF	World Wide Fund

1. Introduction

Himachal Pradesh has 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% of the geographical area. However, with only 26% tree cover, they are the repositories of 3,295 species out of which 95% are endemic to the state and 5% (i.e., 150 species) are exotic. The state's contribution in sustaining life support system of the local as well as the national economy is quite undisputed. Most of the people in rural areas in the State depend directly or indirectly on forests for their livelihood and use significant quantity of forest goods and services like non-wood forest products, fodder, timber etc.

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 Tourism and Hydro Power sector. 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 a fiscal resource. There is considerable untapped hydropower potential in the state as only 32% is potentially developed. Due to the environmental, climatic and natural heritage advantages offered by the state, tourism sector has 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, treatment of catchment areas for improved soil and water conservation. The sound water management is in turn dependent on sustainable forest management. Tourism sector too is largely dominated by nature tourism for which forest management is crucial. Both the priority sectors of the state have high environmental footprint as well as they involve 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 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 tourism sector or building of dams involves developing infrastructure, which involves 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, which can potentially impinge on power production, ecotourism, agriculture, horticulture etc., is climate change. Climate change may alter the distribution and quality of natural resources of Himachal Pradesh and adversely affect 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 form of shifting of tree line to higher altitudes and movement of pine species to higher altitudes. As per the state action plan on climate change by 2100, under the most probable scenario, temperature of the state is likely to increase by 3°C and precipitation will decrease by 20% 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 commitment to low-carbon growth and a carbon-neutral economy. Forests also act as 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 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. Power 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% of the project cost for the development of local areas through the Local Area Development Committees (LDAC), 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 the year 2020. The strategy recognizes creating a tourism sub-plan, which integrates, and coordinate 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 produce; and 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 a movement away from the conventional, commodity production orientation, towards a holistic, people-centered ecosystem level approach.

With the long term perspective of achieving environmentally sustainable development, the state has vowed to prepare Environment Master Plan. One of the key objectives of this is to simultaneously address issues of ecological and environment restoration and bring convergence along with the development activities taking place in the state and ensure close coordination with all the concerned development departments both at the state and Government of India level. The state government has also recognized this important balance between maintaining natural resources and development and is in the process of reorienting and restructuring the environment policy of the state so as to ensure sustainable development.

The state needs yardstick to measure whether the sectors and the development is sustainable. The System of National Accounts (SNA) gives the 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 shortcomings. SNA delivers only limited information for sustainable forest management. For one, the SNA treats cultivated and natural forests differently. In case of cultivated forests, it only records production and changes in the stock while for natural forests it only records production. 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 importantly, forests being the major natural resource available to the people in their vicinity have been a major source of wood and other non-wood products like edible items, fodder, fuelwood, medicinal plants, roofing materials, fiber for ropes etc. Historically, this dependence has been for both consumption as well as 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 are 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 Forestry and Logging category of industries. This includes **forestry** (e.g., planting and conservation of forests etc.), **logging** (e.g., felling and rough cutting of trees, hewing or rough shaping of poles, blocks, etc.), **transportation** of forest products to the sale depots/assemble centers and **farmyard wood**, which includes industrial wood and fuel wood collected by the primary producers from trees outside regular forests. Forest products on the other hand, are classified into two major groups: Major products comprising industrial wood (timber, roundwood, match and pulpwood) and fuelwood (firewood and charcoal wood), Minor products comprising a large number of heterogeneous items such as bamboo, fodder, lac, resin, bhabbar grass, medicinal-herbs etc.

The production figures of industrial wood/timber for each species are supplied by the HPFD annually. After applying conversion ratio separately for each variety of timbers, converted volumes for different varieties are arrived. These are then evaluated at the average wholesale prices of various species of timber prevailing at various sale depots of H.P. Forest Corporation in the state. The estimated fuelwood data are as available from the results of NSS consumption expenditure surveys. The production of firewood is estimated indirectly from the consumption

side. The data on consumption of firewood is available from 5-yearly consumer expenditure surveys of NSSO.

In case of minor forest produce, the exploitation of resin is entirely in the hands of Himachal Pradesh State Corporation. The quantity extracted and the prices are supplied by the Forest Department and the same are used for valuation of resin. The value is then adjusted by deducting 5% of value as trade and transport margin. In case of minor forest products other than resin, only royalty value is available from the HPFD. As per ratio, decided at the national level ten times of royalty value is taken to be economic value of these products. Previously, 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.

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 , NSS Consumption Expenditure Surveys (every five years)
Minor Forest Products	Provisioning services (Resin)	Production estimates from H.P. State Corporation
	Others	Underestimated , only royalty value available from HPFD
Forest Services		
Livestock Grazing	Provisioning services	Attributed to agriculture
Pollination services of wild bees	Supporting services	Attributed to agriculture
Recreation and Tourism	Cultural services	Attributed to trade, hotel, and restaurant, or Other services
Carbon storage	Regulating services	Omitted
Biodiversity Protection	Supporting services	Omitted
Soil Protection	Supporting service	Omitted
Water regulation	Supporting service	Omitted

Source: Prepared based on Gross State Domestic Product of HP (1999-2000 to 2006-07), Economics and Statistics Department, Government of Himachal Pradesh.

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 SNA. As a result, although forests in Himachal Pradesh provide multiple benefits and covers about 66.52% of total geographical area of the state, the sector officially contributes only about 4.8% of total GSDP of the state. This is because as listed 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 is 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 asset accounts to monitor changes in the stock of natural resources and flow accounts to monitor the use of natural resources, impacts of economic activity on the environment, etc.

1.1. How can forest accounts help State Policy?

The 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 initiative has been given shape by 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. The expert group report on 'Green National Accounts in India a Framework' convened by the National Statistical Organization (NSO) under the Ministry of Statistics and Program Implementation (MOSPI) connotes India's obligation to develop the Green National Accounts, and account for the contributions of natural resources in India's economic growth. Natural capital accounting initiatives also exist at global level.

Table 2: NCA and policy linkages for Himachal Pradesh

<i>Accounts</i>	<i>What it does</i>	<i>Which key information does this account provide?</i>	<i>Which key policy does this feed into?</i>
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)	Accounting 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 the potential for increasing this revenue is?) (this would require tourism accounts as well). Inform the damage caused due to forests as well as tourism as well.	Himachal Sustainable tourism policy
Forest ecosystem accounting	Identify and measures 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 Central government for provision of environmental services	HP Hydropower policy 13 th Finance Commission for fiscal transfers from the centre for contribution to environmental services Payment for ecosystem services

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 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 Implementation Natural Capital Accounting in Himachal Pradesh

Due to the Supreme Court ruling, Himachal Pradesh government has imposed 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 and removal of dead and damaged trees. Moreover, management of forests for timber production may not be a long term sustainable option for Himachal as the regeneration rates in higher altitudes is slow and logging creates serious disturbances to local ecology.

With around 66% of the geographical 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 are available in the forests, which cannot be cultivated outside forests due to long gestation periods. Right now, the NTFPs do not generate high returns to gatherers as 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 is also keen to develop NTFPs, as seen in the forest sector strategy of Himachal Pradesh.

In addition to strengthening the NTFP base, a new ecotourism policy has been 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. The state has huge potential for ecotourism due to its beautiful landscape, opportunities for trekking, 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 in Himachal Pradesh (2010), 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 disturbance of hydropower projects on the catchment area, water supply and quality, floods, siltation and erosion are well recognized. The Hydropower policy of Himachal has been formulated in 2006, which has been further amended to safeguard the interests of the people and the delicate ecology and environment. The amended Hydropower policy formulated in 2006 mandates that 1.5 per cent of the estimated project costs be spend on the socio-economic development of the area. The policy also mandates that loss in forests have to be addressed through compensatory afforestation as per the plan and provision of catchment area treatment plans and environmental management plan of the projects.

In implementation of ecosystem accounting at the state level, it may be most feasible to initially, 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 due to 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. SEEA proposes that the prioritization for selecting ecosystem services for accounting purposes should be based on the criteria mentioned in table 3.

Table 3: Prioritization criteria of ecosystem services for accounting purpose

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 well reflects 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 services generated from ecosystem which 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 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.

Table 4: A pathway for the Physical Asset Accounts for the selected assets

Accounts	Rationale	Approach	Key policy Issues	Stake holders 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.	Govt. of H.P., HPFD, HPSFDC, FSI, DoLR, H.P., H.P., DoEST, H.P.
Forest NTFP asset account (other than timber)	Accounting 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 appropriate rents are being paid by forest users. Understand the role of NTFPs in providing livelihoods and conserving forests	Govt. of H.P., HPFD, HPSFDC, FSI, State Tourism Department, DoLR; H.P, DoEST; H.P.
Carbon accounts	Accounting 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; H.P., 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 etc, 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 plus etc.	State Biodiversity authorities, State Technical Council, DoEST, HPFD, MoEF, HP energy department
Eco-tourism 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 of attributed to forests for the tourism services it provides	Department of Tourism, Department of economics and statistics, Department of forests

Based on the policy priorities of the state we suggest 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.

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 linkages 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 (experimental accounts) entails systematic integration of the true contribution of the ecosystem assets and economic activities. The SEEA central framework and the experimental accounts are complementary to each other. The SEEA central framework has already been accepted as a statistical standard. Whereas the ecosystem accounts are called as experimental accounts 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 (i) physical flows between the environment and the economy, (ii) stocks of environmental assets and changes in these stocks, and (iii) economic activities and transactions related to the environment. The Central Framework comprises of following types of accounts:

1. Supply and use tables in physical (e.g. cubic meters of timber) and monetary terms (e.g. 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 i.e., during a year. The **Physical supply and use tables (PSUT)** are recorded by compiling supply and use tables in physical units of measurement. The **Monetary supply and use tables (MSUT)** flows recorded in monetary terms relate to the use of natural inputs from environment and expenditures associated with the environment. A simple form of MSUT and PSUT tables are presented in Table 20 and table 21 in the annex 3.

2. Asset accounts (table 22, Annex 3) 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 23, Annex 3) that highlights the depletion adjusted economic aggregates. These accounts clearly demonstrate flows in monetary transactions pertinent to environment protection.
4. Functional accounts which record transactions and other information about economic activities undertaken for environmental purposes. These accounts takes into account 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 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.

- (i) Physical accounts for the supply and use of ecosystem goods and services.
- (ii) Monetary accounts for the supply and use of ecosystem goods and services.
- (iii) Physical accounts of the environmental assets that supply the ecosystem goods and services.
- (iv) 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 tonnes of timber resources and tonnes of carbon. These accounts can provide information related to quantitative changes in ecosystem condition (e.g. increases 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 and 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 (i.e. spatial areas), and flows between ecosystem assets (inter-ecosystem flows) should be recorded.

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

2.2. Flow Accounts (*Supply and use of forest resource account*)

Natural resource forms the productive base of an economy and provides flow of goods and services from the environment into the economy. Flows within the economy comprises either of products or of residuals while flows from the economy to the environment are in the form of residuals. The basic structure of the follow accounts in physical and monetary units as proposed by SEEA are explained in Annex 3. 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	Industri es	Households	Government	Accumu lation	Flows from/to the Rest of the world	Flows from/to the enviro nment	Total
Supply table							Total supply
Timber							
NTFP							
Forest environment services							
Use table							Total use
Timber							
NTFP							
Forest Environment al services							

The top half of the table 5, i.e. 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, i.e. the flows from/to the rest of the world identifies the exchanges between the national/state boundaries. The so called transboundary flows of forest products is an essential element of the supply-use tables as it is key to determine whether the forest resource of Himachal is being managed sustainably and if not what are the consequences of it to the state and its neighboring states.

It is possible for the Department of Economics and Statistics, Himachal Pradesh 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 hectares (area) and volume accounts in terms of cubic meters. The basic structure for physical asset account for timber resource as proposed by SEEA (is mentioned in Annex 3), distinguishes between type of timber resource, most importantly between cultivated and natural timber resource. For natural timber resource, SEEA further distinguishes between those timber resources available for wood supply and those not available 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/state specific data availability of forest classifications, the physical accounts for timber for the state of Himachal Pradesh would be developed based on the framework described below. Tables 6 give the basic framework for developing physical accounts of forest timber and fuelwood in terms of area for Himachal.

Table 6: Framework for physical asset account for forest resource: Area Accounts for timber, fuelwood (hectares)

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

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

Table 7: Framework for physical asset account for forest resource: Volume Accounts for timber and fuelwood (in cubic meters)

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

Opening stock/ Closing stocks: These represent the stock of forest resources i.e., 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 takes place as a result 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 are activities such as, logging/harvest, logging damage, illegal logging, afforestation that affect (decrease/increase) the stock of forests.

Logging/harvesting (exploitation of forest produce both recorded and unrecorded): Forest harvesting/exploitation works in Himachal Pradesh include major forest produce and minor forest produce (resin tapping and timber extraction etc.) which are majorly done by HPSFDC. Besides, certain quantities of standing volume of timber are earmarked to right holders and free grantees for which they made their own arrangements for exploitation. In addition, right holders extract few quantity of firewood, and certain quantity of timber is extracted, and charcoal is prepared for departmental use by the department. As far as felling of trees are concerned, the owners for their bonafide domestic and agricultural purposes are allowed to cut three trees of coniferous (except chil trees). In 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 Divisional Forest Officer under the Himachal Pradesh Land Preservation Act, 1978. Felling of trees for sale should be in accordance with the 10 years felling programme formulated by the Forest Department and approved by the government except the areas falling within the limits of Municipal Councils, Municipal Councils, Nagar panchayats and Cantonment Boards.

Afforestation: The stock of forested land may increase because of economic activity such as afforestation, resulting in establishment of new forest on land, which 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). Since surface fires are non-stand replacing fires, they are not considered under other volume changes.

Forest encroachments and shifting cultivation: Forests are encroached every year illegally, despite the fact that land is legally classified as forests. 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.

Damage from heavy grazing: Grass cutting and grazing is allowed in the State forests to right-holders as well as to non-right holders.

Other accumulation

This consists of accumulation of timber due to natural growth (mean annual increment), natural regeneration and the transfer of forestland for non-forest purposes such as, agriculture, 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 per cent, 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

The monetary asset accounts for the timber resources involves 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, i.e. 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 for Himachal is presented in table 8.

It is probable that not all timber resources are available for harvest because of forest legislation and/or environment or economic reasons. Like in Himachal, the 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 form a part of 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 the entries are recorded on a gross basis in the SEEA.

Table 8: Monetary asset account for timber (in Million Rupees)

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

For natural timber resources, the natural growth is not considered an increase in inventories since the growth in the trees is not considered as 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 is explained in Annex 3.

2.5. *Forest asset account (NTFP)*

Forests provide range of non-timber forest goods and services that should also be valued while accounting for forest resources. Himachal Pradesh forests provide variety of minor forest produce such as resin, bamboo, bhabbar grass, fodder grazing and medicinal herbs. Accounting for the values of NTFPs indicates the level of dependence of rural communities on forests for their livelihood. In case of minor forest produce, only the HPSFDC does exploitation of resin in the state. In addition, bhabbar grass is commercially extracted and certain royalty is paid for this. While in case of bamboos, there is no restriction on numbers to be felled for bonafide domestic purposes or for use in their own cottage industries.

Extending the forest accounts to include non-produced forest assets such as NTFPs, fodder, bioprospecting values etc. 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) programme. Developing NTFP accounts can help analyse 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, economic and other human activity. Therefore, 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 CO₂, CO and CH₄. Some of the carbon enters the forest product market and carbon that is left onsite 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 Annex 3 and the proposed framework for Himachal forests is presented in table 9.

Table 9: Framework for physical asset account for Carbon

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

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 to soil pool. Forest carbon accounts exhibit whether the forests are net sources or sinks of carbon and their exact contribution to climate change mitigation. Carbon accounts may help to look at ways to link them 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 (i.e. unsustainable harvesting) would result in lower yields, reduced economic profit and a higher risk of extinction, and 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.

Due to complexities in measurement of biodiversity, only selected indicators are focused rather than accounting for all aspects of biodiversity. According to SEEA, the four indicators considered for accounting for state of biodiversity are-

- 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 biodiversity account for species abundance based on SEEA arrangement is described in table 10. Some more detail on biodiversity account is mentioned in Annex 3.

Table 10: Biodiversity account: Framework for species abundance by kingdom for an EAU

	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

Note: The selection of classes and Kingdom shown in the table is indicative only and may vary according to the availability of data at more disaggregated level.

Biodiversity accounts can be useful indicators of species richness, 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 environmental services and REDD plus. Building biodiversity accounts will majorly depend upon availability of data as only limited information is available with the HPFD and the State Biodiversity authorities. The status of area under forests, the quality of the forests and the biodiversity is a general indicator of health of forest ecosystem and they can be linked with other regulating and supporting services.

3. Assessment of Data and information sources for compiling forestry account for Himachal Pradesh

In implementation of ecosystem accounting at the national scale, it may be most feasible to initially, 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 due to 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.

Feasibility of developing forest accounts for Himachal Pradesh majorly depends 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. One is based on land use i.e., the recorded forest area and the other based on canopy density or the forest cover as per the Forest Survey of India (FSI) classification system. In India, the land use is classified based on nine-fold classification system. Land use is classified as-

1. Forests
2. Area under non-agricultural Uses
3. Barren and uncultivable Land
4. Permanent pastures and other grazing Lands
5. Land under miscellaneous tree crops, etc
6. Culturable wasteland
7. Fallow lands other than current fallows
8. Current Fallows

9. Net area Sown

These land use classification system is defined in the Annex 2. The Indian classification of land use varies from the SEEA classification of land use. SEEA distinguishes between land use and land cover. The classifications for land use and land cover are described in the SEEA Central Framework, brief overview of which is mentioned in the Annex 3.

Forest area (or recorded forest area) as per the land use classification refers to all geographical areas recorded as 'Forests' in government records. Recorded forest areas comprises of Reserved Forests (RF) and Protected Forests (PF), constituted under the provisions of the Indian Forest Act, 1927. Besides RF and PF may also include areas which may have been recorded as forests in the revenue records or constituted so under the State Act or local law. Table 11, shows forest area under various legal classifications for Himachal Pradesh.

On the other hand, the 'Forest Cover' refers to all lands more than one hectare in area with a tree canopy density of more than 10%. Thus, 'Forest Area' denotes the legal status of land, whereas 'Forest Cover' indicates the presence of trees on any land irrespective of legal ownership. Forest Survey of India (FSI) classifies forests based on the internationally adopted norms of classification. FSI assess 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 FSI assessment, forest cover is broadly classified in four classes, namely very dense forest (VDF), moderately dense forest (MDF) and open forest (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. The other two classes comprises of scrub and non-forest.

Table 11: Forest area under various legal classifications

Classes of forests	Area in Ha		
	31.03.2007	31.03.2008	Variation
A. Forests managed by the forest department			
Reserved forests	189786	189786	
Protected forests			
a) Demarcated forests	1184040	1191180	(+) 7140
b) Un-demarcated	2120623	2120478	(-) 145
c) Strip forests (road/railway)	1310	1312	(+) 2
Un-classed forests	97668	88634	(-) 9034
Total A	3593427	3591390	(-) 2037
B. Private forests managed by the Forest Department			
Area under Section 38 IFA	10867	10867	-
Area managed under LPA	26002	26002	-
Area under H.P. Private Forest Act	80	80	-
Total B	36949	36949	-
C. Forests not managed by the Forest Department			
Municipal forests	1037	1037	-
Cantonment forests	1340	1386	(+46)
Shamlat & Mustarqua Forests	14960	16997	(+) 2037
Other forests (Private individuals)	55584	55538	(-) 46
Total C	72921	74958	(+) 2037
Grand total	3703297	3703297	-

Source: Annual Administrative Report 2007-08, State Forest Department, Himachal Pradesh

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: SFR (2011)

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

Forest Cover	Area in Km ²
Geographical area	55673
Very Dense Forest	3224
Moderately Dense Forest	6381
Open forest	5074
Total	14679
% of geographical area	26.37
Scrub	328

Source: SFR (2011)

Although majority of recorded forest areas have vegetation cover, there may be some blank areas or areas with tree density less than 10 per cent. These may include wetlands, rivers, riverbeds, creeks in the mangroves, snow covered areas, glaciers, alpine pastures, cold deserts, grasslands etc. on the other hand, there are areas outside the recorded forests with tree patches of one hectare and canopy density beyond 10%. These may include plantations on the community lands, roadside, railways and canals, Eucalyptus, rubber, tea and coffee plantations, etc. Such areas are also considered under the forest cover and are included in the forest cover assessment by FSI.

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 forest cover assessment having areas less than the minimum mappable area of one hectare. They comprise block and liner patches having area between 0.1 ha and 1.0 ha. Trees Outside Forest (TOF) and Tree Cover are two

different entities but closely related to each other. TOF refers to all trees growing outside recorded forest area irrespective of patch size. For estimating growing stock from TOF, entire TOF area is taken into account. For the purpose of forest cover assessment, all TOF patches of 1.0 ha and more are included in the forest cover. However, for the purpose of tree cover estimation, the TOF patches which are less than 1.0 ha in extent and the scattered trees in the rural and urban areas are taken into consideration. Thus, trees included in the tree cover constitute only a part of TOF and therefore, tree cover becomes a subset of TOF. Assessing 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 purpose. For a comprehensive assessment of forest resources inside and outside forest areas including 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 a part of the biennial State of Forest Report published by FSI.

Table 14: Forest Inventory of Himachal Pradesh

Category	Area (in ha)	% Geographical Area	Growing stock (in million cum)
Tree cover	62300	1.12	21.146
Forest cover	1467900	26.37	321.314
Total	1530200	27.49	342.460

Source: FSI, 2011

3.2. Forest Data Systems

State Forest Department, Himachal Pradesh: A wide variety of data is available from the state Forest Department of Himachal Pradesh that can be used to compile forest resource accounts for the state. The forest 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 account.

- 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
- Live stock Census of HP by districts
- 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 produce

- Division wise detail of resin exploitation works by State Forest Corporation
- Volume granted under Timber Distribution rights
- Forest fires their causes and area burnt

Annual administrative reports: This publication contains updated statistics of the forest area, its management, silviculture, harvesting of forest produce, physical and financial achievements of forestry development works and organizational set up of departments.

- Area of reserved, protected and un-classed forest
- Demarcation & maintenance of boundaries
- Area surveyed
- Area under working plan
- Area protected from forest fires
- Area closed & 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 & soil conservation)

Working Plans: The State Forest Department 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
- Reserve forest, demarcated, un-classed forest
- Volume of species
- Value granted to right holders per annum
- Existing and normal growing stock per hectare
- Natural regeneration

- Forest fire
- Logging
- Resin tapping
- Fuelwood requirement
- Fodder requirement
- Cost of felling
- Major forest produce
- 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: Himachal Pradesh Forest Department has recently started Geographical Information System (GIS) on Bhuvan as a GIS based information system. It gives best insights on Himachal forests based on GIS mapping. It provides information on land use land cover, wasteland, watershed, villages (kangra) and village locations- circle wise, division wise, 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 2003-2012. Average number of fires in a year, average area burnt in a year and numbers of fire years are combined to arrive at fire risk zonation at multiple levels i.e. Compartment, Forest and Beat Levels. The GIS Bhuvan information system also enables viewing Himachal Pradesh Forest Department's assets based on boundaries i.e. beat boundary, Joint Forest Management Committees (JFMC) and Green India Mission (GIM) plantation. Currently, only plantations and Entry Point Activities have been added, the forest department is planning to add more.

Green India Mission: Under Prime Minister's initiative on National Action Plan on Climate Change (NAPCC), the Green India Mission (GIM) intends to increase the green cover of India by over 5 million hectares over the next decade. Landscapes identified for GIM activity by proposed activities i.e. entry point of JFMC and GIM plantation in the state can be viewed with the help of GIS system.

Climate vulnerability: This gives level wise information on climate vulnerable landscapes as well as other selected landscapes which require special attention such as ravine areas, predominantly scrub areas and areas with high biodiversity outside Protected Area Network (PAN). Climate vulnerability of level 2 landscapes (approx 10000-15000Ha each) is evaluated using the methodology proposed by the GIM Advisories of Ministry of Environment and Forests. Social, economic, forest vulnerabilities are combined with climate change projections to derive the relative vulnerabilities of these landscapes. Local Landscape Index is developed by providing weightage to various contributing factors like biodiversity, forest cover dynamics, predominance of rural population, caste structure etc. 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 are covered by different categories such as, area under wildlife wing outside PAN, conservation reserve, national park and wildlife sanctuaries. So far, 5 National Parks, 26 Wildlife Sanctuaries and 3 Conservation Reserves covering an area of 8358 Km² (15 percent of geographical area) have been constituted in the state.

Hydrological Information System: Himachal Pradesh also has a Hydrological Information System (HIS) which gives hydrological information on surface water, ground water, water quality and hydro meteorological data. 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 (MoEF), responsible for regularly assessing and monitoring the forest resources of the country. The major activities performed by FSI are- Forest Cover Assessment, assessing Inventory of Forest Areas, developing thematic maps, monitoring Inventory of Trees Outside Forest (TOF) in rural and urban areas, inventory data proceedings, designing methodology and providing services of training, research and extension. FSI is a valuable source of information required to build forest resource accounts for Himachal Pradesh. For example, the State of Forest Report (SFR) India, gives valuable information on forest/tree resources, forest inventory and forest cover at the state and district level. The report is based on interpretation of satellite data on biennial basis.

FSI has been the major contributor on forest biomass estimation and carbon stock. 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-

- Above Ground Biomass (AGB)
- Below Ground Biomass (BGB)
- Dead organic matter (wood)
- Dead Organic matter (Litter)
- Soil Organic Matter (SOM)

Himachal Pradesh State Forest Development Corporation Limited (HPSFC): It is an undertaking of the H.P. 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, H.P. (DoEST): The department works towards improving the effectiveness of environmental management, protect vulnerable ecosystem and enhance sustainability of development. The State Pollution Control Board, state Council for Science Technology and Environment, Environment Division, Biotechnology Division, Science and Technology Division comes under this department. Society for

Environment Protection & Sustainable Development comes under the Environment Division. The DoEST prepares Environment Master Plan, State Strategy & Action Plan on Climate Change H.P., State of Environment Report (SoER), GHG emissions inventory of H.P. These reports provide useful information on sustainable forest management and development.

Department of Economics and statistics, HP: The Directorate of Economics & Statistics, Government of Himachal Pradesh 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 broad database for the state, to help in 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, fuel wood, 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 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 are broadly classified into two groups viz. 'major' and 'minor' forest production. Major forest products include industrial wood, fuel wood 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 conversion ratio separately for each variety of timbers, converted volumes for different varieties are arrived. These are then evaluated at the average wholesale prices of various species of timber prevailing at various sale depots of H.P. Forest Corporation in the state. The estimated fuelwood data are as available from the results of NSS consumption expenditure surveys. The production of firewood is estimated indirectly from the consumption side. The data on consumption of firewood is available from 5-yearly consumer expenditure surveys of NSSO.

In case of minor forest produce, the exploitation of resin is entirely in the hands of H.P. State Corporation. The quantity extracted and the prices are supplied by the Forest Department and the same are used for valuation of resin. The value is then adjusted by deducting 5% of value as trade and transport margin. In case of minor forest products other than resin, only royalty value is available from the HPFD. As per ratio, decided at the national level ten times of royalty value is taken to be economic value of these products. Previously, 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/NSDP of the state. It is evident that forest services like 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. Annex 4 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 table presented in Annex 5. The data sets available for Himachal Pradesh as pointed out in table 15 & 16 show that the data is quite diverse and needs to be refined to make it symmetric.

Table 15: Details of data availability and non-availability

Data needs	Sources	Unit	Availability	Non availability
District wise forest cover of Himachal Pradesh	FSI, State of Forest Report	Area in Km ²	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	State Forest Department, HP; HP Forest Statistics	Area in Km ²	Forest circle, division wise	Forest statistics 2005, forest statistics 2010 doesn't covers this data
Land utilization of Himachal Pradesh	Directorate of Land Records, H.P. Shimla; HP Forest Statistics Directorate of Economics and Statistics, Ministry of Agriculture; Land Utilization Statistics at a glance	Area in Km ²	Land utilization under the nine-fold classification for year 2002-03 & 2006-07 from Forest statistics. Data available for 2001-02 to 2010-11 from MoA	Data from both the sources does not tally. There is a confusion regarding which data is more suitable for compiling the accounts for HP. Moreover, different reports of State Forest department considers different classes of land utilization.
Area under different management working circles in various working plans	State Forest Department, H.P.; HP Forest Statistics, 2005	in hectares	Division wise, working plan wise data as on 31-12-2004	Forest Statistics 2010 does not provide any detail under this head.
Area, growing stock and prescribed annual yield of important species	State Forest Department, H.P.; HP Forest Statistics, 2005, 2010	area (in km ²) G.S. (000 m ³)	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 and river basin wise

Prescribed annual yield of important species from state forests in various forest divisions	State Forest Department, H.P.; HP Forest Statistics, 2005	Yield in m ³	Species wise circle/division wise	Specific year of the data not mentioned. Forest Statistics 2010 does not furnish this data
District and division wise area in HP by different legal classification Circle and division wise forest area of HP by legal classification	State Forest Department, H.P.; HP Forest Statistics, 2005	Area in Hectares	for year 2002-03	HP Forest Statistics, 2010 gives the data for year 2008-09 but district wise, division wise detail is not mentioned
Area planted under various species	State Forest Department, H.P.; HP Forest Statistics, 2005, 2010	Area in Ha	Species wise area planted from 1950-51 to 2006-07, Plantation raised during 200-01 to 2003-04, 2007-08, 2008-09. Total area of plantation as on 31-03-04 and 31-03-2009	
Plantation planted, Survival rate	State Forest Department, H.P. Plantation Brochures	Area in Ha, number of plantations in nos., survival rate in %	Division, range, block wise, circle wise	
Species wise plantations raised according to Five year Plans	State Forest Department, H.P.; HP Forest Statistics, 2005,	Area in Ha	Available from 1 st Five Year Plan to 10 th Five Year Plan, Area in Ha	
Division wise, species wise plantations raised	State Forest Department, H.P.; HP Forest Statistics, 2005	Area in Ha	Available for year 2000-01, 2001-02, 2002-03, 2003-04	
Physical achievements of soil	State Forest Department, H.P.; HP Forest	Rs. lakh	State and central sector	Data speaks about physical achievements but

conservation	Statistics, 2005			figures are in Rs. lakh. Clarity required whether it is physical or financial achievement and on the units
Quantity of timber removed	Department, H.P.; HP Forest Statistics, 2005	Volume in m ³	Removal in decades from 1950-60 to 1990-2000	Latest data required
Resin exploitation	State Forest Department, H.P.; HP Forest Statistics; 2005, Working Plan	Resin blazes in 000 No., quantity extracted in Qtl., 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	Annual Administrative report	Timber in m ³ , firewood in tonnes, charcoal in tonnes	Standing volume of timber & fuelwood exploited by various agencies, circle wise division wise	
Timber distribution	State Forest Department, H.P.; HP Forest Statistics; 2005, Working Plan		Volume granted under Timber Distribution Rights at subsidized rates vis-à-vis Market rate and subsidy for 1998-99 to 2003-04	
Sources of forest revenue	State Forest Department, H.P.; HP Forest Statistics; 2005, 2010	Rs. in 000	Product/source wise	
Area of reserved forests, protected forest, unclassed forest, leased forest	State Forest Department, H.P.; Administrative report, Working Plan	Area in ha	Circle wise division wise area under the category	

Forest settlement	State Forest Department, H.P.; Administrative report	Area in km ² , cost in Rs.	Circle wise Settlement area, cost of settlement	
Area subject to forest fires	Forest Department, H.P., 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 burnt for the year 2005-06	Administrative report of years apart from 2005-06 does not give data on forest fires
Animal grazing	Forest Department, H.P., 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)	Forest Department, H.P., Administrative Report, Data also available from working plans		Area regenerated (natural, artificial), cost of regeneration	Volume of forest cover regenerated not available
Afforestation	Forest Department, H.P., Administrative Report		Area afforested during a year	Volume of afforestation not available
Transfer of forest land to other activities	State Forest Department	Area in Ha	Year wise detail of proposals approved under FCA up to 31.1.2013, 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, Department of Land records	In km ²	District wise data available from different	Division wise/circle wise data for shifting cultivation

			publication of wasteland atlas	required
Encroachments	Working Plans	In Hectares	Extent of area encroached is available forest wise for the working plan period	
Carbon stock	FSI, MOEF	000 tonnes of carbon, tonnes per hectare	FSI now publishes state wise carbon stock in different carbon pools and changes in carbon stock in forests (forest type & density wise) in India.	District wise/circle detail of carbon stock is required
Tourism	State Tourism Department	In numbers	No. of tourists arrived (domestic & foreign), district wise from 2004-2012	
Volume of timber handed for harvesting	State Forest Development Corporation, HP	Not mentioned	Circle wise, species wise volume, royalty rate and average rate for 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	Non availability
Outturn of major products from state forest	State Forest Department, H.P.; HP Forest Statistics, 2005, 2010	Standing volume in m ³	Timber extracted, firewood, charcoal species wise, agency wise 1999-2000 to 2003-04	Value not available
Outturn of minor forest produce from state forest	State Forest Department, H.P.; HP Forest Statistics, 2005, 2010	quantity (in tonnes) and value (in 000 Rs)	Produce wise 1999-2000 to 2003-04 with detail of medicinal herbs Utilized by different agencies (value and quantity)	Forest statistics 2010 does not present detail on medicinal herbs
Sale rates for supply of timber	State Forest Development Corporation, HP	Rates in Rs. per m ³	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 produce at sale depots	Forest Department, H.P., Administrative Report	Volume in cubic meters and value in 000 Rs.	On hand in the beginning and end of year (value and quantity)	
Financial achievements of forestry and wildlife schemes	State Forest Department, H.P.; HP Forest Statistics, 2005	In Rs. lakh	Forestry and wildlife (State and Central sector)	
Financial achievements of Soil Conservation Schemes	State Forest Department, H.P.; HP Forest Statistics, 2005	In Rs. lakh	State and central sector	
Return of grazing in the state forest	Forest Department, H.P., Administrative Report	Value in Rs.	Grazing on payment at full rates and grazing fee	Loss in value due to overgrazing

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 it primary or secondary is completely exploited. Therefore, it is important that the capacity and training of the officers of all relevant sectors to forest accounting is enhanced. Some data exists and some data gaps need to be filled. The environmental issues are usually not a part of annual training plans of most of the departments. There is primary focus on technical training and not on conceptual understanding of environmental issues and how it impacts the environment as a whole. For instance in natural resource management related sector like, agriculture, environment, Forest and Wildlife, fisheries, Land Revenue Department, State Pollution Control Board etc. the current training focus is on presence of trained experts on environmental issues, technical and skill building environment courses. 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. Himachal forest department does have some expertise due to CAMPA, an instrument step up 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 plans for various hydroelectric projects and irrigation projects under implementation. The state also has evolved incentive-based mechanism for the protection, management and conservation of natural resources for sustained production of ecosystem services. In 2008, the Himachal Forest Department has announced a unique scheme for payment of ecosystem services. 10 per cent of the outlay for the CAT plans is mandatorily set aside for implementing PES with local communities. The state forest department is also in the process of developing a community, based bio-carbon project in 177 panchayats 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 the closeness to the mandate of the department knowledge, experience, organizational capacity. Along with the Department of environment science and technology, the department of planning and forest department can play a critical role in mainstreaming forests into the national accounts. The organizational structure of Himachal Pradesh forest department has three administrative levels. The Principal Chief Conservator of Forests (PCCF) and the Chief Conservator (CF) forms the top strategic level. The Deputy Conservator of Forest (DCF) and the Ranges forms the middle/technical level and lastly blocks and beats comprise the front line staff at the executive level. Presently, the forest department has nine Forest Circles (Territorial) and three Wildlife Circles under overall PCCF. Detail organogram of the forest department and their respective powers and duties is explained in Annex 6.

The HPFD along with the HPSFDC provides key information to the DoES for compiling GSDP/NSDP for the state. HPFD also provides information to the DoEST for preparing Environment Master Plan, State Strategy & Action Plan on Climate Change, State of Environment Report (SoER) and GHG emission inventory of the state. These reports and the estimates of GSDP/NSDP are further used for policy formulation for environment management and sustainable development.

An inter-departmental steering committee can be established involving the relevant departments (tourism department, 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 spelt out in policy documents. Hence, there is a serious need to identify these linkages 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 one and located only at the headquarters, not in the field or implementation area.
5. The central sector scheme of 'Training of IFS officers' provides for sponsoring of short-term refresher courses of one to three week duration for the Indian Forest Service officers in the premier training institutions/organizations of the country for advancing the knowledge and skills and change in attitude for managing the natural resources of the country.
6. Apart from this, capacities of Department of Panchayati Raj should also be built to demonstrate stronger commitment to public participation in forest management and eco tourism related activities. They also need to be educated on making forests look a lucrative option for locals.
7. More importantly, different sectors have to recognize that natural resources are the key for their own sustainability and they are not exogenous factors. Various officers have to be given training on the systems perspective rather than sectoral perspective.

The pathways to achieve the detailed ecosystem accounting is given in Figure 1.

Figure 1: Short-term pathway to develop forest accounts for the state of Himachal Pradesh

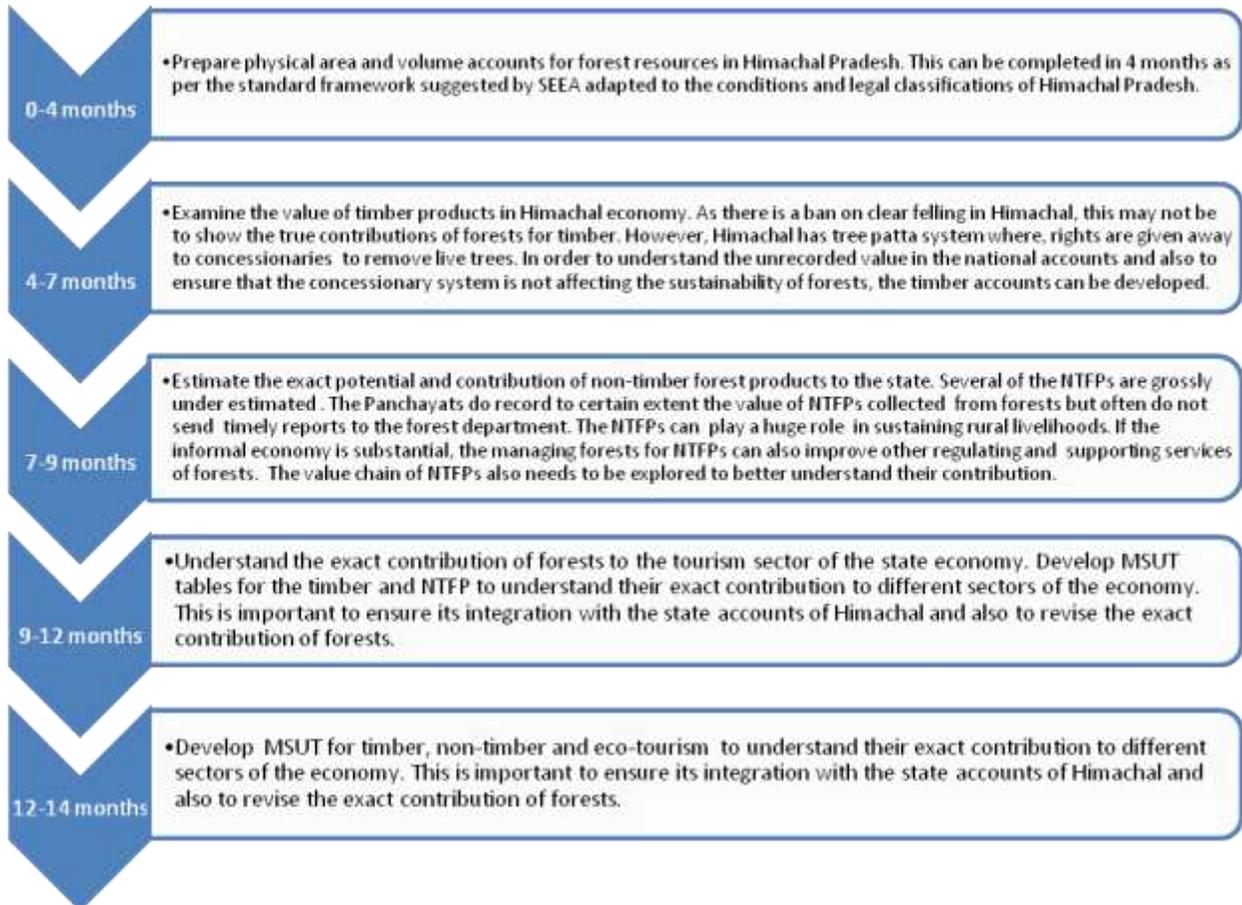


Figure 1 gives the short-run implementation of forest accounts in the next 14 months (short – term).

Annex 1: Definitions of Various Terms

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 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 forest lands having canopy density 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. It also includes bamboos, palms, fruit trees, etc. and excludes 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 mappable area (1ha).

Trees Outside Forest (TOF): Trees growing outside recorded forest area.

Annex 2. Land use classification in Himachal Pradesh

- 1. Forests:** This 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 forest land. 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:** This includes all lands occupied by buildings, roads and railways or under water, e.g. rivers and canals and other lands put to use other than agriculture.
- 3. Barren and uncultivable Land:** The category includes all barren and uncultivable land like mountains, deserts etc. Land, which 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:** They include all grazing lands whether they are permanent pastures and meadows or not. Village common grazing land is included under this head.
- 5. Land under miscellaneous tree crops, etc.:** This category 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, etc. which are not included under 'Orchards' should be classed under this category.
- 6. Culturable wasteland:** 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 not used. They may be assessed or unassessed and may lie in isolated blocks or within cultivated holdings. Land once cultivated but not cultivated for five years in succession should also be included in this category at the end of the five years.
- 7. Fallow lands other than current fallows:** This includes all lands, which 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:** This category represents cropped area, which 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:** This represents the total area sown with crops and orchards. Area sown more than once in the same year is counted only once.

Table 17: Land utilization of Himachal Pradesh 2006-07 (area in Km)

1. Geographical area (by professional survey)	673
2. Area by village paper (revenue record)	444
3. Forest area (as per forest records)	033
4. Land put to non-agricultural uses	16
5. Net area sown	14
6. Fallow lands (current and other fallows)	2
7. Culturable wastes	80
8. Land under miscellaneous tree crops not included in cultivation	1
9. Permanent pastures and other grazing Lands including alpine pastures, barren and unculturable wastes etc.	67

Source: Himachal Forest Statistics 2010

Note: The data is based on figures collected from Directorate of Land Records H.P. Shimla except item no. 3&9. Item no. 3 as per Forest Department record and figure given in item no. 9 are the balance areas i.e. total geographical area (by professional survey) minus the sum of area given in serial no. 3 to 8.

Annex 3: The System of Environmental Economic Accounting (SEEA)

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 towards the development of a statistical framework for ecosystem accounting. The 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 stature for building up the ecosystem accounts under a common set of terms, concepts, accounting principles and classifications, an integrated accounting structure of ecosystem services and ecosystem condition in both physical and monetary terms and the identification of spatial areas as forming the basic focus for measurement.

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 ecosystem, the assets accounts generally need to be developed with context to Geographical Information System. The basic framework for developing these accounts is described in SEEA Central Framework.

Ecosystem services: Ecosystem services forms the central part in the ecosystem accounting framework as they offer a linkage between ecosystem and economic and human activities. SEEA considers three types of ecosystem services, i.e. provisioning services, regulating services and cultural services. However, the supporting services such as soil formation, pollination etc. are not considered by SEEA due to difficulties associated with compilation of these accounts.

Provisioning services: they describe the material outputs from ecosystems, e.g. food, raw materials, fresh water, medicinal herbs.

Regulating services: Regulating services of ecosystem result from, the capacity of ecosystems to

regulate climate, hydrological and bio-chemical cycles, earth surface processes and a variety of biological processes. e.g. 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, waste-water treatment.

Cultural services: This includes the non-material benefits people obtain from contact with ecosystem. They include aesthetic, spiritual and psychological benefits.

Supporting Services: This underpins almost all other services, e.g. erosion prevention and maintenance of soil fertility, pollination, biological control of vector borne diseases etc.

The framework and the related accounts illustrated in the SEEA-Experimental Ecosystem Accounting are complementary to the conceptual framework and accounts described by the International statistical standard for environmental economic accounting- the SEEA Central Framework. The United Nations Statistical (UNSC) adopted the SEEA Central Framework as the first International Statistical Standard for environmental-economic accounting, at its 43rd session in 2012. The Central Framework is built on the previous editions of the SEEA namely the 1993 Handbook of National Accounting: Integrated Environmental and Economic Accounting (SEEA 1993) and the Handbook of National Accounting: Integrated Environmental and Economic Accounting 2003 (SEEA-2003). 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. The SEEA-Experimental Ecosystem Accounting describes approaches to account for ecosystem assets and services separately in physical terms and monetary terms.

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 of following types of accounts:

1. Supply and use tables in physical (e.g. cubic meters of timber) and monetary terms (e.g. 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 i.e., 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 which record transactions and other information about economic activities undertaken for environmental purposes. These accounts takes into account ecosystem services and other ecosystem flows, especially ecosystem degradation.

Table 18: Physical flows of ecosystem services for an Ecosystem Accounting Unit (EAU)

Type of ecosystem services (by CICES)	Type of Land Cover/Ecosystem Functional Unit (LCEU)			
	Forest tree cover	Agricultural land	Open wetlands	Other functional unit such as water, air, minerals etc.
Provisioning services	e.g. tonnes of timber, fuelwood, charcoal, NTFP	e.g. tonnes of wheat		
Regulating services	e.g. tonnes of CO ₂ stored/released, protection from disasters, air filtration	e.g. tonnes of CO ₂ stored/released	e.g. tonnes of P absorbed	
Cultural services	e.g. number of visitors/hikers, spiritual, aesthetic values, educational values		e.g. hectares of bird/animal habitat	
Supporting services	e.g. Soil formation, photosynthesis, nutrient recycling, pollination			

Source: SEEA

SEEA Land Classification

Land Use: Land use reflects both (i) the activities undertaken and (ii) 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 areas, for example protected areas, that are under the active management of institutional units of a country for the purpose of excluding economic or human activity from that area.

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 n.e.c.

2.4. Inland waters not in use

Land Cover: Land cover refers to the observed physical and biological cover of the Earth's surface and includes natural vegetation and abiotic (non-living) 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.

Table 19: 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 inter-tidal areas

Main accounts and tables of the SEEA Central Framework

Monetary supply and use tables (MSUT): MSUT tables 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 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 20 below.

Table 20: Basic form of monetary supply and use table- 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

Note: Dark grey cells are null by definition

Physical supply and use tables (PSUT): 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 PSUT. PSUT are used to assess how an economy supplies and uses several assets including natural resources and are also used to examine changes in production and consumption patterns over time. The PSUT structure (table 21), is based on the monetary supply and use tables with extensions to incorporate a column for environment, and rows for natural inputs and residuals.

Table 21: Basic form of physical supply and use tables- SEEA

	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 & treatment of wastes and other residuals		Accumulation of waste in controlled landfill sites		Residual flows direct to environment	Total use of residuals

Note: Dark grey are null by definition. Blank cells may contain relevant flows.

Within the PSUT, the supply and use identity that applies in monetary terms also applies in physical terms (for e.g. 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 SEEA Central Framework the intent of 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 22)

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 22: Basic form of Asset account as per 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

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 sub-national 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 monetary and supply use table. The balancing item in the production account, is value added i.e. output less intermediate consumption. Next in the sequence, comes the distribution and use of

income accounts. These accounts contain information on the manner of value addition, i.e. 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 are operating surplus i.e. value added less compensation of employees and taxes less of subsidies and savings i.e. 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 23) completes with the financial accounts, which records the transactions involved in lending and borrowing. The balancing item for the capital account is net lending/borrowing, the same as the balancing item for capital account.

Table 23: 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 item/Aggregate	Net lending/borrowing
Financial account	
Main entries	Transactions in financial assets and liabilities
Balancing item/Aggregate	Net lending/borrowing

Source: SEEA Central Framework

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

Functional accounts: Functional account identifies 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 variety of goods and services that are rarely traded in an operative market. Since market for forest goods and services is seldom, 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 24 presents different approaches for 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 labour and produced assets to modify the ecosystem and to harvest the resource. This involves costs involved in harvesting and costs associated with modification of 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 willingness to pay of the consumers for the services involved.

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

Table 24: Approaches to valuation of ecosystem services as recognized by 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

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 25.

Table 25: 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 and cost-based assessments focus on the cost of avoiding or modifying the human activity that is leading to degradation of ecosystem (avoidance cost).

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 due to the location 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 (e.g. 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 valued using different approaches depending upon whether the asset is renewable or non-renewable. Timber being a renewable asset, three methods of valuation is used. These are the present value method, the net price method or the user cost method. The three methods are described briefly below-

Present value method: The present value V_0 of natural resources is the sum of expected net revenue flows $N_t Q_t$, discounted at nominal or real interest rates 'r' for the life T 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, exploration and Q_t is the quantity exploited during the period t and T is the total life time of the resource.

Net price method: The value of the resource at the beginning of the period t, given by V_t is the volume of the resource R_t multiplied with the difference between the average market value per unit of the resource P_t 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, i.e. 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), X ‘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.

Annex 4: Valuation studies in India

Accounting for environment and forest resources have been conducted by different institutional organizations and agencies. Central Statistical Organization (CSO), TERI, GIST are all actively involved in valuation of environment and ecosystem services in India. The government of India through CSO has conducted few studies on accounting for natural resources such as air, water, land, forestry sector, minerals, and valuation of biodiversity. For the state of Himachal Pradesh, the forest department has commissioned a study on “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 forests of Himachal Pradesh based on Millennium Ecosystem Assessment Classification. The study found the total economic value of provisioning, regulating and cultural ecosystem services from forests of Himachal Pradesh to be Rs. 10873 cr., Rs.77067 cr., and Rs.5012 cr. respectively. Thus, the total economic value of selected ecosystem services from forests of Himachal Pradesh was estimated to be Rs. 92,952 crores. Another study on ‘Natural resource accounting of land and forestry sector (excluding mining) for the states of Madhya Pradesh and Himachal Pradesh’ executed by IIFM for CSO, MOSPI estimated total direct benefits from forests of H.P. at Rs. 1128.653 crores and total indirect benefits at Rs.98475.45 crores using the SEEA framework.

The Green India States Trust (GIST) conducted two studies on accounting for India’s forest products and services. In one study Gundimeda et al. (2006) accounted for the ‘Value of biodiversity in India’s forest’ using the benefit transfer and NPV method. Results of the study shows the NPV of ecotourism at Rs. 65193 per hectare and the NPV of bioprospecting at Rs. 22646 per hectare. The second study by Kumar et al. (2006) on ‘Accounting for ecological services of India’s forest- soil conservation, water, augmentation and flood prevention’ valued nutrient loss from forests at Rs. 95895 million, water recharge value Rs. 18578.70 million and flood prevention value at Rs. 111030 million.

The evaluation of above studies clearly illustrates that only limited studies exists 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.

Annex 5: 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 70-100 cm. The maximum temperature goes up to 40° C. It comprises mainly of dry deciduous, chir pine, sal and thorny forest mostly of xerophytic species.

Sub-temperate forests: These forests extend from 916 meters to about 1523 meters above mean sea level with an annual rainfall of 90 to 120 cm. Some upper hills also receive mild snowfall during winters and the maximum temperature in summer remains around 30° C. This zone type contains species like pines, oaks, and broad-leafed species and has good pasturelands.

Wet-temperate forests: These forests extend from 1524 to 2472 meters above mean sea level and are majorly covered with forests and pasturelands. The annual rainfall varies between 100 to 250 cm with snowfall during winters when temperature falls to minus 10° C. maximum temperature during summers ranges between 15 and 20° C. 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.

Dry-temperate forests: These extend to above 2472 metres. The mean annual temperature is around 10°C and mean annual precipitation about 25 cm. The area contains scattered trees and bushes such as chilgoza, willow, robinia, ailanthus, poplars and alpine pastures with bushes such as ephedra.

Table 26: Forest types with dominant tree species occurring in Himachal Pradesh

Forest types	Area (in Km ²)	Important tree species
Tropical Dry Deciduous	2140	<i>Shorea robusta</i> , <i>Acacia catechu</i> , <i>Anogeissus latifolia</i> , <i>Boswellia serrata</i> , <i>Laneacoromandelica</i> , <i>Aegle marmelos</i> , <i>Malletous philipinensis</i>
Tropical Thorn	43	<i>Prosopis spicigera</i> , <i>Salvadora spp.</i> , <i>Acacia spp.</i> , <i>Azadirachta indica</i> etc.
Sub-Tropical pine	3853	<i>Pinus roxburghii</i> , <i>Cedrus deodara</i> , <i>Pinus wallichiana</i> , <i>Quercus incana</i> , <i>Lyonia ovalifolia</i> , <i>Pyrus pashia</i> , <i>Crataegus cremulata</i> , <i>Rhododendron arboreum</i>
Sub-Tropical Dry Evergreen	470	<i>Olea cuspidata</i> , <i>Pinus roxburghii</i>
Himalayan Moist Temperate	4064	<i>Quercus incana</i> , <i>Cedrus deodara</i> , <i>Pinus wallichiana</i> , <i>Pinus roxburghii</i> , <i>Rhododendron arboretum</i> , <i>Lyonia ovalifolia</i> , <i>Litsia umbrosa</i> , <i>Quercus dilatata</i> , <i>Q.</i> <i>semicarpifolia</i> , <i>Picea smithiana</i> , <i>Abies pindrow</i>
Sub-Alpine and Alpine	2512	<i>Abies spectabilis</i> , <i>Pinus wallichiana</i> , <i>Picea smithiana</i> , <i>Rhododendron campanulatum</i> , <i>taxus baccata</i>

Source: SoER, 2011

Table 27: Species wise area, growing stock and yield of important species (2006)

Name of species	Forest Area (Km ²)	Growing stock (in thousand cubic meters)	Prescribed Annual Yield (in hundred cubic meters)
Deodar	890	16517	1736
Kail	698	13365	1320
Chil	1346	12481	981
Fir & Spruce	1029	39364	2430
Sal	190	4852	280
Ban oak	596	5949	156
Mohru oak	32	201	Not provided
Kharsu	118	1717	21
Maple	Not available	298	12
Walnut	Not available	126	2
Bird-cherry	Not available	15	Not provided
B.L. species	533	5217	30
Total	5432	100102	6968

Source: Forest statistics, 2010

Table 28: District-wise forest cover in Himachal Pradesh (area in Km²)

District	Geographic area	Very Dense Forest	Moderately Dense Forest	Open Forest	Total	% of geographical area	Change with respect to FSI 2009 Assessment	Scrub
Bilaspur	1167	24	171	167	362	31.02	0	0
Chamba	6522	853	773	811	2437	37.37	1	38
Hamirpur	1118	39	91	114	244	21.82	-1	0
Kangra	5739	310	1221	533	2064	35.96	2	11
Kinnaur	6401	82	262	256	600	9.37	-2	70
Kullu	5503	586	785	588	1959	35.06	1	23
Lahaul & Spiti	13841	15	32	147	194	1.40	1	31
Mandi	3950	373	735	567	1675	42.41	2	29
Shimla	5131	739	1037	610	2386	46.50	2	32
Sirmaur	2825	130	568	687	1385	49.03	2	56
Solan	1936	55	404	391	850	43.90	1	38
Una	1540	18	302	203	523	33.96	2	0
Total	55673	3224	6381	5074	14679	26.37	11	328

Source: FSI, 2011 Assessment

Table 29: Forest Cover Change Matrix (area in Ha)

2009 Assessment	2011 Assessment					Total 2009
	VDF	MDF	OF	Scrub	NF	
VDF	322400	0	0	0	0	322400
MDF	0	637700	200	0	400	638300
OF	0	400	505100	100	500	506100
Scrub	0	0	0	32700	0	32700
Non-forest	0	0	2100	0	4065700	4067800
Total 2011	322400	638100	507400	32800	4066600	5567300
Net Change	0	-200	1300	100	-1200	

Source: SFR (2011)

Annex 6: Statistical Assessment of Data availability

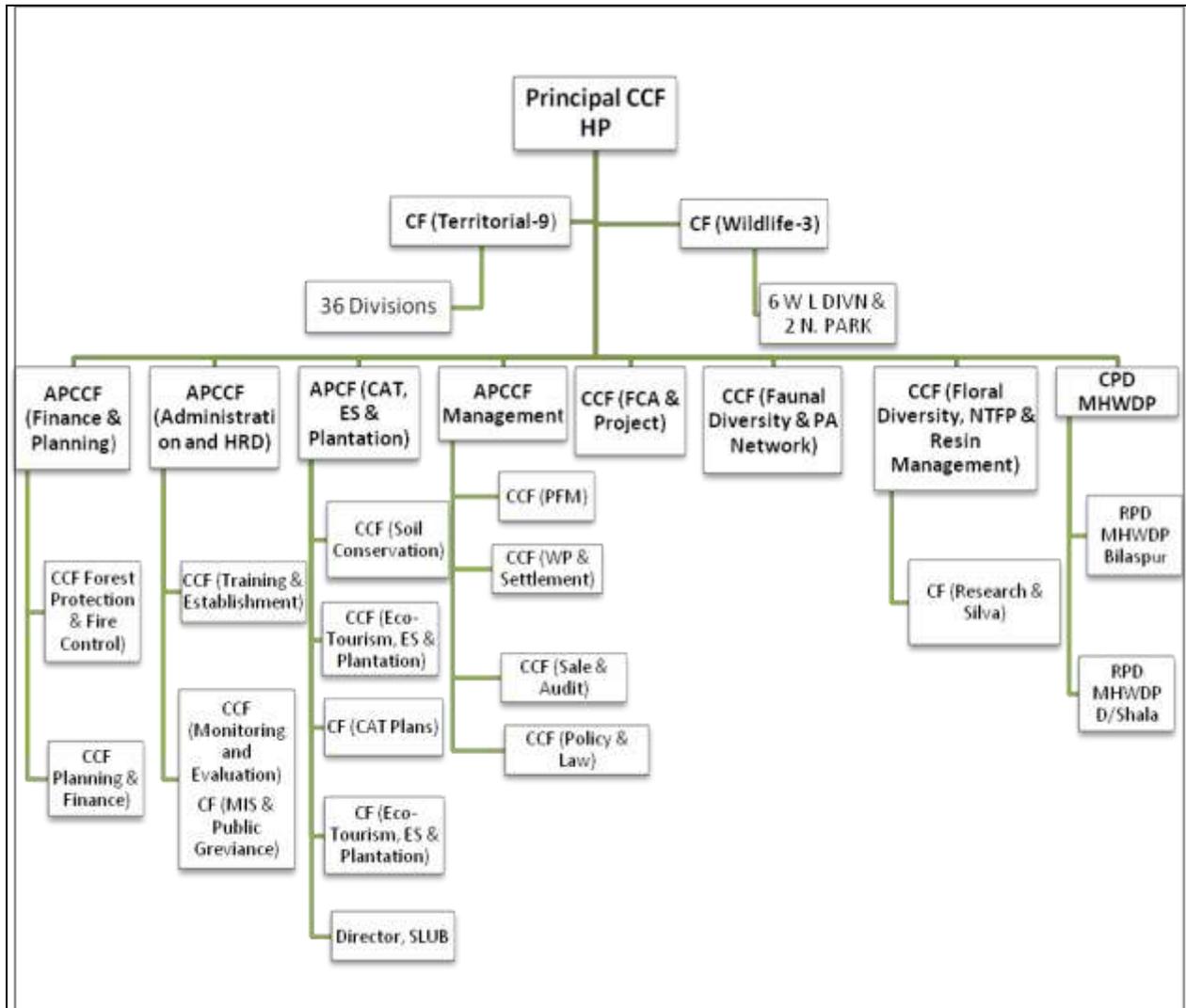
Resource account	Data required	Physical unit	Source	Monetary Values	Source	Remark
		Volume in cubic meters		Rupees		
1. Supply Use	Timber/fuelwood	--	HPFD/ DoES			
	NTFP	--	HPFD	--	HPSFD	Including medicinal plants
	Services			--	DoES, H.P.	Includes PFES
	Industrial use			--	HPFD/ DoES, H.P.	Input Output tables
	Imports/exports	-		--	DoES, H.P.	
	Output			--	DoES, H.P.	
2. Timber resource		Area in Hectares, Volume in cubic meters		Rupees		
	Opening stock	--	HPFD/ FSI	--		
	Logging/harvest+ illegal logging	--	HPFD	--		
	Logging damage					Data not available
	Forest fires	--	HPFD	--		
	Stand mortality					Data not available
	Shifting cultivation	--	HPFD			

	Animal grazing	--	HPFD	--		
	Forest encroachments	--	HPFD			
	Transfer of land to other activities	--	HPFD			
	Natural growth	--	HPFD			
	Regeneration	--	HPFD			
	Afforestation	--	HPFD			
	Closing stock	--	HPFD/ FSI	--		
3. Forest carbon account		Volume in tonnes				Monetary valuation of carbon is done using prevailing prices in carbon markets
	Opening stock	--	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	--	FSI/ HPFD			
	Decrease in carbon	--	FSI/HPFD			
	Closing stock	--	FSI/HPFD			
1. Biodiversity account		Number of species				
	Opening population	--	State Biodiversity Authority/			Adequate data not available

			HPFD		
	Closing population	--	State Biodiversity Authority/HPFD		Adequate data not available
	Net change	--	State Biodiversity Authority/HPFD		Adequate data not available
	Reference population	--	State Biodiversity Authority/HPFD		Adequate data not available
	Opening population as proportion of reference population	--			Adequate data not available
	Closing population as proportion of reference population	--			Adequate data not available

Annex 7: Organizational structure and powers conferred to the officials

Figure 2. Organogram of Himachal Pradesh State Forest Department



Source: Himachal Pradesh State Forest Department

Note: CCF- Chief Conservator of Forest, APCCF- Additional Principal CCF, CF- Conservator of Forests, CPD- Continuous Professional Development

Principal Chief Conservator of Forest (PCCF): At the top most level of Forest Department of the state 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.

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

b. **Conservator of Forests (Planning & Finance) Shimla-**CF is the responsible for budget monitoring at head Quarter Level. Developing data base on Forest Development Agency (FDA's), monitoring expenditure and progress of FDA's.

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

b. **Chief Conservator of Forests (Training and Establishment) Shimla-** The CCF handles mainly the establishment work including court matters and the Registrar (Establishment & Vigilance) works through him. He is also responsible for training and training database of work force.

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

3. **Addl. Pr.CCF (CAT & Plantations) Shimla:** is responsible for all Catchment Area Treatment Plans (CAT) matter regarding outsourcing and formulation, compensatory afforestation, Net Present Value (NPV), state Compensatory Afforestation Fund

- Management and Planning Authority, CAMPA), payments for environmental services matters, 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-*** The CCF is mainly accountable for soil and water conservation matters, land resource management, watershed management, soil work plans, GIS and remote sensing Cell incharge.
 - b. ***Chief Conservator of Forests (Ecotourism & Plantations) Shimla-*** is the Chief Executive Officer (CEO) of Eco-tourism and ex-officio Member Secretary EcoSoc. He is responsible for Eco Tourism Development and management, eco-tourism policies, public-private partnership, issues related to Environmental Impact Assessment (EIA) and Environment Statement (ES).
 - c. ***Conservator of Forests (CAT Plans) Shimla-*** 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 (Eco-tourism & plantations) Shimla-*** The CF is accountable for Eco Tourism Development & Management, co-ordination with HP Tourism Development Corporation (HPTDC), Director Tourism.
4. ***Addl. Pr.CCF (Management) Shimla:*** is responsible for bio-fuels species propagation, Timber Distribution System (TDS), 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-*** is mainly handles grazing and related matters, Grazing Advisory Review Committee, development and monitoring of OFM processes.
 - b. ***Chief Conservator of Forests (WP & Settlement) Mandi-*** is in charge for Preparation and Monitoring of Working Plan implementation, scrutiny and approval

of felling programmes, settlement and demarcation, entries in revenue records and custody and database of survey maps in HPFD.

- c. ***Chief Conservator of Forests (Sale & Audit) Shimla-*** handles all HP State Forest Corporation matter—pricing committee issues etc. He looks after all sale and industry matters, forest based industries- policy and law related to it, saw mills and fuel wood supply to Tribal Areas.
 - d. ***Conservator of Forests (Policy & Law) Shimla-*** mainly manages national and state forest policies, Resin and Timber Trade Acts & 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 &Projects) Shimla:*** is the Nodal officer for forest clearance cases, FCA 1980. He handles road and hydel projects (whether on forest land, or any other govt. land or on 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 & Protected Area Network) Shimla:*** is conferred with the power to formulation, monitor and evaluate of all wildlife areas and CSS.
7. ***Chief Conservator of Forests (Floral Diversity, NTFP & Res. Mgmt), Sundernagar:*** is responsible for conservation and propagation NTFP on governmental and private lands, NTFP and all related matters, National and State Medicinal Plant Boards, fund raising for NTFP projects and schemes. He also monitors NTFP schemes and programmes, Bamboo Mission, disease epidemics and quarantine, invasive alien plant species and their management, etc.

The forest officers mentioned above may also have some additional duties as per their respective positions. Only the duties of the officers considering their contributions towards building the forest accounts has been mentioned above.

Annex 8: List of government Officials and agencies interacted for preparing 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, H.P.
Aryabhata 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	Po Box 357, Nehru Nagar, Bhopal MP , 462003, India
Forest Research Institute	P.O. New Forest- Dehradun (India)

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