Valuation of Forest Ecosystem Services in Uttarakhand Himalayas

Report Submitted
to
Lead India
by

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In response to
TOR for Economist

[TOR: Based on the secondary information and that will be collected by other groups some reasonable monetary value would be ascribed to the identified forest ecosystem services; sound justification for putting such values will have to be provided clearly mentioning that how the present approach is evolved over the earlier approaches; suggest mechanisms that facilitate developing PES for identified forest ecosystem services benefiting local communities and other key stakeholders; identify knowledge gaps that are necessary to be filled for realistic valuation].

Note : The Report is an outcome of (i) the work of the author for the Central Statistical Organization for the Research Project on 'Natural Resource Accounting of Land and Forest Resources (excluding Mining) for the state of Madhya Pradesh and Himachal Pradesh',2006; (ii) Annex 7 'Economic valuation of Forests of Himachal Pradesh' in Himachal Pradesh Forestry Sector Review Report, IIED, 2000 authored by her ;(iii) her inputs as lead author based on the CSO project work to the National Forest Commission Report for chapter 19 on 'Forest in National Resource Accounting', 2006; and the chapter itself and her report titled 'Estimating Economic Value of Forest Land: A Methodology[1]*' to the Institute of Economic Growth, Delhi for MOEF sponsored Project on Estimating Economic Value of Forests, 2006, findings and data of which have been used in the Expert Group Report, 2006 to suggest suitable NPV for forests constituted by the Hon'ble Supreme Court of India in 2005 (iii) Developing incentive based mechanisms for watershed protection services and improved livelihoods' to conduct the Livelihoods Baseline and Impact Studies implemented by Winrock International India besides the data colleted from various sources and independent studies and literature supplied by Lead India, New Delhi and CHEA, Nainital, Uttarakhand.*
The author duly acknowledges the support extended by various agencies in executing her work.

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[1] The study responded to the following terms of reference (i) To identify the definite parameters on the basis of which categories of values of forest should be estimated; (ii) To formulate a practical approach/ methodology to different forest zones of India; (iii) To illustratively apply this methodology; (iv)To determine on the basis of established principle who should pay the cost with respect to which category of values and to whom

Acknowledgement

This report is prepared under contract for the Economist from Lead India New Delhi on short term project on 'Valuation of Forest Ecosystem Services in Uttarakhand Himalaya'. However, the views expressed, and any errors are entirely those of the author & do not necessarily conform to policy viewpoints by the contacted individuals and institutions.

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I. Introduction

1.1 Importance of Forest as Natural Capital

Forests play a vital role in social, cultural, historical, economic and industrial development of any country and in maintaining its ecological balance. They are the resource base for sustenance of its population and repository of biodiversity. Forests are one of the most important components of the terrestrial environmental system and a complete resource base. They form an ecological system consisting of tree dominated vegetative cover. Forest are natural resources and considered as the wealth of nations or a complete resource base. Forests, however, provide in many ways to the global system and play a multi dimensional role. Forests not only provide various goods like timber, fuel wood, pulpwood, fodder and fiber grass and non-wood forest produce & support industrial & commercial activities improve but also produce humus and maintain soil quality, maintain the moisture regime, the ecological balance & life-support systems essential for food production, health, produce clean air and support all round development of human kind. Forests exercise control over the wealth of adjoining land use systems such as agriculture and animal husbandry and also the wealth of urban areas. Degraded forests result into impoverished agriculture, horticulture, and in turn trigger migration of dependent communities to urban areas where they end up in low paid, unsecured informal sector jobs. Lack of availability of fodder in such degraded forests also reduces productivity of livestock population and forces their trans-boundary movement (Verma, 2000)[4].

Tropical forests are the repository of more than half of the world's plant & animal species and are the major source of available biodiversity. The global concern about forest degradation and depletion therefore, relates to the twin problems of destruction of the carbon sinks affecting the global climate & extinction of species affecting bio-diversity. The rural poor in the third World have been blamed for deforestation in the past, but there has been an increasing realization that it is mainly the production centered forest policies and exclusive demand for non forestry developmental activities have accelerated deforestation.(Verma, 2000)[5].Such a centered approach fails to recognize the dynamics of rural survival and their relationship with the forests in terms of fuel wood for cooking, fodder for animals & productivity of their land on account of water regulation and soil conservation/functions. It also fails to realize the pressure of commercial interests in degradation and deforestation. Industries like Timber, Paper; Packing etc. are intensive users of wood & forest produce. Further, economic growth and urbanization do not reduce dependence on forests. As a country progresses, demand for wood for construction, furniture etc. also increases. Thus more timber-oriented approach towards extortion of forest has diminished availability of biomass which in turn has affected the quality of life of the rural people in India (Gadgil, 1991). It is the poor people whose survival is at stake on account of decreasing biodiversity of plant & animal matter which

4 Verma, Madhu. 2000. Himachal Pradesh Forestry Sector review report annexes- Economic valuation of forests of Himachal Pradesh. International Institute of Environment and Development et al.
5 Ibid

otherwise made available to them from forests. Further such progress also brings with itself demand for more land for various developmental activities like construction of road, school, hospitals, houses, setting up of power plants, lying down telecommunication networks etc. Many a time's forest land is targeted for such demands.

More so the value charged for converting forest land for non forestry purposes used to consider only the marketed values like timber and non timber. The whole arrays of ecological services in terms of positive externalities which get lost on account of conversion were never considered. "Either actions leaves externalities - economic impacts occurring when those taking the decision to fell or change land use do not bear all the costs of their action. When a piece of forest land is ploughed, for example, the conversion makes sense to the land owner, but also damages fisheries downstream, increases flooding and chokes rivers and dams with sediment, so creating costs for others. Moreover such actions actually reduce, and not add to a country's total wealth.

The loss of a forest is fundamentally economic in nature. So, it is that its conservation needs to be addressed in economic terms. For forests to be conserved, they need to be perceived as being more valuable than the usual, standard, utilities they provide" (DTE, 2005)[6].

1.2 Claims of the states for protecting large geographical areas under forests and providing Ecosystem Services to Downstream Users

The same study further reports "a piquant contradiction where forest-rich states in India are beginning to grumble about the natural wealth they possess, and are protecting. In his speech to the 12th Finance Commission (FC), Virbhadra Singh, Chief Minister of Himachal Pradesh – a state whose forest cover keeps alive the major rivers that flow into the Gangetic Plains – claimed the state had lost revenue of over Rs. 900 crore in the last five years; he urged the Centre to “practice what it demands in international forums, and evolve a suitable mechanism to compensate the state for providing public good”. For some time now, forest dependent states have begun to demand compensation for conservation; to pull- these states say – their economies out of the woods. “States like Madhya Pradesh (MP) must be compensated at least in proportion to the forest cover that it has protected, which is far more than the national average: said Digvijay Singh, ex-chief minister, at a National Development Council meeting in 2002.

The Memorandum submitted by the Government of Uttaranchal to the 12th Finance Commission in September 2003 put forward the case for special consideration of Uttaranchal's forest resources based on concepts and perspectives widely accepted in contemporary economics. It mentioned that the forests have a value to a far wider set of beneficiaries than residents of the state as they accrue to both national and global stakeholders. It highlighted the study conducted for the state of Himachal Pradesh by

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[6] Too Cut and Dried, Down To Earth, 2005. Estimates based on the per hectare total economic value estimated by Verma, 2000

Verma (2000)7 which indicated that 'the benefits accruing to these categories accounts for a relatively large share of total benefits. In particular, the benefits accruing outside the state from the watershed conservation role of forests appear to be the single largest benefit from forest in the region. This argument justified the consideration for financial accommodation of the state's forests from national resources, which will provide economic reinforcement to the regulatory requirements for forest management and conservation'.

Bearing in mind the difficulties involved in such valuations, the request of Uttaranchal government for such considerations was not entirely based on the empirical results. It also emerged from an assessment of the direct and indirect costs that the state incurred every year in protecting their forest which are both national and global resource. It argued that at least with reference the financial costs incurred in maintaining the forest resources to the standard demanded by the regulatory agencies, the state felt justified in asking for special consideration of its forest resources and constraints, which their perspective imposes on the state with respect to designing its own development strategy. The memorandum further stated that the conservation of forests of Uttaranchal and the consequent restrictions on the development strategy are going to be a permanent phenomenon. Given this the Finance Commission may consider the benefits flowing to the broader community beyond the state's boundaries as a basis for introducing forest cover as a parameter, wit am appropriate weight, in its devolution formula. It emphasized this mechanism as a logical way to treat permanent features of individual state's economic structures. However in the absence of such an amendment of the formula the finance commission was requested to give due weightage to the fact that Uttaranchal's forests are very significant national resource thus transfers from the centre to the state should take this positive externality into account.

The question was raised again in November 2004, when the Planning Commission held consultations with state governments as part of its mid-term appraisal of the Tenth Five - Year Plan. In Madhya Pradesh, near protected areas, people lose Rs. 628 crore annually to crop damage. Of this, Rs. 94 crore is direct loss, while Rs. 534 crore is what they spend on labour and materials. An estimated Rs. 290 crore is what people lose due to lack of access to non-timber forest produce. Thus forest needs to be treated as any other capital specially the financial capital which provides stream of direst and indirect benefits on account of its existence. The principle amount of financial capital becomes forest stock in case of forest capital and interest becomes flow values from forests.

Himachal Pradesh and Uttaranchal, following footsteps of M.P have now begun asking for payments for the benefits their forests provide – freshwater for drinking or irrigation, controlling silt, watershed protection, checking glacier melt – to downstream states. Uttaranchal has even calculated the value of added carbon content due to the recent net increase in its forest cover – a global benefit – as ranging from Rs. 66 crore to Rs. 86 crore.

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[7] Verma, Madhu. 2000. Himachal Pradesh Forestry Sector review report annexes- Economic valuation of forests of Himachal Pradesh. International Institute of Environment and Development et al.

In India forest valuation is in nascent stage but those that have done such valuation have realized its immense utility. The study conducted by the author in 2000 for the state of Himachal Pradesh forests estimated that actual forest benefits are 2.61 times the value of the growing stock, 980 times the total expenditure incurred by the state's forestry sector and 2,607 times the revenue relised by the forests annually. Armed with this knowledge, in August 2002 – before the Supreme Court began to considering the need to levy a price on forests lost of development projects – HP began to charge an environmental value tax, levied on each hectare of forestland diverted for private and industrial purposes, at the rate of Rs. 5 lakh to Rs. 8 lakh per ha. The state is now demanding compensation from the Centre for being an important carbon sink. Its forest sector is undergoing a sea change; HP's new Forest policy, 2007 now speaks of developing ways to provide incentives to local communities that protect forests.

Eventually as a result of this argument the Uttaranchal state has also been sanctioned Rs. 35 crores over a period of five years (Rs. 7 Crores each year)by the 12th Finance Commission towards compensation for keeping large area under forest. But this may be miniscule in relation to the whopping value of ecosystem services provided by its forest. Though the beginning has been made based on broader estimates but more precise and tested methodology to estimate value of various ecosystem services would further help the authorities in making their case sound for the purpose of compensation from the Finance commission.

Following the Net Present Value and any other money recoverable in pursuance of the Hon'ble Supreme Court's order in this regard and in compliance of the conditions stipulated by the Central Government while according approval under Forest (Conservation) Act, 1980 (69 of 1980) for non-forestry uses of the forest land., the Central Government has constituted an authority to be known as Compensatory Afforestation Fund Management and Planning Authority (CAMPA) with effect from 23rd April, 2004 for the purpose of management of money towards compensatory afforestation. The CAMPA shall be custodian of the Compensatory Afforestation Fund and shall have the following functions and powers relating to the Fund, namely:

(i) Receipt of all monies from user agencies towards Compensatory Afforestation, Additional Compensatory Afforestation, Catchment Area Treatment Plan or for compliance of any other condition (s) stipu1ated by the Central Government while according approval under the Forest (Conservation) Act, 1980.

(ii) The unspent funds already realized by the States/Union Territories shall be transferred to the CAMPA by the respective States/Union Territories or user agencies within six months from the date of the issue of this Order and any Compensatory Afforestation Funds which have not yet been realized shall be realized by the States and Union Territories and transferred to the CAMPA.

(iii) The funds recoverable from the user agencies in cases where forest land diverted falls within the protected areas i.e. areas notified under Sections 18, 26-A or 35 of the Wildlife protection) Act, 1972 (53 of 1972) for undertaking activities related to protection of biodiversity and the Wildlife shall be maintained separately.

(iv) Net Present Value (NPV) of the forest land diverted for non-forestry purposes which may be realized pursuant to the Hon'ble Supreme Court's order dated 30-10-2002 in I.A. No. 566 in Writ Petition (C) No. 202 of 1995.

(v) Money receivable in pursuance of the orders of the Hon'ble Supreme Court or the Central Government or any other competent authority authorized in this regard by the Central Government.

The latest direction with regard to NPV is the Report of the Expert Committee following the Hon'ble Supreme Court's order for WP 202/1995 (2005.09.26)8.

1.3 Policy Reforms to Incorporate Economic Valuation Approach

The Forest Policy Review in 2007 has been conducted in many states of te country including Uttarakhand and the new Forest Poicy is out. It has been recognized that states forests and the people dependent on them, are experiencing new types of change, at ever-increasing rates. Thus the policy and institutional framework have to change to the same degree, with the result that systems designed to ensure that all needs for forest goods and services are met, are now inadequate. The policies and strategies of the Forest Departments and other key institutions, should be such that they meet the needs of key forest stakeholders and ensure sustainable management of forest resources, integrating forest sector planning with socio-economic development. The multiple forest values relating to multiple forest stakeholders and economic valuation of forest resources should be done such that true contribution of the sector could be understood and appreciated by all. The Uttarakhand state which is keeping 64.81% of its geographical area as forest area with tree cover on 46.81% of its geographical area can make a case of increasing allocation to the forestry sector so that more money could be spent on protection and regeneration.

1.4 Terms of Reference of the Current Study

(i) Based on the secondary information that will be collected by other groups some reasonable monetary value would be ascribed to the identified forest ecosystem services.

(ii) Sound justification for putting such values will have to be provided clearly mentioning that how the present approach is evolved over the earlier approaches.

(iii) Suggest mechanisms that facilitate developing PES for identified forest ecosystem services benefiting local communities and other key stakeholders.

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8 T.N. Godavarman Thirumulpad Versus Union of India, WP 202/1995 (2005.09.26) (Valuation of forests). Source : SC_Order\SCI-(Valuation of forests).htm , Environmental law Woldwide

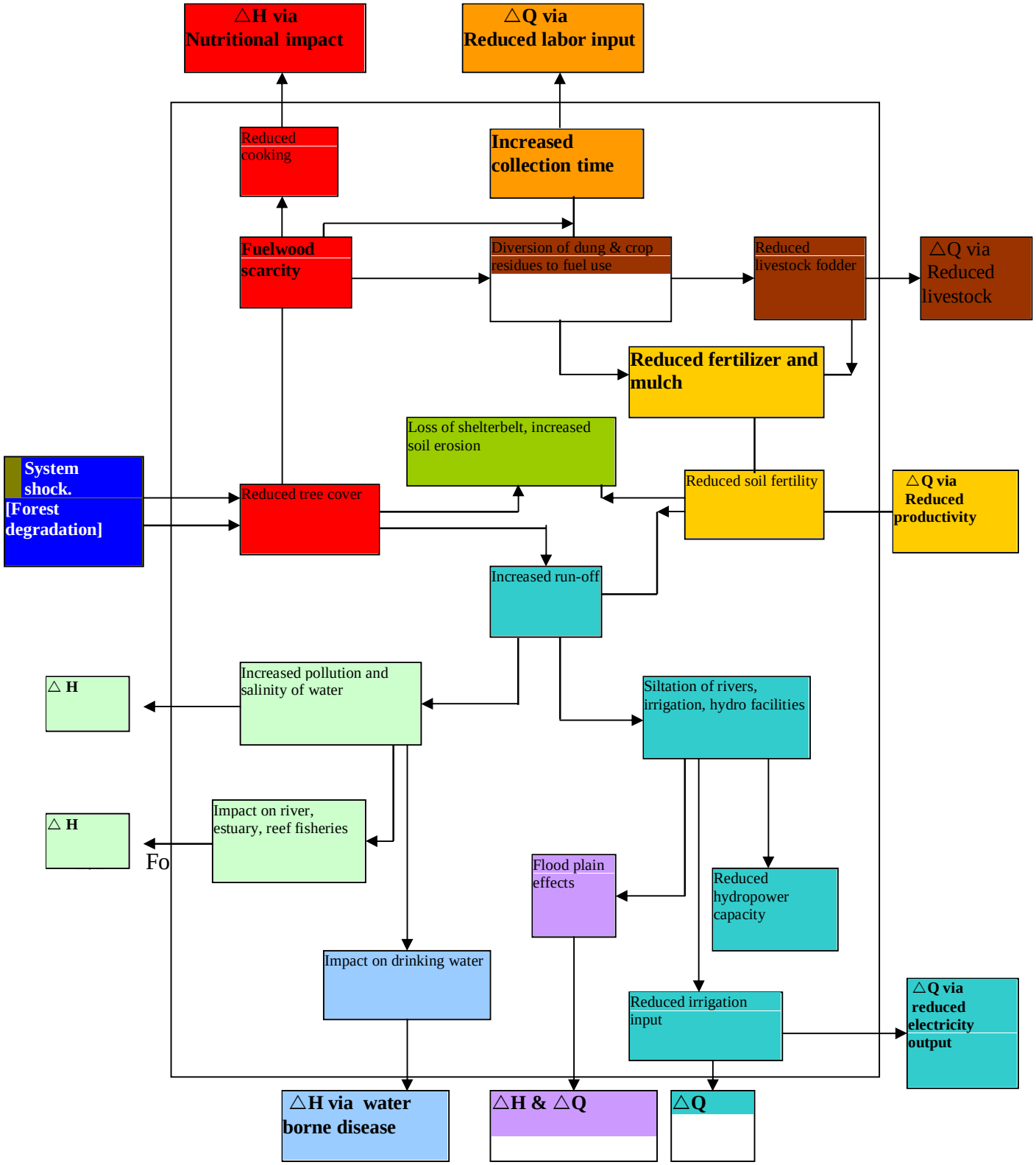
(iv) Identify knowledge gaps that are necessary to be filled for realistic valuation

II. Response to first and second TOR : Monetary value to the identified forest ecosystem services alongwith sound justification for putting such values

2.1 Forestry Linkages

Forests and Wildlife are part of national wealth or stock, however, unlike many other goods and services these resources may not have a ready market. The use, overuse, misuse or abuse of such natural resources is a flow towards the welfare of society. Since their use adds to the welfare and abuse reduces it, their valuation and accounting on the lines of capital formation is necessary to understand the state of welfare of the nation. Forests have very high resource inter connection & the dynamics of an economic system is heavily dependent existence or non-existence of forests. Such resource inter-connections in the form of initial system shock due to forest degradation & its impact there of are shown in Figure.1.The diagram also depicts that forests have high co-efficient of forward linkages which may be negative in case of degradation of forest and positive in case of their protection.

Figure: 1 Resource Inter-connections[9]



△H = Change in Health ; △Q = Change in Quantity

3. David W.Pearce.1997. Economics of Natural Resources and Environment

2.2 Forest Wealth of Uttaranchal

2.2.1General Profile of the State

The entire State forms part of the Central Himalayas. and is interpersed with rivers, deep valleys, glaciers, alpine meadows and high peaks .The State presents a very pristine, pure and picturesque environs. It is no wonder that it is also considered to be the abode of Gods. With altitude ranging from 300 to 3,500 metres, the State of Uttaranchal has three distinct physiographic regions, the Himalayas, the Shivaliks and the plains. It is endowed with diverse vegetation types, which ranges from tropical deciduous to alpine forests, grasslands, high altitude glaciers and a vast stretch of rivers10, rivulets and wetlands.

The State is spread over 53,483 sq. Km of land, which is 1.67 percent of the country's total area. The State has a total population of 8.49 million as per the 2001 Census among which 4.33 million are males and 4.16 million are females. The total number of inhabitated village is 15761 including forest villages. The decadal growth rate of population in the decade 1991-2001 has been 19.20% {All India - 21.34}, down from 24.23% during the previous decade. This in itself is a major achievement but the aim is to bring down this growth rate to replacement levels by 2010. The density of population in Uttaranchal is 159 persons per sq. Km {All India - 324}. However, the spread of population is fairly uneven. For instance the districts of Haridwar and Dehradun together account for roughly 32% of the State's population whereas district Champawat accounts for only 2.65%. As per latest land-use statistics, the total reported area is 55.66 lakh hectares. The land use pattern is depicted in the table 1.

Table 1 : Land use pattern in Uttaranchal (1999-2000)

Sr. no.	Category	Area in Hectares	% Area Report
1	Total reported area	5565804	100
2	Forest	3466152	62.28
3	Barren & Unculturable land	294936	5.30
4	Land put under non-agricultural uses	166768	3.00
5	Culturable Waste	322510	5.79
6	Permanent pastures and other grazing land	222958	4.01
7	Land under misc. tree crops and groves etc.	216260	3.89
8	Current Fallows	13743	0.25
9	Other fallows	69236	1.24
10	Net area sown	793241	14.25

Source : www.uttara.nic.in

10 The state is referred as the water tower for whole of North India, as many perennial (snow fed) rivers originate from the hills in the state (UEPPCB 2004).

The net sown area is only about 14% of the total reported area. The cropping intensity is about 160%, and the ratio of gross irrigated area to gross sown area is only 24.6%.In the hills the major crops grown include Madua, Ramdana and Potato whereas in the Plains the major crops are cereals, pulses and sugarcane.

2.2.2 Forest Area

The Uttarakhand state has 64.79% of its total geographical area declared as forest area with forest against all India percentage of 23.57% and tree cover on 46.81% of its total geographical area as against all India percentage of 20.64%. Of the total forest area of the state only 45.65% forest area is legally under forest department. The per capita forest area of Uttarkhand is 0.41 hectare. The details are depicted in the following table.

Table 2. Uttarkhand Forest Area at a Glance

S.No.	Details	Area (sq.km)
1	Geographical area of Uttranchal	53483
2	Population	8489349
3	Total forest area	34662
4	Per capita forest area (Ha.)	0.41
5.	Per capita forest and Tree cover (Ha.)	0.30
5	Total forest area as percentage of Geographical area	64.79
6	Total forest area under forest department according to legal status	24413.185
7	Forest area legally under forest department as percentage of geographical area	45.65
8	Total forest area under the management of forest department	24273.532
9	Forest area managed by forest department as percentage of Geographical area	45.38
10.	Area under Forest Cover	45.74
11.	Area under Forest and Tree cover	46.81

Source : Uttaranchal Forest Statistics, Forest Department, Uttranchal 2005-06

2.2.3 Forest Cover

Of the total forest cover of the state 16% area has very dense, 58.94% has moderately dense and 24.70%open forest. Only 45.74% (24,465 sq. kms) of state geographic area has forest cover when the tree cover is added it stands at 46.81% (25036 sq.kms) as area with forest and tree cover. The forest cover is 3.62% of country's forest cover and 3.22% of countryy's forest and tree cover. Further the state has an unique distinction of management of forest by Van panchayats covering 2% of reserved forest, 50.20% of protected forests as depicted in table 2.

Table 3: Classification of Forest Area According To Legal Status

S.No.	Details	Area (sq.km)
RESERVED FORESTS (AS DECLARED UNDER IFA 1927, SECTION 20)		
1	Reserved forest under the Control/Management of Forest department	24261.558
2	Reservedllllll Forests under the Control / Management of Forest Panchayats Reserved forest recorded in Sl.No. (i) but for management is under the control of Van Panchayats. Reserved forest which is completely recorded in Van Panchayats	 139.653 348.138
3	Reserved forest under the control / management of other govt. agencies	27.625
	Total Reserved forest	24637.321
PROTECTED FORESTS (AS DECLARED UNDER IFA 1927, SECTION 29		
1	Protected forests under the control and management of forest department	98.614
2	Unclassed and vested forests under the control / management of forest department, which have legal status of protected forest	53.013
3.	(a) Civil and Soyam forests under the control of revenue department (b) Under the control of forest panchayats as village	4768.703 4961.851
	Total protected forest	9882.181
	Private forests (Municipal and cantonment etc.)	131.063
	GRAND TOTAL	34650.565

Source : Uttaranchal Forest Statistics, Forest Department, Uttranchal 2005-06

Eight out of the 16 forest types existing in India (based on Champion and Seth, 1968) can be found in the State. These are the Moist Alpine scrub, Sub-alpine forests, Himalayan Dry temperate forests, Himalayan Moist temperate forests, Sub-tropical pine forests, Tropical dry deciduous forests, Littoral and Swamp Forests and Tropical moist deciduous forests. Chir pine is the most popular species in the region followed by Sal and Oak species. Smal area is under teak forest.

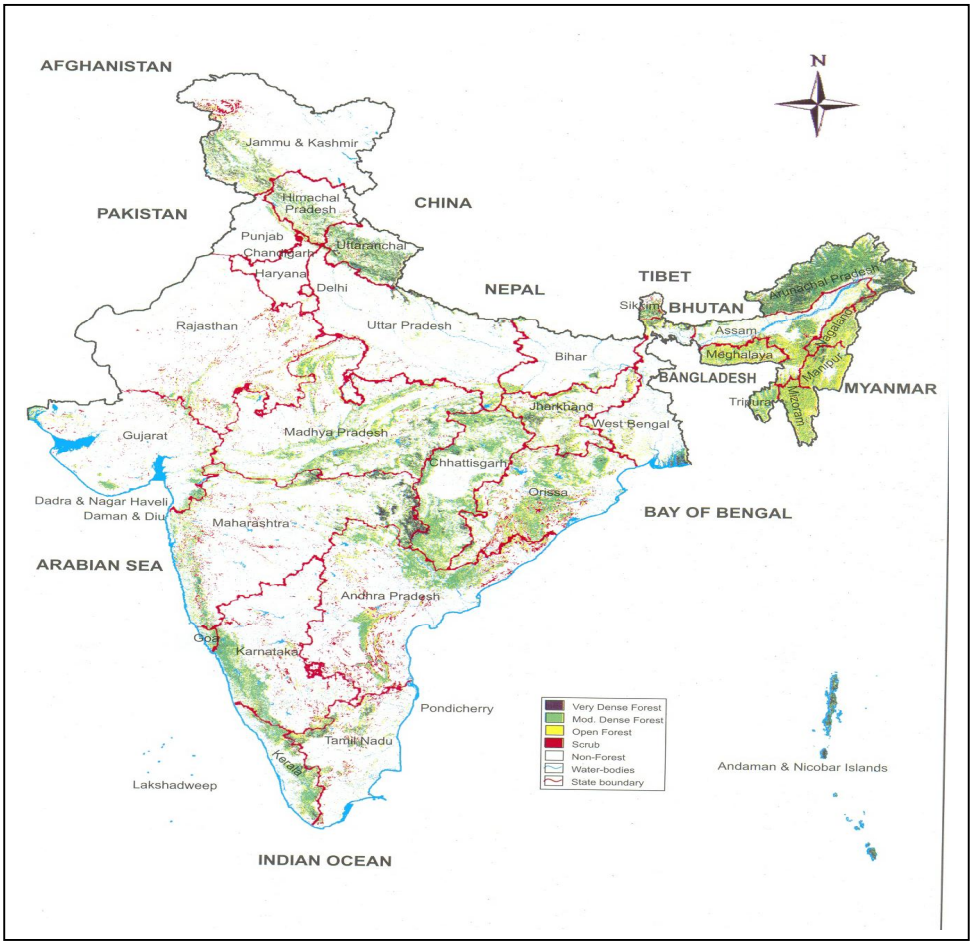
Table 4 : Species Wise Classification of Forest Area Under Forest Department (According To Legal Status)

S.No.	Details	Area (Ha.)	Percentage
1	Sal	315112.91	12.91
2	Teak	20092.76	0.82
3	Chir Pine	399329.89	16.36
4	Oak	300072.20	12.29

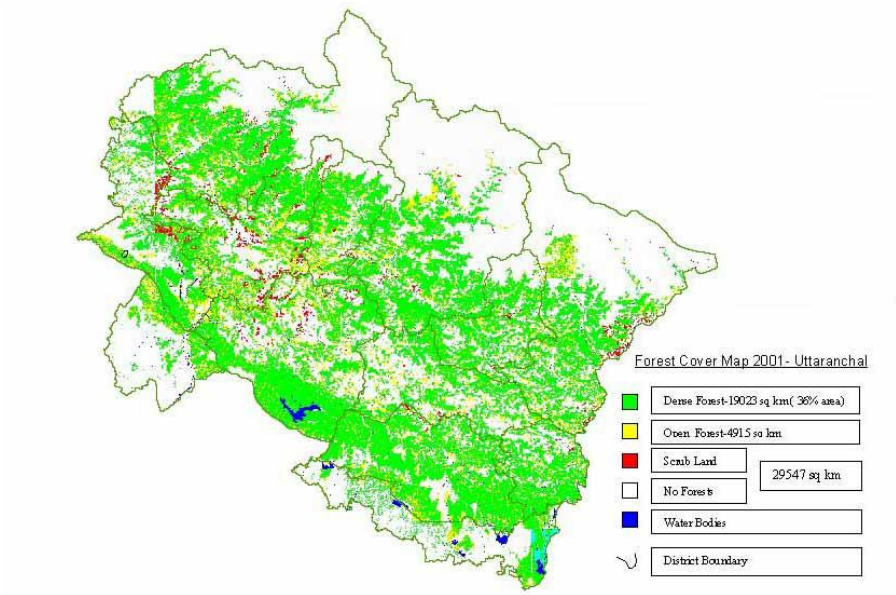
Source : Uttaranchal Forest Statistics, Forest Department, Uttranchal 2005-06

The following map of the India gives a overview of location of forest of the country.

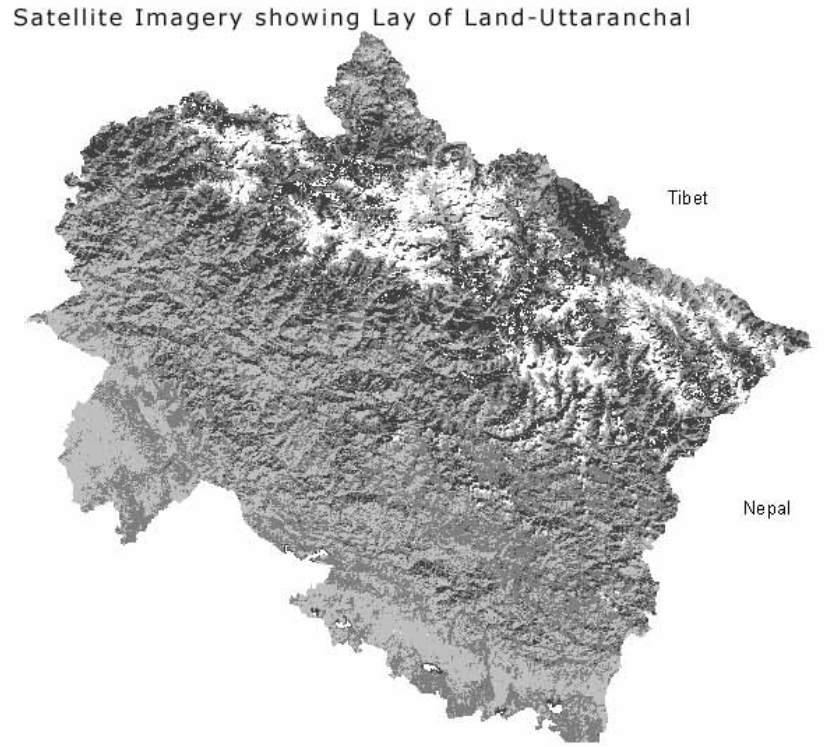
Map 1 : Forest Spread in India[11]



11 State of Forest Report, 2003, Dehradun, Forest Survey of India



Map 2: Forest Cover in Uttaranchal 2001
(Source : www.uttarakhandforest.org)



Map 3: Land Layout in Uttaranchal 2001
(Source : www.uttarakhandforest.org)

2.2.4 Forest Management

Forests of Uttarakhand are mainly managed by the forest department (70.05%), revenue department(13.76%). and the forest panchayats (15.72%). A very small area (0.47%) is managed by the private and other agencies like municipal, cantonment, central govt. etc (Table 5). Similarly comparing circle wise forest management, Garhwal zone has nearly 53% area under its command as against 24.81% in Kumaun zone and remaining under wildlife conservation (Table 6).The forest of the State supports a wide range of biodiversity. Two major 'hotspots' of significance to biodiversity viz. the Kumaon-Garhwal Himalaya and the Shivaliks lie in the State. The region has six national parks, six wildlife sanctuaries, one biosphere reserve, one UNESCO World Heritage Site and two elephant ranges.

Table 5 : Classification Of Forest Area According to Management / Control

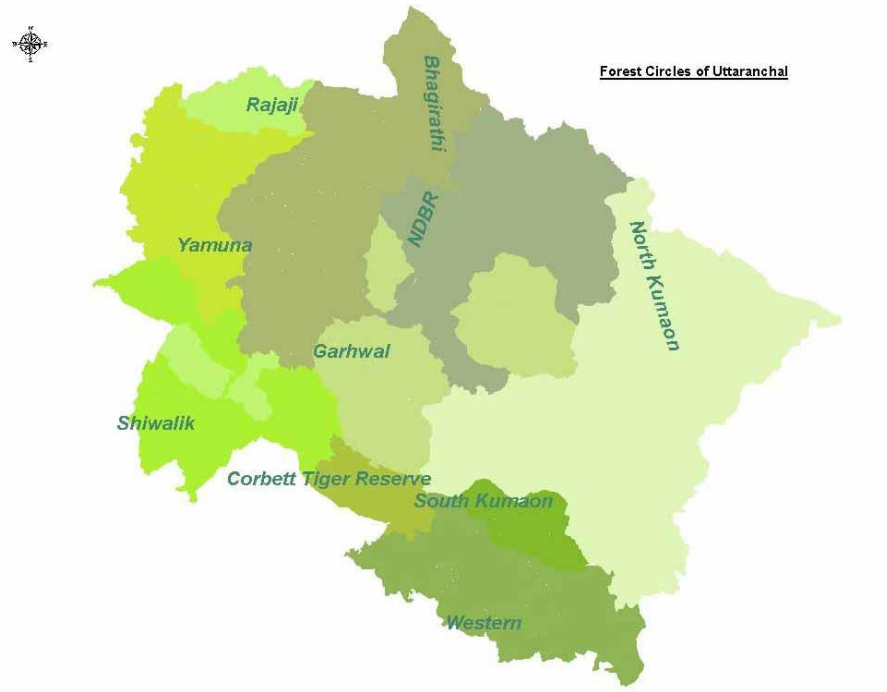
S.No.	Details	Area (sq.km)
UNDER FOREST DEPARTMENT		
1	Reserved forest	24121.905
2	Protected forests	98.614
3	Unclassed and vested forests (which have legal status of protected forests)	53.013
	Total	24273.532
UNDER REVENUE DEPARTMENT		
1	Protected forests (civil and soyam forests)	4768.703
UNDER FOREST PANCHAYAT		
1	Reserved forest recorded but the management is under the control of Van Panchayats	139.653
2	Reserved forests which is completely recorded in Van Panchayats	348.138
3	Protected forests (civil and Soyan forests)	4961.851
	Total	5449.642
Private/ Other Agencies (Municipal, Cantonment, Central Govt. etc.)		158.688
Grand Total		34650.565

Source : Uttaranchal Forest Statistics, Forest Department, Uttranchal 2005-06

Table 6 : Circle And Divisionwise Forest Area Under Forest Department Based on Legal Status (Area-Ha)

Circle/Division	Reserved	Protected	Unclassed & vested	Total Forest Area
1	2	3	4	5
North Kumaun Circle	279657.63	0.00	107.62	279765.25
South Kumaun Circle	59607.50	507.07	0.00	60114.57
Western Circle	264769.846	1156.97	122.40	266049.216
A.Total Kumaun Zone	604034.976	1664.04	230.02	605929.036
Bhagirathi Circle	669236.860	9.98	0.00	669246.842
Yamuna Circle	211844.17	4288.46	24.741	216157.371
Garhwal Circle	244832.50	0.00	0.00	244832.50
Shivalik Circle	147279.46	3898.90	5042.73	156221.09
B. Total Garhwal Zone	1273192.990	8197.342	5067.471	1286457.803
C.Total Wildlife Conservation12	548927.810	0.000	3.830	548931.640
Total-Uttaranchal	2426155.776	9861.382	5301.321	2441318.479

[12] Area covers various national parks and wildlife sanctuaries viz.;Rajaji national park, Govind wildlife sanctuary, Nandadevi national park, Kedarnath wildlife division, Kalagarh Tiger reserve, Corbett national park, Binsar wildlife sanctuary.



Map 4 : Forest circles in Uttaranchal
(Source : www.uttarakhandforest.org)

2.2.4 Forest Utilization and Production

Of the total forest area under the forest department only 62.23%area is exploitable. Rest of the area is either inaccessible, barren and degraded or lie as blank area. The variation in exploitable area the landscape has created great diversity of flora and fauna, and consequently, resources. These resources have been further augmented through plantation activities of the forest department. The resources pertaining to forest areas of Uttarakhand are briefly mentioned below.

a. Timber resources: The plains have plantations raised for commercial use. These include teak, sal, eucalyptus, poplar etc. Hills too provide timber from conifers like Deodar.
b. Non Timber Forest Produce: These include resin from Chir Pine, bamboos, fuel and fodder for use by local people, etc. Jatropha curcas is also being raised primarily as a potential substitute for petroleum.
c. Minerals, Stones, Sand: These are extracted from riverbeds when the rivers spread-out on reaching the plains. The extraction also carries out the function of "river training" i.e. keeping the river bed deeper, thus preventing floods.
d. Aesthetic Values and Tourism Resources: The forests provide the aesthetic value and structural resources that create ecotourism opportunities for the State. In fact, most of the tourism in the State relates to Nature/forest areas and even religious tourism benefits from it. The local communities are being involved in Eco-tourism activities as Community Based Tourism (CBT) has been introduced as a means of employment and income generation for the local communities in the

interior regions by creating home stay and camping sites, nature trails, village tourism etc. A Centre for Eco-tourism and Sustainable was set up in 2003 at Chunakhan near Ramnagar. Attempts have also been made towards controlled and regulated tourism started in a 9 km stretch of Nandadevi Biosphere Reserve Public-Private-Partnership (PPP) in management of Forests Rest Houses has been envisaged. Angling has been identified as a new thrust area in the field of Eco-torism.

Eco-development Committees have been created to involve local village community in conservation of bio-diversity and protection of the natural wealth and facilitate their active participation, eco-development committees (EDCs) have been formed in the Protected Areas (PAs) and funds have been allotted to them

Table 7 : Classification For Forest Areas Legally Under Forest Department According to Utility

S.No.	Details	Area (Ha.)
1	Exploitable forest	1519457.95(62.23%)
2	Inaccessible forest	72073.53(2.95%)
3	Barren Land and Degraded forests 3.1 Degraded forest areas which can be rehabilitated through plantation 3.2 Barren areas (i) Area already planted by forest department (ii) Plantable (iii) Alkaline (iv) Waterlogged (v) Sandy, Riverbank, Rocky etc.	 57602.78 64622.03 34657.84 4033.51 18619.59 51136.03
4	Other blank areas Pasture land Degraded Snow covered	 148767.97 16546.68 310372.76
5	Other	143427.81
	GRAND TOTAL	2441318.48(100%)

2.2.5 Pressures on Forest Resources[13]

Although the major land mass in the State is under forests followed by agriculture (Figure 3) the recent FSI assessment as illustrated in Figure 2 shows that most districts in Uttaranchal do not meet the minimum criteria of two-third area14 under forest cover. This deficit is remarkably high for the districts of Chamoli, Pithoragarh and Uttarkashi which could be attributed to the frequent landslides in the districts of Chamoli and

13 Forestry Issues and Concerns: Uttaranchal, The Energy Resource Institute, New Delhi(www.i-learn.co.uk)

[14] The criteria envisaged in the National Forest Policy, 1988 for the hill states to ensure stability of their fragile eco-system

Uttarkashi (UEPPCB 2004). Only district of Nainital seem to have achieved the target where the existing forest cover seem to be more than the targeted under the policy of 1988.

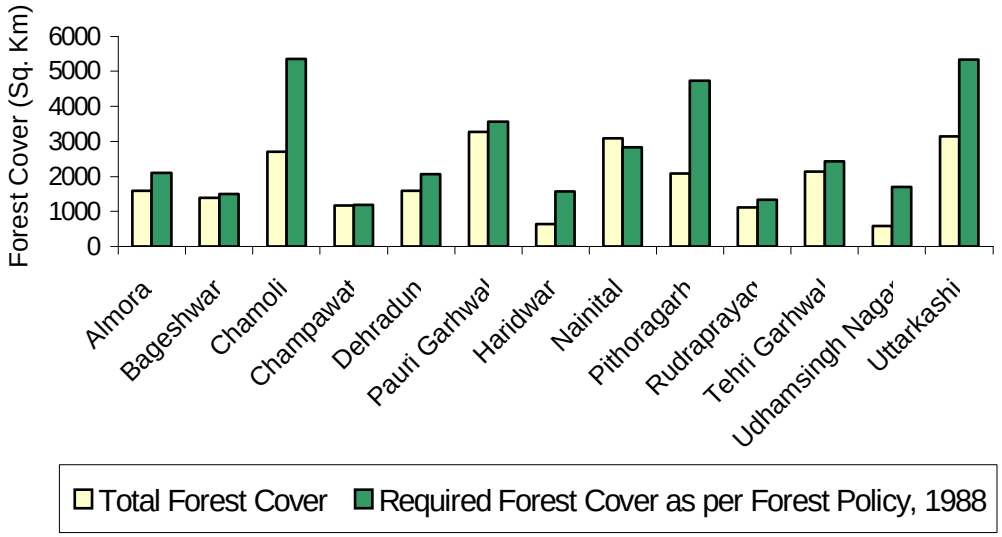


Figure 2. Comparison of district wise forest cover with the forest cover prescribed in the National Forest Policy, 1988[15]

2.3 Forests and Millennium Development Goals[16]

Forests cover about one fifth of India's land mass and are the single largest land based resource that has the potential of reducing poverty of the people of this country and, indeed, they have supported the poor to meet their basic requirements over the long and chequered history of this country. The case becomes even stronger for Uttarakhand where the forest area constitutes 64.79% of its total geographical area with percapita forest area of 0.41 hectare with Uttarkashi district having highest per capita forest of 2.4 hectare. The forests wealth plays a very important role in addressing the Millennium Development Goals (MDGs) which are the world's time-bound and quantified targets for addressing extreme poverty in its many dimensions-income poverty, hunger, disease, lack of adequate shelter, and exclusion-while promoting gender equality, education, and environmental sustainability. They are also basic human rights-the rights of each person on the planet to health, education, shelter, and security. The first MDG of eradication of extreme poverty and hunger and the seventh goal of ensuring environmental sustainability are very strongly linked where in the context of India looking to the high

[15] As in reference 12

[16] The Millennium Development Goals (MDGs) are the world's time-bound and quantified targets for addressing extreme poverty in its many dimensions-income poverty, hunger, disease, lack of adequate shelter, and exclusion-while promoting gender equality, education, and environmental sustainability. They are also basic human rights-the rights of each person on the planet to health, education, shelter, and security.

dependence of people on forest resources, forest if managed properly in true understanding of its immense value, can plau a very vital role in ensuring eradication of poverty.

2.4 Provision of Ecosystem Services from Forests

Traditionally, the forest resources are taken as "free gifts of nature". The neoclassical economists introduced "natural capital" with "man- made capital" and recognized the changes in natural capital such as depletion, degradation or regeneration as a result of human interference in assessing the value of resources. Unlike manmade capital, natural capital is strongly linked with the habitat and ecology and provides multiple and interrelated benefits to the human population and thus promotes human wellbeing. Various tangible and intangible goods and services provided by forests are indicated in Table 7. The nutrient cycling services of forests promote the growth of forests itself. Man-made capital is typically unidirectional and also has established markets. However, most of the goods and services provided by forests do not have markets. As a result, the intangible services of forests such as recharging of ground water, regulation of stream flows, flood control, prevention of soil erosion, nutrient cycling, water purification, carbon storage, pollution control, micro-climatic functions, biodiversity, evolutionary processes, human habitat, recreational, spiritual and aesthetic values are grossly underestimated or ignored during development planning. The situation has changed considerably post Rio Earth Summit due to increased awareness on the value of forests as a natural capital.

Table 8 : Goods and Services Provided by Forests[17]

Goods Provided by Forests	Services Provided by Forests
Firewood	Soil conservation
Pulpwood	Protection & regulation of water supplies
Fodder	Amelioration of climate
Timber	Shelter from hot & cold winds
Non-edible oils	Absorption of dust and noise
Medicines	Maintenance of genetic pool
Fibres & Flosses	Habitat for wildlife
Resins	Recreation
Lac	Maintenance of visual quality of the environment
Tendu & other leaves	
Bamboos and Canes	Maintenance of carbon di-oxide balance in the atmosphere.
Fodder	

17 Lal J.B. Value of India's Forest . 1992, Price of Forests Agrawal, Anil.Ed. New Delhi. Center for Science and Environment.

2.5 Forests and Millennium Ecosystem Assessment (MA)[18]

Millennium Ecosystem Assessment, which was carried out between 2001 and 2005, was an attempt to provide the report card of the health of various ecosystems of the world. It identified provisioning regulating, cultural and supporting services as four major services that the ecosystems provide to human beings for their livelihood security. It placed human well-being as the central focus for assessment, while recognizing that biodiversity and ecosystems also have intrinsic value. "Tools now exist for a far more complete computation of the different values people place on biodiversity and ecosystem services. However, some ecosystem services are more difficult to value, and therefore many decisions continue to be made in the absence of a detailed analysis of the full costs, risks, and benefits" (Millennium Ecosystem Assessment, 2005). The MA exercise highlights the importance of contribution of forests and its ecosystem services in ensuring both ecosystem health, resilience, security in relation to livelihood security. It provides some exemplary linkages such as:

- 100,000 species of pollinators, most important pollinator- honey bee- is for agriculture and horticulture purposes, natural wild pollinator are often forest species, their service is between $4 to $7 billion/year to US agriculture.

- Rattan and sago palm depend on animal pollinator

- Carbon storage: Tree and forest store "CARBON" a close primary forest has 280 ton c/ha. when converted to jhum 200 ton c/ha compared to a open forest with less than 100 ton carbon.

- NTFP: 50 million people depend on NTFP. 40-60% their annual income.

- Financial value of world timber (commercial and non commercial) : the annual value of world trade in industrial wood product is $140 billion.

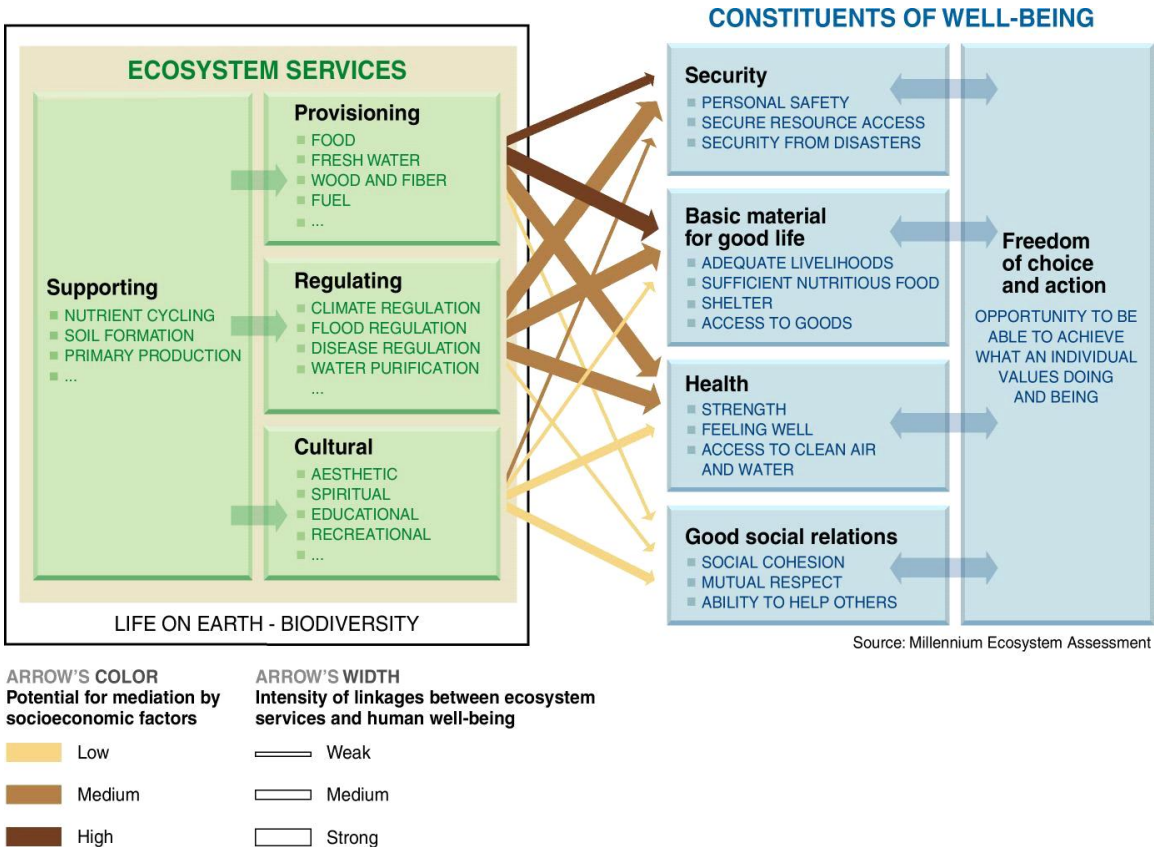
- Services such as carbon soaking power of forest, coastal defense activities of coral reef, the pollution filtering potential of wet land and costal area.

The assessment mainly finds that humans have radically altered ecosystems in last 50 years and the changes have brought gains but at growing costs that threaten achievement of development goals. It alarms about degradation of many ecosystem services, increased risk of abrupt changes in ecosystems and growing harm to poor people. It indicates that

18 Millennium Ecosystem Assessment, 2006. The largest assessment ever undertaken of the health of ecosystems which was done by 1360 experts from 95 countries. The MA has consensus of the world's scientists and was designed to meet needs of decision-makers among government, business, civil society, focused on goods and services and their sustainability, emphasized human well being and looked to the future and the policy options for desired outcomes.

poor people are most dependent on ecosystem services and most vulnerable to degradation of the services. The linkage between the ecosystem services and the human well-being is depicted in the following diagram developed in MA exercise..

Figure 3 : Ecosystem Services and the Human Well-being



The main ecosystem services from Uttarakhand forests considered in the study besides the tangible ones like timber, fuelwood, fodder, NTFPs are landscape beauty, carbon sequestration, agrobiodiversity and biodiversity, succession, and many watershed services like soil building, nutrient movement, hydrological and climate regulations etc. Valuation of these services has been dealt in the last section of the chapter.

2.6 Current Contribution of Forest to the GDP of the Uttarakhand State

Despite making considerable contribution in Uttarakhand's economic and ecological systems, the forests of the state do not get proper recognition of their contribution in the State income (SDP. The present system of national accounts (SNA) is primarily focused on growth rates of Gross Domestic Product (GDP) and it fails to capture several important elements of natural wealth – both qualitative and quantitative. The value of forest reflected in the India's System of National Accounts (SNA) represents less than 10 % of the real value. In 2002-03, forests contributed Rs. 27013 crore to India's GDP at the

current prices, which was 1.2% of the GDP. The contribution of forest to India's GDP has varied from 1.0 to 1.5 % over the nine year period from 1993-94 to 2002-03. Similarly the contribution of forestry and logging to India's Net Domestic Product (NDP) also varied from 1.6% to 1.3% during the same period. The forests of the state of Uttarakhand also confronts such ironic scenario where despite being provider of wide array of ecosystem services described as 'life supporting systems', its contribution reflected in the SDP is only 3.50% as only few goods and services from forest of Uttarakhand are marketed and thus accounted in the current calculus of SDP of the state.

Table 9 : Share of different sectors in net domestic output of Uttaranchal State at current prices , 2003-04[19]

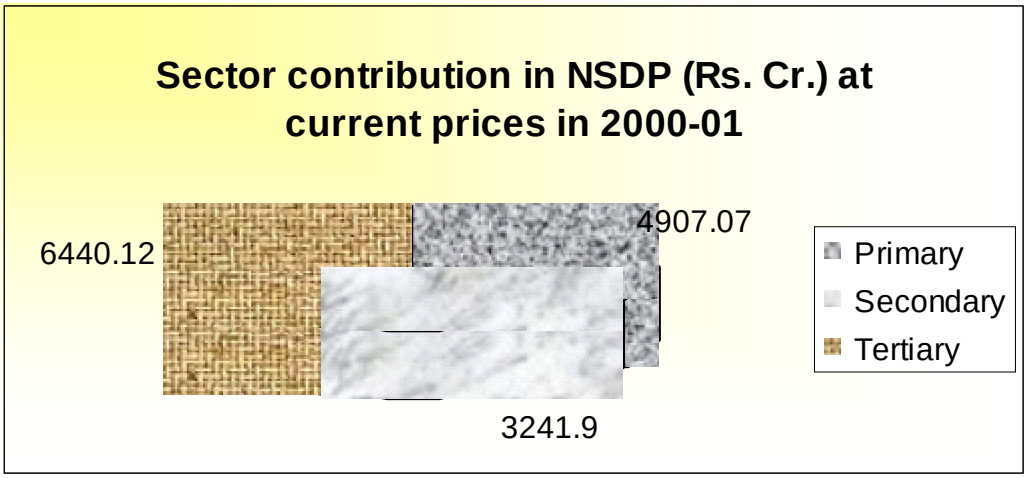
S.N	Sector	Product (Rs. in crore)	Percentage Share
0	1	2	3
A	PRIMARY SECTOR	4907.07	33.64
1	Agriculture	4042.84	27.71
2	Forestry & Logging	510.96	3.50
3	Fishing	6.89	0.05
4	Mining	346.38	2.37
B	SECONDARY SECTOR	3241.90	22.22
5	Manufacturing		
	a) Registered	784.61	5.38
	b) Unregistered	263.08	1.80
6	Construction	2072.81	14.21
7	Electricity, Gas & Water Supply	121.40	0.88
C	TERTIARY SECTOR	6440.12	44.14
8	Transport, Storage & Communication	725.74	4.97
9	Trade, Hotels & Restaurants	1062.67	7.28
10	Banking & Insurance	1049.51	7.19
11	Real Estate, Ownership of Dwelling & Business Services	933.57	6.40
12	Public Administration	968.01	6.64
13	Other Services	1700.62	11.66
14	Total (A+B+C)	14589.09	100.00

Industrial base of the region is very weak. There are a few factories in the entire region. Small and household industries are, however, in large numbers spread over all the districts in the region. Most of them skill-based, and are afflicted with severe problems on raw material and marketing fronts. NSDP At current prices, the NSDP of Uttaranchal was Rs. 14589.09 crore in 2003-04, reflecting an increase of Rs. 1517.85 crore over 2002-03. In percentage terms there is an increase of 12.13 percent. The share of primary, secondary, tertiary sector is Rs. 4907.07 crore, Rs. 3241.90 crore and Rs. 6440.12 crore

[19] Source http://gov.ua.nic.in/planning/annualplan0607/PROFILE.doc

respectively. In percentage terms it means a representation of 33.64, 22.22, and 44.14 respectively, out of the total NSDP (Diagram 2).

Figure 4 : Sector contribution in Net Domestic Product at current prices



Source http://gov.ua.nic.in/planning/annualplan0607/PROFILE.doc

The Annual Plan 2006-07 of Uttaranchal recognizes that "though the recorded forest area in Uttaranchal is 64.8% with vegetation cover 43.5 percent. More important, over 5411 hectares of forest areas have a canopy density of less than 40 percent. Maintenance of this forest cover is important not only for Uttaranchal but for the whole country. Our vision is to not only maintain and increase this Forest Cover to the desired levels but also to develop a harmonious and eco-friendly relationship between the people and the forests".

It further states that the strategies that the State Government has followed have actively involved the village communities in protection and management of the forest wealth. Thus besides the institutions of Van Panchayats, the newly created institution of Joint Forest Management have provided the institutional framework for this interaction. An interesting and encouraging experiment has been creation of Van Panchayats /Joint Forest Management Committees which consist entirely of women. The Protected Areas (PA's) Network constitutes about 18. 69% of the forest area and a similar protective role is played by the Eco Development Committees in and around the protected areas. To encourage cultivation of Bamboo and Jatropha (Bio fuel) a separate Board has been created and plantation on mass scale has been introduced from the year 2004-05. But to carry out all such activities the sector gets only 6.35% of total outlay annually as against 27% outlay to the agriculture (2006-07). Though looking to the usual quid pro quo mechanism of allocation of funds for contribution to SDP in Indian planning process, it looks though double of the contribution but looking to the geographical extent of forest area of 64.79% the allocation is highly disproportionate.

Thus it's high time to recognize, value and account the contribution of ecosystem services from Uttarakhand forests in the state domestic product estimation framework

and also develop incentive based mechanisms for the communities conserving the forests of the state specially the 12,064 Van Panchayats[20] of the state currently managing 523,289 hectare area of forest.

2.7 Ecosystem Services: Values and Valuation

2.7.1 Economic Value of Forests

Good provided by natural ecosystems are the basic building blocks of human welfare. Natural ecosystems provide much of the food as we eat, the water we drink and the clothes we wear, material for shelter, fuel to keep us warm and inspiration and experience that enrich our lives. The ability of ecosystems to provide these goods depends on the less obvious ecosystem services or processes through which the goods are created and maintained. The quantity or processes through which the goods are created and maintained. The quantity and quality of water available for human use – an ecosystem good depends on the water purification services of an ecosystem. The process by which ecosystems provide clean water depends on complex interactions between vegetative cover, soils, wetlands, microorganisms and other ecosystem components (Daily 1997)[21]. When the components that contribute to water purification are damaged or altered, water quality and human welfare may suffer.

Some goods and services from natural ecosystems cannot be produced simultaneously at a single location. Cutting down trees for wood products may reduce at least for a time, the level of carbon sequestration or erosion control services of natural forests. Clearing land for food production may eliminate wildlife habitat for some species and reduce genetic diversity. Such conversion of natural ecosystem causes the most concern when it takes place on a large scale or when it alters a rare ecosystem that provides globally or regionally valuable goods or services such as habitat for an endangered species.

The economic value of a natural resource as natural capital or asset can be defined as the sum of the discounted present values of the flows of all goods and services from the resource. The economic concept of value is based on a premise of neoclassical welfare economics that the purpose of an economic activity is to increase the well being of the individuals, who constitute the society and that each individual is the best judge of what is "good" or "bad" for him or her. The basis for estimating economic value of a resource or an environmental amenity is its probable effect on human welfare. However, the anthropocentric focus of economic valuation does not preclude a concern for the survival and well being of other species of the ecosystem. People do value other species not only

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20 Forest Panchayats popularly known as Van Panchayats20 (VP) were constituted in 1931 in Uttaranchal to enable the people to manage a portion of revenue forests lying in the vicinity of their villages. Later, in 1976 the Uttar Pradesh (UP) government made amendment to the VP Act to bring VPs within the ambit of the Indian Forest Act and framed a set of rules to govern their area. The Uttaranchal Forest Rules, 2001 made a further amendment to the VP Act that has given greater control to the Forest Department (FD) in the management of these forests.

21 Daily G.C. (ed). 1997. Nature's Services: Societal Dependence on Natural Ecosystem. Island Press: Washington D.C.

because of their direct utility to them but also because of altruistic or ethical concerns (Agrawal, 199222 ; IIED, 199623). The estimation of the economic values of natural resources and environmental amenities and services is necessary as there are no markets for most of them and as there are externalities in their use. Such values would help in determining the trade off between economic development and quality of environment and determining the extent of financial liability of firms and households, who degrade natural resources and pollute the environment. Further it helps in preparing green national accounts, i.e., accounts that incorporate national income accounts the benefits and costs of natural resources and environmental amenities and services.

On account of absence of any framework for estimation of such values, the present system of income accounting in forestry sector only takes note of contributions such as industrial wood, fuel wood and minor forest products, that too the recorded removals are accounted for, which are small portion of actual removals but no valuation and accounting is done for unrecorded tangible values and the whole stream of intangible values i.e. ecological services from forests. In India, forests meet nearly 40% of the energy needs of the country of which more than 80% is utilized in the rural areas, and about 30% of fodder needs of the cattle population. Forests products also play very important role in rural and tribal economy as many of the Non-Wood Forest Products (NWFP) provide sustenance to the rural poor. For landless families and marginal farmers forest related activities often represent the primary source of income. It is estimated that about 270 million tonnes of fuelwood, 280 million tonnes of fodder, over 12 million cmt of timber and countless non-wood forest products are removed from forests annually. At a conservative level of pricing (Rs. 500 per tonne of fuel/fodder) the value of these commodities will approximately aggregate to over Rs. 300,000 million per annuam. (MoEF, 199924).

There is lack of understanding of the true role of forests in the well-being of the people, forest lands have become degraded on account of overuse and mismanagement, the investment in the sector has not kept pace with the removals and the few resources available to the forestry sector are often put to non-productive uses. Where as the investment in the manmade capital and financial capital is on rise, the forestry sector on account of lack of appreciation of its true and total value has always been less appreciated and thus has received less budgetary allocation and investment. Low investment in the sector is clearly manifested by low annual growth of the sector as compared to other sectors of the Indian economy as shown in the following table which is equally true for the individual states.

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22 Agrawal, Anil.Ed. 1992, Price of Forests. New Delhi. Center for Science and Environment.

23 Verma, Madhu. 2000. Himachal Pradesh Forestry Sector review report annexes- Economic valuation of forests of Himachal Pradesh. International Institute of Environment and Development et al.

24 *National Forestry Action programme*. 1999. Vol. 2. Executive summary. Ministry of Environment and Forests, Government of India.

Table 10 : All India Annual Growth rate - Gross Domestic Product at factor Cost by Sector at Current and Constant (1999-00) Prices

Industry	2000-01	20001-2002	2002-2003	2003-2004	2004-2005@	2005-2006*
Agriculture, forestry and fishing	0.7 (-0.2)	8.3 (6.30	-3.0 (-7.2)	12.9(10.0)	0.6 (0.0)	10.9(6.0)
Forestry and logging	7.7 (2.7)	8.4 (3.1)	0.6 (0.7)	6.3 (-1.1)	2.2(1.6)	5.5(1.6)
Manufacturing	13.7(7.7)	5.0(2.50	9.7(6.8)	12.3(6.6)	16.7(8.7)	14.6(9.1)
Total GDP at factor Cost	7.8 (4.4)	9.1(5.8)	7.9(3.8)	12.5(8.5)	12.0(7.5)	13.8(9.0)

Note : Figures in parenthesis show growth rats at constant prices, @ Provisional estimates, * Quick estimates

Similarly the value charged for converting forest land for non forestry purposes used to consider only the marketed values like timber and non timber. The whole arrays of ecological services in terms of positive externalities which get lost on account of conversion were never considered. "Either actions leaves externalities - economic impacts occurring when those taking the decision to fell or change land use do not bear all the costs of their action. When a piece of forest land is ploughed, for example, the conversion makes sense to the land owner, but also damages fisheries downstream, increases flooding and chokes rivers and dams with sediment, so creating costs for others. Moreover such actions actually reduce, and not add to a country's total wealth. The loss of a forest is fundamentally economic in nature. So, it is that its conservation needs to be addressed in economic terms. For forests to be conserved, they need to be perceived as being more valuable than the usual, standard, utilities they provide"[25] .

2.7.2 Unrecorded Values of Forests

Most importantly the scores of other goods and services from forest such as watershed benefits, eco-tourism, C-sequestration and other eco-system services are not at all taken into account. Similarly on cost side the degradation and depletion of these sources is also ignored. If all such direct and indirect contributions from Indian forests are quantified, the standing forests of India would be worth Rs.59,20,190.2 crores26. As a matter of fact, the current system of National Economic Accounts does not sufficiently account tangible benefits, and there has been complete non-recording of intangible benefits, non-recording of illegal removal of forest produce, insufficient recording of authorized removals from the forests and insufficient recording of losses in the forests. Above all there is lack of system of Flow and Stock Accounting systems. For reflecting true contribution of forest of India in its National Income such that proper budget allocation can be done in relation to its contribution, it is imperative to value such contributions and set up an integrated System of Economic and Environmental Accounting of forests of India.

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[25] Too Cut and Dried, Down To Earth, 2005. based on the per hectare total economic value estimated by Verma, 2000

[26] *Ibid.*

Some of the key goods and services provided by forests which are not accounted for in the GDP include provisioning of water and its recharge and purification, prevention of soil erosion, regulation of flood control, storm protection services, particularly by mangroves, safeguards against natural disasters, provisioning of oxygen, provisioning of grass and fodder, provisioning of fruits, tubers and honey, provisioning of medicinal plants, provisioning of livelihood factors such as Kosa silk, kendu/tendu leaves, sal seed and even salt and minerals, provisioning of fish and other aquatic resources and safe havens for propagation of such resources, microclimatic functions, carbon store and carbon sequestration, nitrogen fixing, biodiversity, recreational, cultural and aesthetic services etc.

2.7.3 Role of Forest Policies and National Environment Policy in reflecting True Contribution of Forests

After independence, the 1894 policy was replaced by another policy in 1952. This policy indentified vital national needs; which included a system of balanced and complementary land use, need of checking of denudation of mountainous regions, erosion of river banks and invasion of sea-sands on coastal tracts and the need of ensuring supply of fodder and small wood, etc. The policy also dealt upon the proportion of forest areas and for the first time, a target was identified i.e. 'India, as a whole, should aim maintaining one-third of its total land area under forests'. No attempt but was made to inculcate appreciation about intangibles which would have encouraged stakeholders to save and invest in forests.

However, a major shift was noticed in forestry sector after the National Commission on Agriculture (NCA), constituted in 1970, was entrusted with the task of making recommendations on improvement of forestry sector. Acting upon the recommendation of the National Commission on Agriculture, Government of India, through a resolution dated 7 December 1988 formulated a new forest policy where one of the basic objectives was the 'maintenance of environmental stability through preservation and, where necessary, restoration of the ecological balance that has been adversely disturbed by serious depletion of the forests of the country'. This was a clear improvement over the Forest Policy in 1952, as for the first time “environmental stability” was considered as the prime object of the Forest Policy and direct economic benefits were subordinated to this principal aim. Though this policy also maintained that national goal, should be to have a minimum of one-third area of total land area under forest or tree cover but remains silent on recognition of ecosystem services from the forests.

The recent National Environment Policy 200627, the first umbrella policy for various natural resources relates to current perceptions of key environmental challenges like conservation of critical environmental resources and enhancing of resources for environmental conservation. The policy recommends the use of economic principles in environmental decision-making. It states that 'it is necessary that the costs associated with the degradation and depletion of natural resources be incorporated into the decisions of economic actors at various levels, to reverse the tendency to treat these resources as “free

27 National Environment Policy, 2006. Ministry of Environment and Forests, Government of India.

goods" and to pass the costs of degradation to other sections of society, or to future generations of the country'.

It recognizes that the forests provide a multiplicity of environmental services. Foremost among these is the recharging of mountain aquifers, which sustain our rivers. They also conserve the soil, and prevent floods and drought. They provide habitat for wildlife and the ecological conditions for maintenance and natural evolution of genetic diversity of flora and fauna. They are the homes of traditional forest dependent communities. They yield timber, fuel wood, and other forest produce, and possess immense potential for economic benefits, in particular for local communities, from sustainable eco-tourism.

It recognizes that on the other hand, in recent decades, there has been significant loss of forest cover, although there are now clear signs of reversal of this trend. The principal direct cause of forest loss has been the conversion of forests to agriculture, settlements, infrastructure, and industry. In addition, commercial extraction of fuel wood, illegal felling, and grazing of cattle, has degraded forests. These causes, however, have their origins in the fact that the environmental values provided by forests are not realized ad direct financial benefits by various parties, at least to the extent of exceeding the monetary incomes from alternative uses, including those arising from illegal use. It states that the similar situation is faced by other natural resources as well. Thus to correct the situation it recommends that the following actions will be taken:

Strengthen, including through capacity building, the initiatives, taken by the Central Statistical Organisation in the area of natural resource accounting, with a view to its adoption in the system of national income accounts. Further strengthen in all respects, the system of collection, collation and analysis of all significant and relevant environmental monitoring data.

Develop and promote the use of standardized environmental accounting practices and norms in preparation of statutory financial statements for large industrial enterprises, in order to encourage greater environmental responsibility in investment decision-making, management practices, and public scrutiny.

Facilitate the integration of environmental values into cost-benefit analysis, to encourage more efficient allocation of resources while making public investment decisions.

2.8 System of Environmental and Economic Accounting (SEEA)

2.8.1 Need for Total Estimate of Ecosystem Services

National scale aggregate indicators of ecosystem services are useful for stimulating and supporting a broad public discussion about trends in the provision of these services. These are important considerations involved in producing an aggregate indicator, including whether the scientific and technological capacity exists, how to address varying perceptions of the societal importance of different services and how to communicate information about these services to both decision makers and the general public.

Although the challenges are formidable, they are not insurmountable. Quantification of ecosystem services and dissemination of information to decision makers and the public is critical for the responsible and sustainable management of natural resources28.

2.8.2 Basic Framework of SEEA

For reflecting the true value of forests to the nation's national income, it is imperative to conduct natural resource accounting (NRA) in India. NRA is a revaluation of the National Income Accounts of a country, adjusting for the values of natural resources used in various economic activities during the past "fiscal year". The changes in both "stock" and "flow" of forests need to be accounted for. Forests get degraded in quality and quantum due to economic and human activities. They also go through natural decay and regeneration. Forests may also have been enhanced due to plan interventions, forest conservation and management of Protected Areas (NBSAP, 2002).

There are three alternate methods to NRA. First is the UNSTAT proposed satellite system for environmental accounting (SEA), it does not make any change in the core System of National Accounting (SNA), but proposes establishing linkages between the SNA and the integrated economic and environmental accounting. The second method is to treat natural resources as a separate set of activities in an Input-Output table. Then the outflows from such natural resource sectors will have been absorbed by other sectors of the economy. For example, water production from the Water Resource Sector would flow to many industrial sectors, household sectors and of course, to the agriculture sector as irrigation. The third method of arriving at the Green GDP is to account for depletion of natural resources using either the Use Cost method or Depreciation or Net Price method 29
Improvements in methods of existing System of national accounts (SNA) were debated in 1992 during UNCED held at Rio de Janeiro, which recommended the System of Integrated Environmental and Economic Accounting (IEEA). UN Statistical Division in 1993 suggested a satellite system of environmental and economic accounting (SEEA) showing environmental related sectoral activities along with their physical accounts of flow changes, valuation and links to the main SNA

2.8.3 Scope of Forest Resource Accounting (FRA)

Quantifying and monitoring the flows of ecosystem services is critical Forest Resource Accounting (FRA) provides a realistic estimate of the contribution of forest to the GDP of the economy. Presently, the budgetary allocation in India is nearly following the quid pro quo technique of budgetary allocation in relation to contribution to GDP, states with large geographical areas under forests like M.P., H.P. Arunancahl Pradesh, Uttaranchal, Chattisgarh etc. could make a strong case for higher budgetary allocation using Ecosystem quantity and value estimate for their forestry sector so as to promote sustainable development. Else the states will always face resource crunch in the forestry

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[28] ***Laura et.al*** Aggregate Measures Of Ecosystem Services: Can We Take The Pulse Of Nature? Front Ecol Environ 2005; 3 (1): 56-59

[29] (NBSAP, 2002, Parikh et. al, 1992).

sector. Further the communities conserving forests like JFM committees will also have sustained interest in investing in this natural capital. When the contributions shall get recorded through a system of FRA, the contributing stakeholders can also be identified and this would help setting up a compensation/payment /incentive based mechanism to such conservationists. The logic has been appreciated by the Government of India and other fund allocation agencies and as per the recent development an amount of Rs. 1000/- (On thousand crores) has been year marked from the centre for distribution amongst the states sacrificing development of agriculture and industrial development by conserving large areas under forests. If a regular system of FRA is established, it will further help in such budgetary allocations leading to improved management of India's forests.In fact the state of Himachal Pradesh in India, based on the findings of Verma (2000)30 seem to have learnt lesson from Brazil and has levied one time ecological value added tax to compensate for the loss of revenue to those Indian States which have done a good job of protecting their forests. The

2.8.4 Beneficiaries of FRA and Typical FRA Products

The FRA so developed could be of immense use to national and state legislatures, natural resource management agencies, forest owners and concessionaires, forest industry and trade groups, local communities dependent on forests and supporting NGOs, international fora, secretariat to conventions and donor agencies etc.(IIED, WCMC, 1996). Depending on need, the particular FRA ‘products’ selected for a given location may contain State-of-the forests Report (baseline data and maps selected criteria and indicators),Balance sheet of forest stocks and flows (including non-timber forest products), Concession monitoring and forest investment programme, Forest valuation (national or forest unit level), Audits of forest management (by different stakeholders) and administration, Forest sustainability assessment (according to national standards/ international principles) , Country level forest management certification etc. FRA can also play a key role in cross-sectoral initiatives such as land capability information system, national environmental management system, national biodiversity database and national resource accounts (monetary or physical).

2.9 Review of Studies on Valuation Ecosystem Services from India's Forests

2.9.1 Valuation of forests in the context of developing countries

Bishop, J.T. (ed) 1999, “Valuing forests; A review of Methods & Applications in Developing Countries” cites numerous examples of application of valuation techniques in such countries. The study deals in detailed manner with valuation of NTFPs & other non-marketed benefits & difficulties encountered in such valuation. The study highlights that in case of NTFPs as the main cost of harvesting is typically household labor (though in some cases like medicinal plants, nominal royalty is taken by the government), pricing lab our input is a difficult task due to thin labour markets, estimation of time excluded in

30 Verma, Madhu. 2000. Himachal Pradesh Forestry Sector review report annexes- Economic valuation of forests of Himachal Pradesh. International Institute of Environment and Development et al.

NTFPs collection & complimentarily between harvesting NTFPs & other activities like agriculture. Wage rates are used to workout production cost of NTFPs extraction. Tobian & Mendelson (1991) used travel cost method in Costa Rica to estimate the eco-tourism value to domestic users of Monteverde Cloud Forest Biological Reserve. They derive a national creation value of the site approximately $ 100,000 per year. The study further provides example of use of production function approach to evaluate the impact of forest disturbance on hydroelectric power generation and for water supply. Aylward etal, (1999) valued the hydrological impacts of forest conversion in upland areas, in a case study of the Arenol watershed, in Costa Rica. Besides these it cites such studies in Bolivia, Peninsular Malayasia & Thailand. CVM & TCM were used together by Willis et al (1998) to estimate consumer demand for forest reservation sites in Peninsular Malayasia. They found that the two methods generated comparable estimates, and that the aggregate benefits of forest recreational areas exclude the (direct) costs of their provision.

2.9.2 Economic Valuation of India's Forests - An Overview

Several attempts have been made in India recently through case study approach to estimate economic value of intangible benefits of forests like eco-tourism, recreation, water supply, watershed value, carbon store & biodiversity. Table 1.9 provides an overview of such studies

Table 11 : Economic values of intangible benefits of forests derived from India case studies - an Overview

I Goods and services valued	II Annual value	III Location	IV Methodology applied	V Source
Recreation/ Ecotourism	Rs. 16197 per ha (Rs. 427.04 per Indian visitor Rs 432.04 per foreign visitor)	Keoladeo National Park, Bharatpur	Travel Cost Method	Chopra (1997)31
Recreation/ Ecotourism	Rs. 20944 per ha (Rs. 519 per Indian visitor and Rs. 495 per foreign visitor)	Keoladeo National Park, Bharatpur	Contingent Valuation Method	Murty and Menkhuas (1994)32

[31] Chopra, Kanchan; kadekodi, Gopal. 1997. Natural resource accounting in the Yamuna Basin: Accounting for forest resources. Delhi, Institute of Economic Growth

[32] Murty, M.N,; Menkhuas, S. 1994 Economic aspects of wildlife protection in the developing countries: A case study of Keiladeo National park, Bharatpur, India. Delhi, Institute of Economic Growth

Recreation/ Ecotourism and Other Benefits	Rs. 23300 per ha (Rs. 90 per household Rs. 7.5/month/ household): Rs. 340 million/year	Boriveli National Park Mumbai	Contingent Valuation Method	Hadler et.al. (1995)33
Ecotourism	Rs. 676 per ha (for locals) Total Rs. 3.2 million per year	Periyar Tiger Reserve Kerala	Contingent Valuation Method, Travel Cost Method	Manoharan (1996)34
Ecotourism	Total Rs. 2.95 million (Rs. 34.68 per visitor)	Kalakadu Mundanthurai Tiger Reserve, Tamil Nadu	Contingent Valuation Method	Manoharan and Dutt (1999)
Ecotourism/ Recreational/ Pilgrimage/ Sacred grove	WTP for maintenance and preservation of the lake by the local community= US$ 0.88 (Rs. 36.08) local pilgrims = US$ 2.2 (Rs. 90.2) Resident visitor = US$ 2.5 (Rs. 102.5) Non-Resident visitors= US$ 7.2 (Rs. 295.2) (Aggregate WTP = US$ 46940 based on total visits per year (Rs. 1.92 million) Per hectare value= Rs. 1604	Recreational value of a sacred lake in Sikkim Himalaya (Khecheopalri Lake)	Travel Cost Method Contingent Valuation Method	Maharana et. al (2000)

33 Hadler, N; Sharma, Sudhir; David, Ashish; Muraleedharna, T.R. 1997. Willingness to pay for Borivili National Park: Evidence from contingent valuation. Ecological Economics. V. 21, pp 105-122.

34 Manoharan, T.R. 1996. Economics of protected areas: a case study of Periyar Tiger Reserve. (Ph.D. thesis). Dehra Dun, Forest Research Institute.

Ecotourism	**WTP for the management of the Park: By foreign tourists= $8.84; By domestic tourist = $1.91; By local community=$6.20 per year WTP total for annual maintenance works out to $87.777**	**Khangchendzong National Park, Sikkim**	**Contingent Valuation Method**	**Maharana et. al (2000)**
Soil Conservation	Cost of soil erosion: Rs. 21583 per ha	Doonvalley	Replacement Cost Approach	Kumar, P (2005)35
Water supply	Rs. 4745 per ha	Almora Forests	Indirect methods	Chaturvedi (1992)36
Ecological functions (Use Value) for local residence	Rs. 624 per ha	Yamuna Basin	Contingent Valuation Method	Chopra and Kadekodi (1997)37
Carbon store	Rs. 1,292 billion for total Indian forests and Rs. 20125 per ha.	Indian forests	Species wise forest inventory data	Haripriya (1999)38
Carbon store	Rs. 1.2 lakh/ha	Indian forests	Biomass estimation	Kedekodi and Ravindranath (1997)39
Watershed Values (soil conservation	Rs. 2.0 lakh/ha metre of soil	Yamuna Basin		Chopra and Kadekodi (1997)40
Forest in	Total Economic Value of	Himachal	Total	Verma (2000)41

[35] Kumar, P. 2005. Market for ecosystem services: An overview of experiences and lessons learned. Discussion Paper Series No. 98/2005. Delhi, Institute of Economic Growth.

[36] Chaturvedi, A.N. 1992. Environmental value of forest in Almora. In Agarwal, Anil. Ed. Prices of forests. New Delhi, Centre for Science and Environment.

[37] Chopra, Kanchan; Kadekodi, Gopal. 1997. Natural resource accounting in the Yamuna basin; Accounting of forest resources. Delhi, Institute of Economic Growth

[38] Haripriya, G.S. 2001. Integrated environmental and economic accounting: An application to the forest resources in India. Environment and Resource Economics, V. 19(1)

39 Kadekodi, G; Ravindranath, N.H. 1997. Macroeconomic analysis of forestry options on carbon sequestration in India. Ecological Economics. V. 23, pp 201-223.

40 Chopra, Kanchan; Kadekodi, Gopal. 1997. Op.cit.

41 Verma, Madhu. 2000. Himachal Pradesh Forestry Sector review report annexes- Economic valuation of forests of Himachal Pradesh. International Institute of Environment and Development et al.

Himachal Pradesh	Forests in Himachal Pradesh is estimated as Rs. 106664 Crores, which is 2.61 times the value of the growing stock. The contribution of forestry as a percentage of corrected GSDP is 92.40% instead of recorded 5.26%	Pradesh State	Economic Value (TEV) Approach	
Forest In Maharashtra	Contribution of Forests is estimated as Rs.35,245.65 Millions as against Rs. 14,080 Millions shown in SNA. (i.e. It is 3.56% of adjusted NSDP and not 1.46 % recorded) Value of depletion (Difference between the value of Opening Stock, Other volume changes and the Closing Stock in forest accounts) = Rs. 6.989 Millions (This is 19.8% of the estimated value added) Estimated asset values of forests = 28.6% of net fixed capital stock.	Maharashtra State	Physical accounting (Tools employed: Net Price Method; Present Value Method, etc.)	Parikh and Haripriya (1998)
Forests in Yamuna Basin	Use Value of Timber = Rs. 8,279 to Rs. 18,540 per cu.m of extracted timber Annual value of main non timber forest products = Rs. 7509 per squ km. in Hills and Rs. 558 per sq km in plains. Use value of ecological functions and unrecorded production = Rs. 176 per ha in HP Rs. 3509 per ha in Haryana Average = Rs. 624 per ha. Value of Preservation as contributing to National Output = Rs. 576 lakhs per year Household willingness	Yamuna Basin	Contingent Valuation Method; Direct Market Valuation, Multi-criteria Analysis and Travel Cost Method	Chopra and Kadekodi (1997) 42

42 Chopra, Kanchan; Kadekodi, Gopal. 1997. Natural resources accounting in the Yamuna basin; Accounting of forest resources, Delhi, Institute of Economic Growth

	to pay in rural areas for use value of forests: Rajasthan = Rs. 1072 per ha Uttar Pradesh = Rs. 360 per ha Himachal Pradesh = Rs. 176 per ha Haryana = Rs. 3509 per ha			
Iron Ore	User cost per tone = Rs. 8.63 per tone	Goa	User Cost Method	TERI (2000)43NBSAP 44
Contributions of Forests in GDP	Calculated the contribution to be 2.37% of 1996-97 GDP (base year 1993-94) as compared to 1.2% as computed by CSO	All India		Chopra, Bhattacharya and Kumar (2002)45

The range of annual values of selected tangible and intangible benefits of Indian forest. derived from various case studies and from various kinds of forest land in India are depicted in table 12 and 13.

Table 12: Annual values of selected benefits of forests[46]

S.No.	Economic benefit	Nature of benefit	Value of annual flow of goods & services per hectare (Rs.)	
			Minimum	Maximum
1	Timber	Tangible	2701	9270
2	Non timber forest products	Tangible	538	2957
3	Ecological functions (watershed)	Intangible	624	2.0 lakh
4	Eco tourism	Intangible	676	20,444
5	Carbon store	Intangible	20125	1.2 lakh

43 The Energy and Resources Institute. 2000. Pilot project on natural resource accounting in Goa (Phase I). TERI Project Report No. 99RD61. New Delhi, TERI.

44 India. National Biodiversity Strategy and Action Plan. 2002. Economics and valuation of biodiversity-Thematic Working Group report. New Delhi, Ministry of Environment and Forests.

45 Chopra, K., Bhattacharya, B. and Kumar, P. 2002. Contribution of forestry sector to gross domestic product. Mimeo. New Delhi, IEG.

46 Manoharan, T.R. 2000. Natural Resource accounting: Economic valuation of Intangible benefits of Forest. New Delhi, research and Information System for the non-aligned and other developing countries.

Table 13: Economic values of various kinds of forest land in India[47]

S.No.	Nature of Forest land	Selected economic benefit	Value of annual flow of goods & services per hectare (Rs.)		Present value* of goods & services per hectare (Rs.)	
			Mini.	Max.	Mini.	Max.
1	Plantation/Single species forest (teak, sal forests, etc.) (Crown density < 40%)	Timber	2701	9270	33660	115525
2	Multi-species plantation/open forests (crown density 10-40%)	Timber + NTFP	3239	12227	40365	152375
3	Dense forests (crown density >40%)	NTFP + Ecological functions + Carbon store	21287	322957	265283	4024758
4	Protected Areas	Eco tourism + ecological functions+ carbon store	21425	340444	267003	4242685

* At 5% rate for a period of 20 years

The estimates show that the value of annual flow of goods and services of dense forests varies from Rs. 2187 per hectare to Rs. 3.2 lakh per hectare. In case of protected areas the value is from Rs. 12425 pwe hectare to Rs. 3.4 lakhs per hectare. The Present Values (PV) of the forests flows have been worked out at 5 per cent rate of discount for a period of 20 years. The PV of dense forests varies from Rs. 2.65 lakh per hectare to Rs. 40 lakh per hectare and that of Protected Areas varies from Rs. 2.67 lakhs per hectare to Rs. 42 lakhs per hectare.

Several states including Madhya Pradesh, Himachal Pradesh, Chhattisgarh, Uttaranchal and Bihar are charging Net Present Value (NPV) from the user groups who are clearing forests for alternate uses, at the rate of Rs. 5.80 lakh per hectare of Rs. 9.20 lakh per hectare, depending on the quantity and density of the forestland converted for non forest purposes48.

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47 Manoharan, T.R. 2000. Natural Resource accounting: Economic valuation of Intangible benefits of Forest. New Delhi, research and Information System for the non-aligned and other developing countries.

48 Supreme Court Judgment dated 26th September 2005, case No. Writ Petition (Civil) 202 of 1995 directed to set up an expert group to suggest suitable NPV. The following issues were examined by the expert group. (i) To identify the definite parameters (scientific, bio-metric and social) on the basis of which categories of values of forest should be

2.9.3 Estimating Total economic Value of Forests of India - A Case of Forests of Himachal Pradesh

Besides the above, it will be useful to mention structure developed in the study on Forest Resource Valuation and Accounting for the State of Himachal Pradesh done by Verma (2000)49, incorporating various estimates, both physical and monetary, on the contribution of forests to the state economy, as per table 14 below:

Table 14: Economic Valuation of Forests in Himachal Pradesh- Summary of Findings

Economic Value of Direct and Indirect Benefits		
	Physical value	Monetary value (Rs. crores)
Total growing stock	10.25 crore m3	40860
I. Direct Benefits		
A. Direct Consumptive benefits		
1.Salvage	3.50 lakhs m3	32.00
2.Timber for right holders	1.06 lakhs m3	60.00
3. Fuel wood	27.60 lakh tonnes	276.00
4.Fodder	92.0 lakh tonnes	690.00
5.Minor forest produce	1161.56 tonnes	25.00
Total Direct consumptive benefits		1083.00
B. Direct Non Consumptive Benefits		
6.Ecotourism	66.56 lakh - Tourists	6657
Total Direct Benefits(A+B)		7740
II. Indirect Benefits		
7.Watershed	6.77crore m3 - Growing stock in river Basin Forest Circle and 36986 km2 - entire forest area	73972

estimated; (ii) To formulate a practical methodology applicable to different biographical zones of India for estimation of value in monetary terms in respect of each of the above categories of forest values ;(iii) To illustratively apply this methodology to obtain actual numerical value for different forest types for each biographical zone of the country; (iv)To determine on the basis of established principles of finance , who should pay the cost of restoration and / or compensation with respect to which category of values of forest and (v) which project deserves to be to whom exempted from Payment of NPV.

[49] Verma, Madhu. 2000. Himachal Pradesh Forestry Sector review report annexes- Economic valuation of forests of Himachal Pradesh. International Institute of Environment and Development et al.

8.Microclimatic factors	969018 Households	145
9.Carbon Sink	14346 km2 - Area under tree cover and scrub forest	17645
10.Biodiversity/ Endangered Species	8966- Total no. of species found in Himachal Pradesh & 125 - Endangered species	7137
11.Employment Generation	48.40 lakh man days	25
Total Indirect Benefits (7+11)		98924
Total Economic Value(I+II)		106664

It is evident from the table that except for some contribution by way of salvage removals, TD Rights and MFPS, all values go totally unaccounted despite having enormous monetary worth. The watershed values contribute the most (69%) followed by carbon sink values (16%). When TEV in terms of Rs/Hectare contribution of forests is calculated for the legal forest area (36,986 km2) it stands at Rs. 2.89 lakhs whereas for the actual forest cover (143, 46 km2) it approximates to Rs. 7.43 lakhs. If we take the contribution only in terms of intangibles, it stands Rs. 6.90 lakhs as against Rs. 53 thousand per hectare for direct values for actual forest cover and Rs. 2.89 lakhs as against Rs. 21 thousand for direct values for legal forests.

The total contribution of forests amounts to Rs. 106664 crores but what is accounted is only Rs. 41 crores by way of revenue realized by the department. The total economic value so generated is compared with the value of the growing stock, total expenditure incurred on forests (Annual Budget) and the revenue realised from forests as per the following table.

Table 15: Contribution of Forests Vs Investments in Himachal Pradesh

Forest Resource Contribution vs. Investment(Rs Crores)	
Value of Growing Stock	40860
Total Economic Value of Forests	106664
Total Expenditure incurred in forest (Annual Budget)	109
Revenue realised by forests	41
Contribution of Forests to the GSDP	
Total GSDP	9258
Forestry as logging	487
Forestry as % of GSDP	5.26
Total Economic Value of Forests (as per current estimation)	106664
Corrected GSDP	115434
Forestry as % of corrected GSDP	92.40

The table finds that total economic value is 2.61 times the value of the growing stock, 980 times the total expenditure incurred in the forestry sector of Himachal Pradesh and 2607 times the revenue realized by the forests annually. This comparison proves gross underestimation of forestry sector's contribution in the economy of the State. When the GSDP of the State is corrected for total economic value calculated through the current study the contribution of forestry sector increases from 5.26% of GSDP to 92.40 % of GSDP. The framework adopted in the above study could be adopted for the Indian economy as a whole to reflect the monetary value of contributions and the opening and closing stock model would be useful to assess the net changes in the current year.

2.10 Techniques of Valuing Forest Resources

The value added generated by forest goods & services is a portion of the extraction cost, measured as output minus all intermediate costs of production. The insitu value is the amount that someone will be willing to pay to rent the forest in order to have access to the non-market forest products. If non-market forest products were to be included in forest asset accounts, it is the insitu value that would be used. The major areas of concern is the valuation of intangible benefits from forests. A number of methods could be formed in literature to estimate intangible benefits of forests (Doxen and Sharman, 1990, Deance & Moran, 1994, NNEP, 1998). Methods specific to various intangible benefits are presented below.

Table 16 : Valuation Techniques for Forest Goods & Services[50]

Forest products	Valuation techniques
Land	Market Price
Commercial Timber Non Commercial Timber	1. Market prices 1. Market prices Local market prices of the same product Price of close substitute products
Non timber Forest Goods	Local market price of same product Price of close substitute product Production cost
Forest Services Livestock Grazing Recreation and Tourism	 Price of close substitute product Production cost 1 Travel cost 2. Hedonic price of land CVM & conjoint analysis
Forest environmental and protection services Carbon Storage Biodiversity and habitat preservation. preservation Protective services	 Carbon tax Carbon emission permit trading tax Global damage from climate change averted CVM & conjoint analysis Damage cost Damage prevention costs CVM & conjoint analysis

[50] Eurostat. 2002. valuation of European Forests: Results of IEEAF Test

2.11 Recommended Framework of Valuing Forest Ecosystem Services in India

Many valuable ecosystem services as mentioned above are finally gaining some attention. Today governments, companies, and citizens are increasingly recognizing the value of the wide range of services our forest ecosystems provide51. Number of independent studies has been done using various techniques to estimate various economic values of forests which have greatly helped in bringing these environmental considerations into economic planning. The following table provides the proposed framework based on the methodology developed and data generated in NRA Project of CSO at IIFM by Verma et.al. (2003-2006) for annual values from forests which was provided through the report titled 'Estimating Economic Value of Forest Land: A Methodology", Verma, (March, 2006)52 to the Institute of Economic Growth, Delhi for MOEF sponsored Project on Estimating Economic Value of Forests, 2006, findings of which have been used by the Expert Group Report, 2006 to suggest suitable NPV for forests constituted by the Hon'ble Supreme Court of India in 2005 and costs estimates suggested by the Empowered Committee's Report on NPV at IEG, New Delhi 200653.

Table 17 : Estimation of NPV of Forest Resources of India for its Use in Forest Resource Accounting System

Ecosystem Service	Annual Value (Benefit)	Annual Costs
1.Timber - logging, TDRs/Nistar and Salvage	Long run Stumpage value approach or Stumpage price of mature timber and salvaged timber	Costs of production (departmental), extraction and transport
2.Fuel wood	Total value of fuel wood collected in a normal year = No. of rural households collecting fuel wood from	Cost of collecting fuelwood = (No. of rural households) X (Total annual time cost of collection per household

51 Jenkins, Michael. 2002. Selling Forest Environmental Services: Market based Mechanisms for Conservation and Development. Edited by Stefano Pagiola, Joshua Bishop, and Natasha Landell-Mills

52 The study responded to the following terms of reference (i) To identify the definite parameters on the basis of which categories of values of forest should be estimated; (ii) To formulate a practical approach/ methodology to different forest zones of India; (iii) To illustratively apply this methodology; (iv)To determine on the basis of established principle who should pay the cost with respect to which category of values and to whom.

53 Supreme Court Judgment dated 26th September 2005, case No. Writ Petition (Civil) 202 of 1995 directed to set up an expert group to suggest suitable NPV. The following issues were examined by the expert group. (i) To identify the definite parameters (scientific, bio-metric and social) on the basis of which categories of values of forest should be estimated; (ii) To formulate a practical methodology applicable to different biographical zones of India for estimation of value in monetary terms in respect of each of the above categories of forest values ;(iii) To illustratively apply this methodology to obtain actual numerical value for different forest types for each biographical zone of the country; (iv)To determine on the basis of established principles of finance , who should pay the cost of restoration and / or compensation with respect to which category of values of forest and (v) which project deserves to be to whom exempted from Payment of NPV.

	forest in last 365 days x Average value of collection per collecting household. (the value to be used is the relevant price in the nearest local market)	valued at 15% of average agricultural wage rate).
3.Fodder Grazing	Total value of fodder collected in a normal year = No. of rural households collecting x fodder from forest in last 365 days x Average value of collection per collecting household. (the value to be used is the relevant price in the nearest local market) Total no. of livestock grazing in state forest x total fodder receipt	Cost of collecting fodder = (No. of rural households) X (Total annual time cost of collection per household valued at 15% of average agricultural wage rate). Management cost
4.Non Timber Forest Products (including grass) - extraction method Consumption method	Per hectare value of NTFP collected in each circle – Value of NTFP in each circle / Net forest area in each circle. Value of NTFP in each circle = Value of NTFP collected in a normal year per household x No. of rural households (the value to be used is the relevant price in the nearest local market) or cost function to get actual market value of medicinal herbs based on the royalty or permit value collected. Household survey using Village input-output model	Cost of collecting NTFP = (No. of rural households) X (Total annual time cost of collection per household valued at 15% of average agricultural wage rate). Wage rate for labour inputs
5.Carbon Sequestration	Value of carbon stock = carbon content x market rate of carbon. Carbon Content= Biomass x IPCC-GPG default value1. Biomass = Growing stock x Conversion factor	No. direct costs.

6.Ecotourism/Landscape beauty	Per hec. Value of Eco-tourism in each circle = Total value of Eco-tourism in each circle / Net forest area in each circle. Value of Eco-tourism dependent on forest ecosystems = No. of people visiting different circles per year mainly due to natural beauty X average expenditure incurred per person	Costs incurred by the Forest Department in the maintenance, preservation and development of national parks and wildlife sanctuaries. The per hectare cost were calculated to arrive at costs for each circle. See Step 6 for common departmental costs.
7. Watershed function - soil building, nutrient movement, Hydrological and climate regulations, floodplain benefits	Value per hectare for specific watershed function based on secondary site specific studies.	As per site specific secondary studies.
8. Biodiversity/Bioprospeting (i) Actual value approach (ii) Option value approach	(i) Potential value of drugs that can be obtained from the bio-diversity present in forests (ii) insurance premium paid to ensure the supply of an asset, the availability of which otherwise would be uncertain	Cost of collection R&D costs

Note: (1) The value for fodder, fuelwood, NTFP are based on the report of the NSSO 54th round Survey on Common Property resources in India, (2) Annual values in column 2 for items 1-8 are calculated as per methodology developed by Verma et.al. (2003-2006) at the IIFM, Bhopal in the Project on ' Natural Resource Accounting of Land and Forest excluding mining) in the States of M.P. and H.P. sponsored by the Central Statistical Organization (CSO) of the Ministry of Statistic and Program Implementation, GOI.(4) Annual Costs in column 3 were calculated for items1-7 except for TDRs/Nistar and Salvage, Grazing and household consumption of NTFPs in Empowered Committee's Report on NPV, New Delhi 2006.

2.12 Key considerations in Valuation

In a nutshell, in the context of valuation of ecosystem services, its purpose and appropriateness of methodology are the key considerations. Stefano et.al (2004)[54] summarizes the approach, rationale and methodological framework for exercise as per the following table.

Table 18: Valuation of ecosystem services – when, why and how?

Approach	Why do we do it?	How do we do it?
Determining the total value of the current flow of benefits from an ecosystem	To understand the contribution that ecosystems make to society	Identify all mutually compatible services provided: measure the quantity of each service provided; multiply by the value of each service
Determining the net benefits of an intervention that alters ecosystem conditions	To assess whether the intervention is economically worthwhile	Measure how the quantity of each service would change as a result of the intervention, as compared to their quantity without the intervention; multiply by the marginal value of each service
Examining how the costs and benefits of an ecosystem (or an intervention) are distributed	To identify winners and losers, for ethical and practical reasons	Identify relevant stakeholder groups: determine which specific services they use and the value of those services to that group (or changes in values resulting from an intervention).
Identifying potential financing sources for conservation	To help make ecosystem conservation financially self-sustaining.	Identify groups that receive large benefit flows from which funds could be extracted using various mechanisms.

2.13 Challenges to Valuation Exercise

In order to provide true and meaningful scarcity indicators of forest ecosystem values and functions, economic valuation should account for the state of ecosystems wherin significant tradeoffs exist between conservation and economic development, and

54 Stefano,Pagiola et al. (2004), assessing the Economic Value of Ecosystem Conservation, TNC,IUCN-WB, Washington DC

decisions favor the latter. This case appropriately fits to the state of Uttarachal where considerable demands come from other sectors developmental projects and in all cases the developmental net benefits outweigh conservation net benefits. Therefore decisions based on 'snapshot' ecosystem values can provide false policy directives. In this regard the following table provides an insight into the approaches to valuation exercise.

Table 19: Avoiding common pitfalls to valuation[55]

Use net benefits, not gross benefits	**Failing to consider the costs involved in using resources (the cost of harvesting products), for example, or the cost of piping water from its source to the user) result in an over-estimate of the value of ecosystem services.**
Include opportunity costs	The cost of an action in not limited to the out of pocket costs involved in implementing it. They also include the opportunity costs resulting from the opportunity of alternative actions (or inaction). Omitting opportunity costs makes actions seem much more attractive than they really are.
Don't use replacement costs	….Unless you can demonstrate (i) that the replacement service is equivalent in quality and magnitude to the ecosystem service being valued (ii) that the replacement is the least cost way or replacing the service, and (iii) that people would actually be willing to pay the replacement cost to obtain the service
Don't use benefits transfer	….Unless the context of the original valuation is extremely similar to the context you are interest. Even then, process with caution. However, it is a good idea to compare your results to those obtained elsewhere.
Don't use value estimates based on small changes in service availability to assess the consequences of large changes in service availability	Economic value estimates are not independent of the scale of analysis. Value estimates are almost always made for small ("marginal") changes in service availability, and should not be used when contemplating large changes.
Be careful about the double counting	Many valuation techniques measure the same thing in different ways. For example, the value of clean water might be measured by the avoided health care costs or by a survey of consumer WTP for clean water, but consumer WTP for clear water is due (at least in part) to their desire not to fall sick, so these two results should not be added together, if they are, the value of clear water will be over-estimated.

[55] Stefano,Pagiola et al. (2004), assessing the Economic Value of Ecosystem Conservation, TNC,IUCN-WB, Washington DC

Don't include global benefits when the analysis is from a national perspective	**More generally, only consider benefits (or costs) that affect the group from whose perspective the analysis is being undertaken. Including benefits, which are primarily global in nature an analysis undertaken from a national perspective, is a particularly common from of this mistake, and results in an over-estimating of the benefits to the country.**
Adjust for price distortions	…..When concluding the analysis from the perspective of society as a whole, but not when conducting the analysis from the perspective of an individual group.
Avoid spurious precision	Most estimates are by necessity approximate. Don't simply paste the result in the spreadsheet, with its three decimal points, into the report; round the result appropriately. When there is substantial uncertainity, report the results as ranges.
Submit results to sanity checks	Are the results consistent with other results? Are they reasonable in light of the context? Extraordinarily results are not necessarily wrong, but must be checked carefully. Extraordinary results require extraordinary proof.

2.14 Estimates of Monetary Value of Forest Ecosystem in Uttarakhand under Different Valuation Scenarios

The Importance of natural forest ecosystems to human well being cannot be overstated. Forests provide raw materials for food, fuel and shelter. In forests, ecosystem components such as micro-organisms, soils and vegetative cover interact to purify air and water, regulate the climate and recycle nutrients and wastes. Without these and many other ecosystem goods and services, life as we know it would not be possible. When we make decision to alter natural forest ecosystems, we often given little though to the consequences that change may have on forest ecosystem services or to the ultimate cost of losing those services. This oversight stems from our incomplete knowledge about how changes in ecosystems affect the level of services that the systems provide and out inadequate understanding of the roles played be seemingly trivial ecosystem components. Perhaps the most significant factor is that few ecosystem services have clearly established monetary values but most of them have not. And this can have a strong impact, considering that many decisions are based on monetary estimates of ecosystem services.

The following sub - sections present values of ecosystem services from Uttaranchal forest under various methodological scenarios. This has been done to get a broader understanding as well as comparative estimates of different methodological frameworks using both quantitative and qualitative valuation techniques which might also help in cross checking the values which otherwise would either be underestimated or overestimated. This would further help in selecting the appropriate combination of valuation techniques for valuing forest ecosystem services in Uttaranchal through

detailed secondary and primary data so as to eventually adjust the SDP of the state and to get proper award of funds for sustainable management of Uttaranchal forests.

2.14.1 Scenario I : Values of Ecosystem Services from Uttarakhand Forest Based on Estimates of Costanza's[56] Framework

While people appear to value the non market services associated with forest ecosystems, quantifying the value of these goods and services in monetary terms is difficult. Costanza et al. (1997b) identified 17 specific goods and services provided by ecosystems: gas regulation, water regulation, water supply, erosion control and sediment retention, soil formation, nutrient cycling, waste treatment, pollination, biological control, refugia, food production, raw materials, genetic resources, recreation and cultural services. The Costanza study provides a revealing but rough estimate of the magnitude of ecosystem service values on a global scale, and the reported values can serve as a basis for estimates relevant to specific regions or ecosystems. The following table provides the estimates of forest ecosystem values for tropical, temperate and all forests of US.

Table 20: Estimates of Forest Ecosystem Values by Costanza, 1997

Ecosystem goods or services	Market nature of servicea	Global values by forest type ($/acre)b All forest	Tropical	Temperate Boreal	Value of all US forestc
Climate regulation	NM	57.1	90.2	35.6	18.5
Disturbance regulation	NM	0.8	2.0	n.a.	n.a.
Water Regulation	NM	0.8	2.4	0.0	0.0
Water supply	M,NM	1.2	3.2	n.a.	n.a.
Erosion control and sediment retention	NM	38.8	99.1	0.0	0.0
Soil formation	NM	4.0	4.0	4.0	2.1
Nutrient cycling	NM	146.1	373.1	n.a.	n.a
Waste treatment	NM	35.2	35.2	35.2	18.3
Biological control	NM	0.8	N.A.	1.6	0.8
Food production	M	17.4	12.9	20.2	10.5
Raw materials	M	55.8	127.5	10.1	5.3
Genetic resources	M,NM	6.5	16.6	n.a.	n.a
Recreation	N.NM	26.7	45.3	14.6	7.6
Cultural	NM	0.8	0.8	0.8	0.4
Total		392.1	812.2	122.2	63.6

Note: n.a. = Not available.

56 Costanza R. et al. 1997b. The Value of World's Ecosystem Services and Natural Capital. Nature 387:253-60

a. "NM denotes a good or service that is primarily non – market in nature. "M" denotes a primarily market good or service. "MNM" denotes a good or service that has significant market and non-market characteristics.
b. Calculated from the $/hectare estimates of Costanza et al. (1997b) based on a conversion factor of 2.471/acres / hectare. All values are in US 1994 dollars.
c. Estimates for the United States were based on a total area of 520 million acres of temperate / boreal forest

The Uttarakhand Forest ecosystem services monetary values have been worked out using the estimates of tropical forest.

Table 21a: Estimates of Forest Ecosystem Values of Uttarakhand as per Values Generated for Tropical Forest Ecosystem Services by Costanza, 1997 - For total Forest area of 34650 sq. kms.

Ecosystem good or service	Market nature of service	Global values by forest type - $ / acre (Rs/Acre) All Forests of the world	Tropical Forests	Value of Uttaranchal forests- In $ (Rs)* for total forest area (8562175.61 Acres- figure rounded off to 8652175)
Climate regulation	NM	57.1	90.2 (4089)	$ 772308185 (Rs. 35010733575)
Disturbance regulation	NM	0.8	2.0 (90)	$ 17124353 (Rs. 770595750)
Water regulation	NM	0.8	2.4 (108)	$20549220 (Rs.924714900)
Water supply	M.NM	1.2	3.2 (144)	$ 27398960 (Rs.1232953200)
Erosion control and sediment retention	NM	38.8	99.1 (4459.5)	$848511542 (Rs. 38183019413)
Soil formation	NM	4.0	4.0 (180)	$34248700 (Rs.1541191500)
Nutrient cycling	NM	146.1	373.1 (16699.5)	$3194547493 (Rs. 142984041412)
Waste treatment	NM	35.2	35.2(1584)	$ 301388560 (Rs. 13562485200)
Biological control	NM	0.8	n.a.	-
Food production	M	17.4	12.9 (580.5)	$110452057 (Rs. 4970342588)
Raw materials	M	55.8	127.5(5737.5)	$1091677313 (Rs.49125479063)
Genetic resources	M.NM	6.5	16.6(747)	$ 142132105 (Rs. 6395944725)
Recreation	M,NM	26.7	45.3(2038.5)	$ 387866527 (Rs.17453993738)
Cultural	NM	0.8	0.8(36)	$6849740 (Rs. 308238300)
Total		392.1	812.2 (36549)	$6954198535 (Rs. 312938934075)

Note : (i)NM" (ii) "M" as per table 20.
***** Calculated for total Uttaranchal Forest area i.e. 3465065 Hectares or 8562175.61 Acres (conversion factor of 2.471 acres/ hectare) ansd 1$= Rs. 45. All values are in Rs. Lakhs

Estimating the forest ecosystem services values using the average values generated in Costanza's study, it is fond that Uttarakhand's forest area generate Rs. 31293 crores per acre of ecological services besides the tangible ones which are though partially recorded in the system of accounting of the state income. Amongst the ecological services the nutrient cycling function adds the maximum value of Rs. 14298 crores, followed by value of raw materials (Rs. 4912 crores), Erosion control and sediment retention (Rs. 3818), recreation (Rs . 1745), climate regulation (Rs 350 crores), genetic resources (Rs . 639) and food production (Rs. 497). Low values were found for water supply and regulation, soil formation and noise disturbance.

The values have also been estimated for the area under forest and tree cover (6186395.61 Acres) from here the values actually emanate, the total value per acre comes to Rs. 22610 . Individual values emanating from existing forest and tree cover of various ecosystem services are shown in the table 21.

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Table 21b: Estimates of Forest Ecosystem Values of Uttarakhand as per Values Generated for Tropical Forest Ecosystem Services by Costanza, 1997 - For total area under Forest and tree cover 25036 sq. kms.

Ecosystem good or service	**Market nature of service**	**Global values by forest type - $ / acre (Rs/Acre)**		**Value of Uttaranchal forests- In $ (Rs)* for total area under forest and tree cover (6186395.61 Acres- figure rounded off to 6186395)**
		All Forests of the world	**Tropical Forests**	
Climate regulation	NM	57.1	90.2 (4089)	$ 558012829 (Rs.25296169155)
Disturbance regulation	NM	0.8	2.0 (90)	$ 12372790 (Rs556775550)
Water regulation	NM	0.8	2.4 (108)	$148447348 (Rs.668130660)
Water supply	M.NM	1.2	3.2 (144)	$ 19796464 (Rs.890840880)
Erosion control and sediment retention	NM	38.8	99.1 (4459.5)	$613071744 (Rs. 27588228503)
Soil formation	NM	4.0	4.0 (180)	$24745580 (Rs.1113551100)
Nutrient cycling	NM	146.1	373.1 (16699.5)	$238143975 (Rs.103309703302)
Waste treatment	NM	35.2	35.2(1584)	$ 217761104 (Rs.9799249680)
Biological control	NM	0.8	n.a.	-
Food	M	17.4	12.9 (580.5)	$79804495

production				(Rs.3591202298)
Raw materials	M	55.8	127.5(5737.5)	$788765362 (Rs.35494441313)
Genetic resources	M.NM	6.5	16.6(747)	$ 102694157 (Rs.4621237065)
Recreation	M,NM	26.7	45.3(2038.5)	$ 280243693 (Rs.12610966208)
Cultural	NM	0.8	0.8(36)	$4949116 (Rs 222710220)
Total		392.1	812.2 (36549)	$5024590019 (Rs.226106550855)

Note : (i)NM" (ii) "M" as per table 20.
***** Calculated for total Uttaranchal Forest area i.e. 2503600 Hectares or 6186395.6 Acres (conversion factor of 2.471 acres/ hectare) ansd 1$= Rs. 45. All values are in Rs. Lakhs

2.14.2 Scenario II : Values of Ecosystem Services from Uttarakhand Forest Based on Estimates as per Forest Disability Index

The finance division of the Planning Commission worked out an interesting index called as the forest disability index based on the reasoning that on account of keeping large area under forest. There has been loss of Rs. 467831 per sq.km. net revenue from forest conservation in relation to the production in relation to agricultural sector productivity. Taking the value further to the overall loss, there has been net loss of Rs. 1621 crores annually to the state on account of forest conservation. The current contribution of the forest sector to the SDP of Uttarakhand is only Rs. 511 crores annually. If we further net it out from Rs. 1621 crores, the final annual loss to the forestry sector comes to Rs. 1110 crores. In exchange of sacrifice of this revnue the sector provides tremendoua amount of watershed services specially water to the downstream regions. The the finance commission should consider these figures as base figures for providing compensation to the state for reaching the target of forest cover in its 64.79% of geographical area.

Table 22: Computation of Forest Cost Disability Index for Uttaranchal vis-a vis-Other States having large Geographical Areas under Forest57

S.No.	Items	Madhya Pradesh	Himachal Pradesh	Uttarakhand
01.	Total Area of the state	308,245	55,673	53483
02.	Area under Forest(Sq. km)	95,221	35,407	34,650
03.	Percentage of Area Under Forest	30.90	63.60	64.79
04.	Per Unit Cost of maintenance(Rs. Per Sq. Km.)	41856	41856	41856
05.	Total Cost (Rs.)	3976320000	1481995392	1450310400
06.	NSDP from Agriculture	152877000000	27486800000	40428400000
07.	Agriculture Income Less Forest Cost	148900680000	26004804608	2592529600
08.	Revenue Loss (Per Sq.Km.)	156373	467099	467831

[57] Adapted from Finance Department, Planning Commission Report 2002-2003

The values reflected here can help assessment of compensation to the van panchayats who have been managing forest incur considerable costs in terms of their labour & time inputs but still do not get enough incentives for sustainable management of such forest areas. The compensation so received by the department can be shared with the van panchayats in proportion to te protected and reserved forests maintained by them.

2.14.3 Scenario III : Values of Ecosystem Services from Uttarakhand Forest Based on Estimates of P.J. van der Meer study on Goods and Services from Cultivated Forests in Garhwal Region, Uttaranchal, India58

A study undertaken for the project Networking Forest Plantations in a crowded world: optimising ecosystem services through improved planning and management strategies (NETFOP) with ICFRE, Dehradun for the EU, 2005-06 by experts from the Netherlands, Germany and India focused on plantation forest conducted during 2005-06 drew on the European expertise in quantifying and using modelling approaches for ecosystems services at the stand and landscape levels and the Indian experience in the socio economic and participatory aspects forest management. The objectives of the study were as follows:

1. To improve the management of plantations of EG&S through the development of a methodology for assessment and monitoring.

    a. Assess the various benefits and services (Fuel wood, fodder, grazing, water, minor forest products, indigenous medicines, carbon sequestration, recreation, employment, salinity and soil erosion control) by the plantations on public, community and private lands as perceived by the various sections of the society (local people, forest departments, and scientist) through comparative studies in a developing country (India) and developed countries (Germany and Netherlands).
    b. Quantify the socio-economic impacts of these various ecosystem services provided by the forested lands on rural development and poverty alleviation in the rural areas of northern India under various plantation programmes involving participatory management programmes in hills that are relatively well forested and compare with that in plains that are dominated by the irrigated agricultural lands.
    c. Evaluate silvicultural treatment in manipulating the ecosystem services from the plantations on public and community lands using comparative studies in India, Germany and Netherlands.

2. To increase the awareness of role of plantations in providing EG&S.

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[58] P.J. van der Meer, A.F. Olsthoom, J. Schmerbeck & R.de. Groot. 2006. Presentation titled 'Goods and Services from Cultivated Forests in India, Germany and the Netherlands' conducted for the project Networking Forest Plantations in a crowded world: optimising ecosystem services through improved planning and management strategies (NETFOP) with ICFRE, Dehradun for the EU, 2006
http://www.icfre.org/institutes2/netfop/index.htm

a. Establish a network on the planning and management of forest plantation with a focus on ecosystem services.
b. Explore and learn from comparative case studies on diverse and changing nature of community involvement in public and community land use management in the target countries.
c. Develop a joint knowledge based management system that will form the basis for developing university courses on ecosystem services and their management for Environment and Forestry curricula.

3. Optimizing planning of plantations for EG&S

a. Analyse ecosystem services management at landscape level and develop prescriptions/ tools to optimise them based on landscape position.
b. Develop and suggest guidelines to incorporate the knowledge gained through theses studies in management plans for sustainable management of plantation areas to address sustainable utilisation of land resource and their development to improve the net social benefit through participatory management.

The methodology adopted by the study included evaluation of the ecosystem benefits of plantations on community and forest lands as perceived by the rural community and maximizing these benefits for land use planning through a modeling approach for meeting the needs of the rural community under a given set of constraints. It involved an interdisciplinary approach involving academicians and scientists with silviculture, botany, social, resource use planning, forest extension, economics and system modeling expertise. Reviews of the existing techniques, ongoing projects on similar land use systems, community participation in decision making were carried out , so as to built the project base from the current state of affairs and knowledge and avoid duplication of work. To address the multiple interests and values of plantations on community and public lands, case studies and survey methods, to identify what is important to the community, were adopted. These benefits assessment for plantations was done in isolation but within a broader framework in real decision making by including socio-economic surveys. A method for multidisciplinary landscape assessment for exploring biological diversity, environment and local people's perspectives in forest landscape (CIFOR, 2002) was followed and suitably modified to develop the methodology fulfilling the requirements of European and Indian situations. Such a methodology allowed for a collaborative process to define and collect decisive information with regard to environmental impacts and local people's perspectives. The field methods emphasize the landscape-scale characterization through high replication of small data-rich samples and community based assessments to assess local values of afforestation products and landscape units. Community participation was studied based on case studies of past and ongoing community and forest land plantation programmes in the project area.

The following section presents the provisional findings of the work[59] as stated in the presentation titled 'Goods and Services from Cultivated Forests in India, Germany and the Netherlands' by P.J. van der Meer, A.F. Olsthoom, J. Schmerbeck & R.de. Groot. 2006. The presentation mentions use of Community meeting, household questionnaire, key person interviewed and Pebbles distribution of (PDM) for the collection of primary data. The Indian component of the study was conducted in Indian site of Garhwal region of population of 3.5 million (151 persons per Km2) with forest and vegetation of Low zone: Sal trees (Shorea robusta), Middle zone: Chir pine (Pinus roxburghii), High zone: Oak (Quercus leucotricophora) and Deodar (Cedrus deodara). 4 villages in three ecological zones were included (low zone: 600-1000m), middle zone (1000-1600m) and high zone (>1600m) were surveyed. The following table provides details of surveyed villages.

Table 23 : Village Profile of the Study area in Garwahl

	Kalimati (Low)	**Silla (middle)**	**Dabell (High)**	**Bureskhand (High)**
General description	Sub-urban	Remote	Tourist	Tourist
Elevation (meter)	650	1600	1600-2000	220
Ecological Zone	Sal and associates	Oak and Chir pine	Oak and Deodar	Oak and Deodar
Number of household	35	46	65	60
Population	253	340	940	855
Status of the state forest	Partly degraded	Dense	Dense	Strongly degraded
Community forest management	Village forest committee	Van Panchayat	Village Forest committee	Watershed committee

Various important parameters seem to have been kept in mind to represent the diversified fabric of the villages including their management practices. The study used the typical Millennium Ecosystem Assessment, 2005 framework to describe various ecosystem services of the region. The findings of the study are presented through Tables 24 to

[59] The P.J. van der Meer, the Lead presenter of the work has also been contacted to get the detailed findings. As the final report is under the process the provisional figures mentioned in the study have been included in the report to understand the comparative values under different scenarios.

Table 24 :Quantification of Provisioning service in the Garwhal Region

Provisioning services	Total quantities (Kg/hh/yr)	% of forest	Quantities from forest (kg/hh/yr)
Food products	38	68%	26
Raw material(timber, fibre, baskets)	77	69%	53
Energy (fuelwood)	1794	69%	1229
Cattle-related products (fodder, cattle-bed)	6603	58%	3815
Agriculture related products (manure and others)	8215	61%	4997
Genetic resources		90%	-
Medicinal resources		30%	-
Ornamental resources		60%	-
Cultivation (grazing)	16419	67	10939
Water (Sanitary facilities	-	34%	-
Total	31,146	64%	21,059

The table clearly shows heavy dependence people on forest resources as 67.6% household requirement is met through forest of the region.

Table 25: Quantification of Provisioning service in the Garwhal Region – across landscape

Functions	State Forest	Com forest	Agri. Land	Grass land	River and streams	Fallow land	Villages
Food products	5	2	4	7	3	6	1
Timber (Const.)	1	2	6	4	7	5	3
Timber (tools)	1	2	4	5	7	3	6
Fuelwood	1	2	3	5	5	4	7
Grazing	1	2	5	3	6	4	7
Fodder	1	6	2	3	7	5	4
Cattle bed leaves	1	2	4	5	6	3	6
Medicinal Plants	3	4	1	6	7	5	2
Ornamental	1	2	3	5	6	4	7
Propagules	1	2	3	5	6	7	4

Table 26: Provisioning Service from Surveyed Garwhal villages - Economic Benefits

Provisioning Services	Quantities from forest (kg/hh/yr)	Price (€ Kg)	Direct market value €/hh/yr)
Food products	26	012-1.52	14
Raw materials (timber, fibre, baskets)	53	138-517	15
Energy (fuelwood)	1229	0.05	61
Cattle – related products (fodder, cattle-bed)	3815	0.02/0.006	57
Aricultural-related products (manure and others)	4997	0.006	31
Genetic resources	-	-	-
Medicinal resources	-	-	-
Ornamental resources	-	-	-
Cultivation (grazing)	10939	0.02	219
Waste (Sanitary facilities	34% respondents	187€ Sanitary facility	1
TOTAL			(399) 75% of annual income (€ 533)

The table shows that the 75% of the annual income of the people cones from the sale of marketable products from forests.

Table 27: Information Service from Surveyed Garwhal villages Importance landscapes units

Function	State forest	Com. Forest	Agri. Land	Grass land	River & stream	Fallow land	Village
Aesthetic	1	4	2	5	3	7	6
Recreation	4	2	6	3	1	4	5
Cultural heritage	5	4	2	2	6	3	4
Inspiration	1	2	4	5	6	7	3
Spiritual and religious	5	4	2	5	6	1	3
Education	1	2	3	6	7	6	4

Table 28: Information Service India – overall valuation

Information functions	Ecological Value (1)	Socio-cultural value (2)	Economic Value (3)	Total Value	Rank
Aesthetic	0	10	2	12	3
Recreation	0	7	3	10	4
Cultural heritage and identify	11	10	1	22	1
Inspiration	0	7	0	7	5
Spiritual and religious	5	8	1	14	2
Education	5	4	1	10	4

(1)Especially in giving uniqueness/ rarily and renewability value
(2)Especially in giving health (therapeutic) and heritage value
(3)Especially as attraction for forest nature-based tourism.

Table 29 : Regulating service from Surveyed Garwhal villages – ranking per village

Function	Kalimati (low-urban)	Sills		Average rank
Local climate regulation	1	1	1	1
Soil quality maintenance	6	2	2	2
Water flow regulation	4	5	4	3
Water quality maintenance	2	8	5	4
Natural hazard regulation	5	4	7	5
Air quality regulation	2	9	6	6
Erosion control	6	3	9	7
Pollination	8	7	3	7
Biological control	8	6	6	8

Table 30: Regulating Service from Surveyed Garwhal villages – Importance landscape.

Function	State forest	Com. Forest	Agri. Land	Grass land	River & stream	Fallow land	Village
Local climate regulation	1	2	5	6	3	7	4
Soil quality maintenance	1	2	7	4	3	5	6
Water flow regulation	1	2	4	5	7	5	3
Water quality maintenance	1	2	5	4	3	6	7
Natural hazard regulation	1	2	4	5	7	3	6
Air quality regulation	1	2	4	6	3	7	5
Erosion control	1	2	4	3	7	5	6
Pollination	1	3	2	7	6	5	4
Biological control	1	2	3	6	6	6	4

Table 31 : Regulating Service from Surveyed Garwhal villages – Valuation

	Direct market value (Rs./hh/yr)	Indirect market value (Rs./hh/yr)	Willingness to pay (Rs./hh/yr)	TEV (Rs./hh/yr)
Erosion control		V		4300
Water flow regulation		V		
Water quality maintenance	470	V		9200
Soil quality maintenance		V		4300
Natural hazard regulation		V		4300
Air quality regulation		X	4100	4100
Local climate regulation		V		4300
Biological		V		4300

control				
Pollination		V		4300

The presentation indicates that the forests of Uttaranchal are most important landscape units for provisioning and regulating functions (PDM). Less-developed" village is more dependent on provisioning services than more developed villages and economic value provisioning and regulating service very high (75% - 100% of average annual income). Though it collected qualitative data for information services but found them difficult to value economically. The per households TEV can be can be extrapolated for the rural household population to estimate the benefits derived from Uttaranchal forests.

2.14.4 Scenario IV : Values of Ecosystem Services from Uttarakhand Forest Based on Estimates of the Green Accounting for Indian States and Union Territories Project (GAISP) 2004-06

The Green Accounting for Indian States and Union Territories Project (GIST) has conducted studies on forest ecosystem services using the available secondary data and attempted to adjust the national account using the improved estimates for forest values. (Summary tables Annexure I)

The GIST study component of ecological services of India's forest estimated soil loss prevented by forest of India wherein for the dense forest of 1.90 million ha in Uttranchal the soil loss prevented was 23.38 million tones in the year 2001 and 22.64 million tones in 2003. Nutrients of run off were Nitrogen (2.32 mg per g), Phosphorus (0.44 mg per g), Potassium (8.25 mg per g) and organic carbon (22.5 mg per g). For N, P, K, organic matter the nutrient loss for Uttrachal was estimated as 54.24, 1.03, 192.88, 526.03 million kg for the nutrients as above respectively in 2001 whereas the figures stood at 52.53, 1.00, 186.79 and considerable increase of organic matter run off to 5094.14 in 2003-04. The economic value of nutrient loss was estimated at total 228.23 crores in 2001-02 and 221.02 crores in 2003. Thus the change in economic value over 2003 -2001 for nutrient loss in soil erosion prevented by dense forest was estimated as -7.21 crore rupees. Further the economic value of differential water charge due to dense forest only was estimated at 12.2 crores in 2001 and 11.8 crores in 2003 in Uttranchal state. The flood avoidance benefits for dense forest area was estimated at 540.36 crores in 2001 and 523.29 crores for effective avoided flood damage. Thus totaling the valuing the nutrient loss, water recharge and flood benefits Rs. 1188.49 crores worth of ecosystem services were provided by Uttranchal forest in 2001 with annuity value of Rs. 29712.4 crores. The total value stood at 1150.95 crores annually for these services and 28773.97 crores for annuity value in 2003. Thus the change in annuity value for ecological services was 930.49 crores in the state. Adjusting these figures to the net domestic project there was a decline of 1.79% in the value i.e. the ESDP was 98% of NSDP.

Another component of GIST project estimated the biodiversity value of Indian forest using data of National Parks in the state and generated net consumer surplus estimates from ecotourism in UP and Uttranchal state. It further worked out the marginal willingness to pay by the pharmaceutical companies for bioprospecting for the state of

Uttar Pradesh which worked out to be Rs. 76728/- based on all species in the state. The adjusted value of ESDP worked out to be 92% of NSDP. The present value per hectare for non use values for species conservation estimated to be Rs. 25 lakhs for flagship species Rs. 1 lakh.

The value of timber, carbon, fuelwood and NTFP were worked out for the undivided state of UP which was estimated as 2123 lakh Cu.m, 1255 lakh tones of carbon. The per ha carbon in biomass was estimated as 34.5 TC/ha whereas the value of NTFP is estimated as 812.5 per ha (20311 as NPV), value of fodder Rs. 111.5 per ha and NPV of fodder at Rs. 2786.3. When the values were adjusted in National Accounts not much significant change could be found in the ESDP and NSDP values.

2.14.5 Scenario V : Values of Ecosystem Services from Uttarakhand Forest Based on Estimates of the project on Natural Resource Accounting of Land and Forest (excluding mining) in the states of Madhya Pradesh and Himachal Pradesh by IIFM for the Central Statistical Organisation, MOSPI, GOI (2003-06)

The proposed framework as given in section 2.11 based on the methodology developed and data generated in NRA Project of CSO at IIFM by Verma et.al. (2003-2006) for annual values from forests from the states of Madhya Pradesh and Himachal Pradesh. The state of Himachal Pradesh and state of Uttaranchal nearly have same forest area i.e. 37,033 sq. kms and 34,662 sq. kms with forest and tree cover on 14,844 sq. kms and 25,036 sq. kms respectively. Thus the due to vegetative and locational similarity , the per hectare values for ecosystem services generated under IIFM-CSO project based on the methodology explained in section 2.11 have been used to generate the values for ecosystem services from Uttaranchal forest. It can be seen in the following table that the Uttaranchal forest provides whopping sum of Rs. 124761 crores through watershed values followed by the Rs. 27815 crores from carbon sequestration function and total indirect benefits worth 17312 crores annually. The state provides 161921 crores worth of ecosystem services annually whereas the recorded value in the current system of SDP is only Rs.510.96 Crores in 2003-04, which is just 0.31% of the actual provisioning of various services.

Table 32 : Value of Ecosystem Service of Uttranchal State (2005)

S.No.	Ecosystem Service	Per ha value of forest and tree cover area in HP	Extrapolated value of forest and tree cover area in Uttranchal (2503600 Ha)
I. Direct Benefits			
A. Direct consumptive benefits			
1	Timber logging	221.30	**554046680 (Rs. 55Crores)**
2	Fuelwood	762.73	**1909570828 (Rs. 190Crores)**
3	Fodder (collection)	546.95	**1369344020 (Rs.137 Crores)**
4	Grazing	2607.20	**6527385920 (Rs. 652Crores)**
5	Minor forest produce	195.16	**488602576 (Rs. 49Crores)**
	Total Direct consumptive benefits	4334.61	**10852129596 (Rs. 1058Crores)**
B. Direct non- consumptive benefits			
6	Ecotourism Indian visitors – Foreign visitors –	 3061.03 209.04	**7663594708 (Rs.766 Crores)** **523352544 (Rs.52 Crores)**
	Total Direct benefits (A + B)	7603.42	**19035922312 (Rs. 1903Crores)**
II. Indirect Benefits			
7.	Watershed benefits	498329.29	**1247616484400 (Rs. 124761Crores)**
8.	Microclimatic factors	976.82	**2445566552 (Rs. 244Crores)**
9.	Carbon stock Carbon Flux	111102.12 653.73	**278154967200 (Rs. 27815Crores)** **1636678428 (Rs. 163Crores)**
10.	Biodiversity	27917.00	**69893001200 (Rs. 6989Crores)**
11	Employment generation	168.41	**421631276 (Rs. 42.1Crores)**
	Total indirect benefits (6 to 11)	639150.16	**173123940000 (Rs. 17312Crores)**
	Total economic value of ecosystem services (I+II)	**646753.59**	**16192108108000 (Rs.161921Crores)**

Framework adapted from Verma, 2000 – as used in IIFM- CSO study 2006

2.14.6 Scenario VI : Values of Ecosystem Services from Uttarakhand Forest Based on Independent Studies conducted by Lead India and CHEA and other experts under the current project of Lead India on Valuation of Forest Ecosystem Services in Uttarakhand Himalayas and some external studies on additional values (Annual in Rs.)

Table 33 : Ecosystem services values from independent and external studies.

S.No.	Ecosystem Service	Study Base and values	Annual Value in Rs.
01.	Silt control	Nainital Lake study : 3157 tonnes of silt control from Nainital forest of 600 acres (242.8 Ha.), costing Rs. 2 Lakhs annually i.e. Rs. 823.7 /ha	**Extrapolating to the Forest and tree cover area of Uttaranchal = Rs. 206.22 crores (FTC of 25036 sq.kms)**
02.	Carbon Sequestration	Net accumulation in Biomass@ 6.6 M t C per year @ US $ 10 per t of C	**US$ 66.1 Million or Rs. 297.45 crores (US$ 1 =Rs 45) for the area of 23528.05 sq.km**
03.	Soil carbon pool	263.58 M t C upto 1.5 m depth	**US$ 2635.8 Million or Rs. 11,861 crores**
04.	Landscape beauty	(i) National parks (UAFD statistics 2004-05) – for the forest area of 24413 sq.kms. (ii) Nainital lake @ Rs. 3020 per Ha. (Lower estimate) and (iii) Nainital lake @ Rs. 4260 per Ha.(Upper estimate)	**(i) Both from Indian and foreign tourist in the year 2005-06 – Rs. 12.44 crores** **(ii) Extrapolating to FTC of UA = 756.08 crores** **(iii) Extrapolating to FTC of UA = 1066.53 crores**
05.	Logging* Fuelwood* Fodder* and other products	Rs. 151.06 crores as total revenue earned by forest department (2005-06)	
08.	NTFPs	Resin, minor minerals, stone flower or Jhula, Moss grass	**Rs. 11.61 Lakhs**
09.	Ecological succession value of Forest60	(i) Fallow lands(<5years old) @US$ 8.20/Ha/Year (ii) Young Secondary Forest(5-20 Years old)@US$ 20.60/Ha/Year (iii) Old Secondary Forest (>20 Years old)@US$ 6.80/Ha/Year	**For FTC area using the estimate of Young Secondary Forest = 232 crores**
10.	**Pollination Service (Per Ha. Value is estimated for Forest area in USA 36504000 Ha.)***	**(i) Supplementary services of honeybee to Native pollinators = US$ 1.6 Billion in USA (for USA Forest = Rs1972/Ha)*** **(ii) Estimated value of managed honeybee in absence of native pollinators = US$ 8.3 Billion in USA (Rs 10231/Ha)*** **(iii) Native benefit of all other pollinators = US$ 4.1 billion -US$ 6.7**	**(i) Rs. 493.70 crores** **(ii) Rs. 2561 crores** **(iii) 1265 crores - Rs. 2067 crores)**

[60] Michael C. Gavin.December 2004. Changes in Forest Use value through Ecological succession value of Forest and Their Implication for Land management in the Peruvian Amazon. Conservation Biology. Vol. 18 Issue 6 Page 1562.

		billion annually	

* Estimated by the authour assuming the value emanating from USA forest area

The above estimates further throws light on the important role played by the state forest and the need for recognition of these values in the accounting system of the state.

Table 34: Other Vital Information Relating to Uttranchal Forest (2005-06)[61]

S.No.	Item	Value (Rs.)
1	Forest revenue	151.06 crores
2	Non Plan expenditure	111.85 crores
3	Plan expenditure	201.70 crores
4	Total expenditure	313.55 crores (raised to Rs. 600 crores – Rs. 300 crores for non-plan and plan in 2006-07)*
5	Annual plan budget provision	205.59 crores
6	Annual plan expenditure	201.70 crores
7	Livestock pressure cow Buffalo Sheep Goat	 2188182 Nos. 1228194 Nos, 295845 Nos. 1158197 Nos.
8	Forest fires Affected area Estimated loss Illicit felling (a) number of cases (b) volume of trees (c) Quantity of ceased timber (d) Compensation realized	 3652 ha 10.82 lakhs 1777 1898 Cu.mt. 599 Cu.mt. Rs. 5.80 lakhs
9.	**Encroachment in forest area**	**9822 ha**

3. Response to third TOR : Mechanisms that facilitate developing PES for identified forest ecosystem services benefiting local communities and other key stakeholders.

3.1 Evolving Markets and Incentive based Mechanisms for ecosystem services from forest

[61] Source : UFD Statistics 2005-06, *personal discussion

There is increasing appreciation around the world of the role played by forests in providing important environmental services such as carbon sequestration, landscape beauty, biodiversity conservation and watershed protection. As many of these services are facing increasing threats there is recognition that existing, traditional regulatory approaches and public expenditures alone may not suffice to ensure their protection and sustained flow. Thus, in many parts of the world, explicit value is being placed on these services and real payments are being generated for forest owners and managers acting as incentives for conservation. In many cases poor communities residing in upstream catchments in and around forests have an important role to play as stewards of the area. The increased incentives for undertaking conservation therefore hold a huge potential for directly improving their livelihoods. The case of Uttaranchal becomes more specific where the forest constitute an important component not only for the people living in Uttaracnchal but also in downstream regions. Thus stakes of various communities are very high in conserving the forests of the state.

Under the "conventional, hard, centralized and regulatory" approach towards environmental conservation, it has been the responsibility of governments to ensure access to ecosystem services where these are scarce relative to demand. The main instruments have been direct forest management by government agencies, regulation of private forest use, public investment to improve private management, or targeted taxes and subsidies. These factors include lack of financial incentives for providing forest ecosystem services, concern for sustainable timber production, finding means to finance forest conservation and provision of safety net services from forest to reduce poverty. But in recent years there has been a paradigm shift towards "soft, participatory and facilitative" approach several factors have stimulated those concerned with tropical forest ecosystem services to begin exploring ways to create market based instruments with the involvement of all concerned stakeholders.

The need for exploring the relevance of alternative and complementary approaches such as ‘Payments for Environmental Services’ (PES) is particularly true in the case of India, where over two-thirds of the country’s total cultivable land is environmentally fragile and facing varying degrees of degradation. Public forests, which legally constitute 23 % of the country’s total geographical area, and comprise some of the most important watersheds also face severe pressures from a growing human and livestock population. A large proportion of the rural population is still directly dependent on forests for their basic subsistence and livelihood needs. It is estimated that nearly 170,000 villages with a total population of 147 million are located in the vicinity of forests. Further, many upstream areas are being increasingly harnessed for hydropower and other projects, the benefits of which accrue over a large scale downstream, but the efficient functioning of which is contingent upon the protection of critical forest areas / watersheds upstream. The recent draft National Environment policy of India mentions that foremost amongst the environmental services provided by forests is the role-played in the recharging of mountain aquifers, which sustain our rivers.

The Government of India (GoI), realizing the limitations of the regulatory and public expenditure approach and the fact that it is impossible to protect forests without the full

and active participation of local communities who depend on them, has in recent years adopted a more participatory approach to natural resources management through programmes such as Joint Forest Management (JFM), participatory watershed development and Participatory Irrigation Management (PIM). While these have been successful in may respects, it has been found that most often the incentives offered are insufficient to alter land use and management practices of poor forest dependent communities. Equity in watershed protection projects is an important issue, as most benefits accrue disproportionately to the landed and rich within a community while the costs are borne by the poorer and landless forest dependent communities. In the case of larger downstream beneficiaries such as hydropower projects and urban water supply agencies too, there are no payments made to upstream communities for the watershed protection services that they provide to the former, be it reduced siltation or improved water flows and water quality.

The state of Uttaranchal is also facing similar situation where the cost of conservation is borne by the forest conserving local communities and the large benefits are reaped by other key stakeholders. The need for introduction of enough incentives for all forest conserving communities specially the 12,064 Van Panchayats of the state conserving 523,289 Hectare area of the state becomes more pertinent in this case for sustainably managing the strategically located frets of Uttaranchal state. Given this scenario, facilitation of Payment for Ecosystem Services (PES) are extremely relevant in India, as they offer the potential of addressing both conservation and livelihood concerns.

There has been an increasing trend all over the world to set up mechanisms for PES. A recent global survey found almost 300 new cases of payments in all continents. For example, a private Costa Rican utility company voluntarily pays into a fund that provides money for private upstream landholders to increase forest cover. This reduces sedimentation, thus providing sufficient water flow for hydroelectricity generation. In Paraguay, AES, an international power company, paid US$2 million to form a protective reserve for one of South America's last remaining areas of undisturbed dense tropical forest. This helps to offset carbon emissions. In Karnataka State, India, farmers have formed a fund with the assistance of an NGO, the Government of India and the Swiss Agency for Development Cooperation to help other local farmers with watershed protection activities such as regenerating forest and maintaining fallow land. The following Table 35 gives an overview of such PES mechanisms around the world highlighting the main instruments and the actors who need to pay for availing ecosystem services. The past decade has seen the widespread emergence of systems for financial payments for forest ecosystem services Table 36 provides summary of such mechanisms including the providers, the buyers and the relevant instrument to set up the PES mechanism.

Table 35: Instruments to promote forest ecosystem services[62]

Land actors	Instrument	Examples	Who pays?
Government	Public direct management of forest resources	National forests and forest protected areas	Government (taxpayers)
Government	Regulation of private forest resource management	Harvest permits, rules on logging methods	Private forest owners & managers
Government	Support services for forest owners/users' own initiatives	Technical assistance program for forest owners to improve management	Government or NGOs
Government	Public pricing policies to reflect ecosystem costs and benefits	Lower tax rate on forested land	Mixed; indirect incentive (outcome not measured)
Government market	Open trading deals under a regulatory cap or floor	Carbon trading under the Kyoto Protocol	Consumers or producers subject to cap (least cost)
Government Market	Public payments to private land and forest owners to maintain or enhance ecosystem services	Agro-environmental payments for forest conservation easements on farms	Government
Market	Self-organizing private deals	Payments by a water bottling company to upstream watershed managers	Private company, NGO, community (user)
Market	Ecolabelling of forest or farm products	Forest certification	Consumer, intermediary

[62] International Tropical Timber Organisation (ITTO), The Current Status of Future Potential of markets for ecosystem services Provided by Tropical Forests, Technical series No. 21, October, 2004.

Table 36 : Examples Of Payments For Forest Ecosystem Services[63]

Name of case study	Water-related ecological service provided	Supplier	Buyer	Instruments	Intended Impacts on forest	Payment
Self organized private deals						
France: Perrier Vittel's Payments for water	Quality drinking water	Upstream dairy farmers and forest landholders	A bottler of natural mineral water	Payments by bottler to upstream landowners for improved agricultural practices and for reforestation of sensitive infiltration zones	Reforestation but little impact because program focuses on agriculture	Vittel pays each farm about US$230 per hectare per year for seven years. The company spent an averaged of US$ 155,000 per farm or a total of US$3.8 million
Reforestation but little impact because program focuses on agriculture	Regularity of water flow for hydroelectricity generation	Private upstream owners of forest land	Private hydroelectric utilities, Government of Costa Rica and local NGO	Payments made by utility company via a local NGO to landowners; payments supplemented by government funds	Increased forest cover on private land; expansion of forests through protection and regeneration	Landwoners who protect their forests receive US$45/hectare/ year, those who sustainably manage their forests receive

[63] International Tropical Timber Organisation (ITTO), The Current Status of Future Potential of markets for ecosystem services Provided by Tropical Forests, Technical series No. 21, October, 2004.

						US$70 / hectare / year, and those who reforest their land receive US$116/hectare/year
Cauca River, Colombia: associations of irrigators' payments	Improvements of base flows and reduction of sedimentation in irrigation canals	Upstream forest landowners	Associations of irrigators; government agencies	Voluntary payments by associations and government agencies to private upstream landowners; purchase by agency of lands	Reforestation, erosion control, spring and waterways protection, and development of watershed communities	
Trading Schemes						
United States: nutrient trading	Improved water quality	Point-source polluters discharging below allowable level; non-point source polluters reducing their pollution	Polluting sources with discharge above allowable level	Trading of marketable nutrient reduction credits among industrial and agricultural polluting sources	Limited impact on forests; mainly the establishment of trees in riparian areas	Incentive payments of US$5-10 per acre
Australia: irrigators	Reduction of water salinity	New South Wales State	An association of irrigation	Water transpiration	Large-scale reforestation,	Irrigators pay US$40/hectare/

financing upstream reforestation		Forests (state government agency)	farmers	credits earned by State Forests for reforestation and sold to irrigators	including planting of desalination plants, trees and other deep-rooted perennial vegetation	year for ten years to NSW state forests. Revenues are used by State Forests to reforest on private and public lands. Private landowners receive an allowance but rights remain with State forests.
Public payment schemes						
New York City. Watershed management program	Purification of New York City's water supply	Upstream landowners	Water users taxed by New York City with supplemental funds provided by federal, State and local government	Taxes on water user, New York City bonds; trust funds; subsidies; logging permits; differential land use taxation, development rights; conservation easements; development of	Adoption of low impact logging; retirement of environmentall y senstive land from agricultural production; forest regeneration	Dairy farmers and forester who adopted best management practices were compensated with US$40 million, which covered all their additional costs. Foresters who improved their management

				markets		practices (such as low impact logging) received additional logging permits for new areas, and forest landowners owning 50 acres or more and agreeing to commit to a ten-year forest management plan are entitled to an 80% reduction in local property tax.
Columbia; environmental services tax (eco0tax) for watershed management	Regularity of water flow for industrial uses; regularity and water	Private landowners and municipalities	Industrial water users and municipalities	Eco-tax on industrial water users; payments by municipalities and watershed authorities to landowners	Improved forest management, expansion of forests	NA
State of Parana, Brazil: public redistribution	Rehabilitation of private and public areas for	Municipalities and private landowners	State of Parana	Public-sector redistribution mechanism;	Rehabilitation degraded forest areas	US$170 / hectare

mechanism	watershed protection			State provides additional funds to those municipalities with protected areas and which harbour watersheds that supply neighbouring municipalities.		
US: conservation reserve program	Reduction of soil erosion, improvement of water quality and regularity of stream flow	Owners of cropland and marginal pasture lands	US Department of Agriculture	Conservation easements; restoration cost-share agreeement; yearly rental payments to landowners for engaging in conservation, additional incentive payments	Though the program is directed at farms, advantages to trees are many, tree-planting, strips, riparian buffers, grassed waterways, field windbreaks, shelter belts, living snow fences, and establishment of bottomland timber	Farmers receive US$125/hectare /hyear and are compensated for 50% of costs to establish approved conservation practices. Total government cost US$ 1.8 billion/year

3.2 Economies of Scale for Bundling of environmental services

When conditions are right, market helps to ensure resources are allocated to their most valuable use and this help to maximize social welfare. Missing market can create distortion in resource allocation. The creation of markets for individual environmental service often deals with only part of the problem and may in certain circumstances create new distortions. Where markets for service are missing, little investment will be channels towards production of the service64. Instead funds will flow towards sectors where investments yield competitive returns. Creation of market for environmental service, tend to benefit people from new investment, would increase flow of services and reduce negligence. At the same time damage inflicted on the non marketed service will not be internalize by those responsible since there are no financial consequences. Ultimately one should attempt to create markets wherever they are missing. While focusing on isolated services represent a practical way forward in the near term, to reap the economies of scale the markets for bundled environmental service might lead to larger incentives for multiple stakeholders.

The following diagram65 suggest that either merged budles i.e. where environmental services are sold together and cannot be subdivided for sales to separate purchasers and shopping basket bundles – where purchaser can acquire specific services on their own or as a part of a package and land stewards can sell different services to different buyers. The two approaches to bundling may face constraints as the set up costs including the transaction cost of such markets but may ultimately lead to more efficient allocation to resources and higher returns to sellers. Thus this mechanism would require enormous technical data and institutional requirements for successfully marketing a bundle of services to separate buyers.

4 Response to Fourth TOR : Identification of knowledge gaps that are necessary to be filled for realistic valuation

4.1 Limitations of Valuing and Paying for Ecosystem Services

4.1.1. Lack of Standardized methodology for valuing and aggregative Ecosystem Services : Ecosystem services occur at various scales and are quantified by different metrics, thus making aggregation into a single equation dependent on creative and thoughtful scholarship (unavoidable value judgment). Furthermore the services included in the equation will need to be weighted relative to each other and to account for the tradeoffs of increasing one service at the expense of another.66 The system is bested with various problems especially in a developing country's context mainly on account of (i) Valuation problems due to vast array of forestry resources

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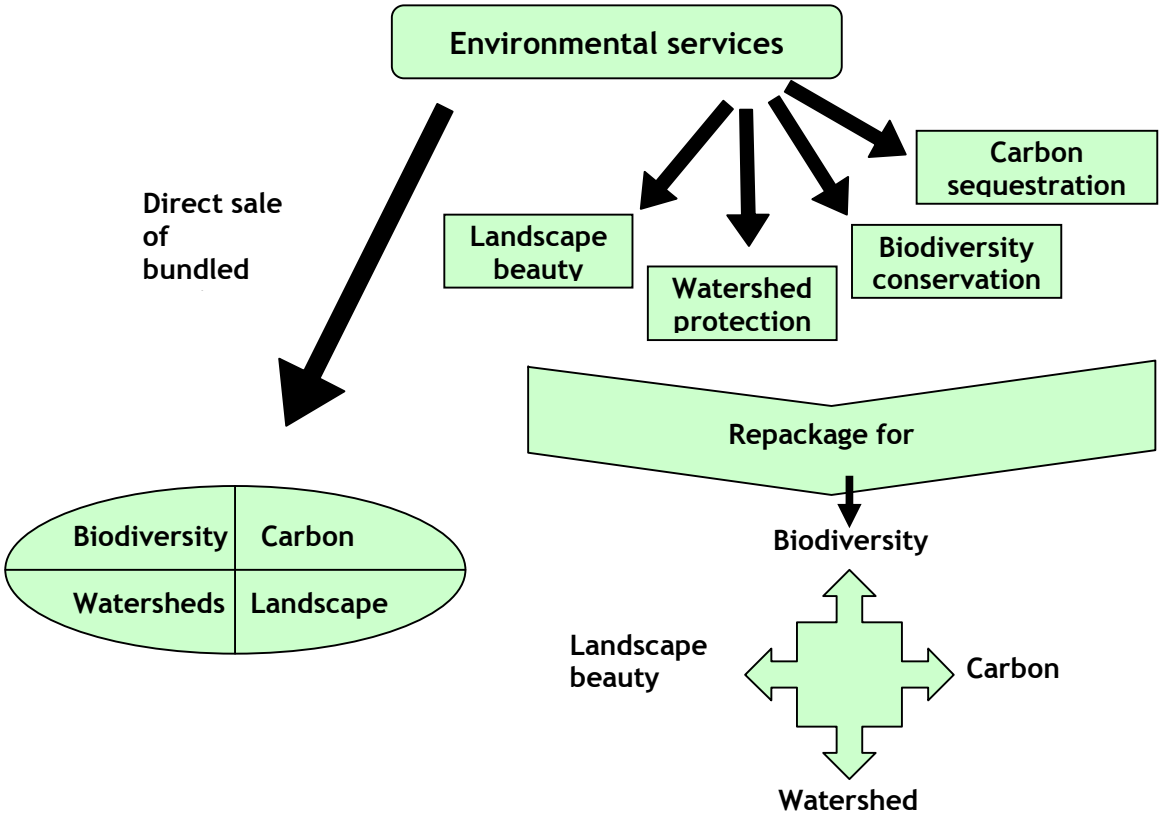
64 Natasha Landell-Mills and Ina Porras Silver Bullert or Fool's Gold ?, IIED, 2002

65 *Ibid.*

66 Meyerson A. Laura et.al 2005. Aggregate Measure of Eosystem Services: Can we Take the Pulse of Nature.Front ecol Environ.2005;3(1):56-59

Figure 5 : Bundling of Environmental Services



requiring individual approaches to valuation and value itself perception based estimate in many cases.(ii) Lack of organized data in the form of forest stocks and flows, (iii)Problem of double counting on use and non use values and various intangible like carbon storage, biodiversity, ecotourism, landscape values which exist on account of each other, (v) Problem of aggregation of values based on two distinct approaches viz.; namely, 'revealed preference' values and 'stated preference' values and (vi) Data Gaps on the biophysical measurement and economic valuation of ecological services from forests and how to account for them in national accounts. Further till now there had been no simple methodology available for estimating the values of ecosystem services. In this regard the current methodology developed by NRA project of IIFM-CSO, 2006 comes handy for estimation.

4.1.2 Problem of long and short term benefits : System of Integrate accounting is a flow income accounting system. Welfare benefits from preservation of forests have long stream of benefits. In a strict theoretical sense, such benefits can not be easily written off under current income or welfare streams. This issue gets more complicated particularly because of the fact that preservation can be costless. But it involves, sacrifice of current consumption from developmental use of natural resources. Therefore, care should be taken to spread preservation benefits over a long time horizon and accounted accordingly.

4.1.3 Problem of double counting?: Timber after felling from the forest has a price reflecting its use or utility value. But it has emerged out of the carbon sequestration function of the forest in the past, abating global climate change. Now how does one segregate its use and non-use values? To complicate matters further, what is to be done if the security value of forests is also to be accounted along with the timber and non-timber values?

4.2 Limitations of Equitably Distributing Benefits and Payments of Ecosystem Services

Even once the payment for ecosystem services get generate din the system, the major task remains is that of distribution of such benefit. The formula based NPV committee report on extent of benefits accruing to various stakeholders is considered where the benefits to be distributed as (i) Local- 100% of NTFP, fuelwood and fodder values; 50% of watershed services and 45% of biodiversity values (ii) State- 100% of ecotourism and timber values; 50% of watershed services, 90% of carbon and 45% of biodiversity values; (iii) National - 10% of carbon and 10% of biodiversity values.67 The increased allocation @ Rs. 7 crores per annum has already been effected by the 12th Finance Commission of India and the CAMPA, but the allocation of rewards of conserving communities and suffered communities is yet to be worked out.

4.3 Suggestions for Improvised System

4.3.1. Pilot Implementation at selected sites

The system evolved by the group may be initially tested in some pilot sites to gain experience and validating of the procedure of FRA. In this regad it is important to mention the suggestion of Mr. Digvijay Singh Khati, CF, Finance, Department of Forest, Uttaranchal to conduct an intensive study of Uttarkashi district of Uttaranchal which has the maximum area under reserved and protected forest, is an abode of Gangotri glacier and watershed of two major rivers of India68. Further the upstream and downstream linkages of services are more visible in this region.

4.3.2 Developing Markets for Ecosystem Services

Developing markets for ecosystem services can promote conservation and support local livelihoods since it rewards to the resource owners/ managers for their role as stewards in providing these services. Further, these markets can also increase the economic value of forest ecosystems. As mentioned 300 such markets exist for ecosystem services across the world. In India such markets have been experimented in the states of Himachal Pradesh and Madhya Pradesh. Infact we can emulate from Costa Rica69 Payments for

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[67] As per Reference 47.

[68] In person communication with the authour during her visit to UFD on 19th April, 2007.

[69] COSTA RICA In 1996 it implemented an innovative programme of payments for Environmental Services (PES). Through financial and legal mechanisms, local, national and international beneficiaries of

Environmental Services (PES) has been implemented . Similarly the MEXICO'S FOREST FUND70 could be another model which could be adopted in India.

3.3.3 Legal and policy research

In a normal situation of market development enabling policies and laws develop as a need of the society. However, to fasten the development of market for these goods and services it would be necessary to create an enabling environment to begin with. This calls for a thorough research in this field. Further in the case of these goods it would also be necessary to establish who, and to what extent, are the producers and to what extent they can demand payment for services rendered by them. Research would also be necessary to establish practices and benchmarks for fair negotiations between the producers and consumers.

4.3.4. Dissemination of Knowledge about Ecosystem Services Values amongst all concerned

As the forests have multistakeholder and multisectoral linkages, the knowledge so generated by the expert group shall be disseminated in the form of working or policy papers on 'developing framework for valuing forests to guide the policy' to them for inculcating appreciation of the concept and need for such a system.

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forest services compensate those who protect them. Costa Rica's 1996 forestry law explicitly recognizes four ecosystem services provided by forests Carbon fixation and sequestration, hydrological services, biodivertsity protection, scenic beauty. The law compensates those who provide these services. Funds are allocated through the National Forestry Financial Fund, which works directly with people and also through NGOs. It raises money from international donors and national sources like a fuel tax and payments made by hydroelectric plants, and distributes this money through contracts with individuals or groups of people. There are three types of contracts – for reforestation, protection and sustainable forest management – under which a fixed annual payment is made, based on compliance. The forest protection contract is the most popular.

[70] MEXICO'S FOREST FUND: Mexico had the second fastest deforestation rate in Latin America because of forest conversion for agriculture and cattle grazing. Lack of finances limited investment in forest sector. In July 2003, they established a forest fund to protect forests and developed mechanisms for PES. The aim of the fund was to reduce both poverty and deforestation. The fund has initiated payments for hydrological services in 1.3 lakh ha. Renewable contracts have been issued for a period of five years. Local communities are paid annually – approximately $350 Mexican Pesos (US$38) per hectare – based on results verified through inventories from satellite imagery. As service providers they have to maintain land use, prohibit deforestation or deterioration, monitor and evaluation, and report any noncompliance. There also plans to use the fund to develop markets for biodiversity conservation and carbon sequestration. By 2006, the goal is to have 600,000 hectares receiving PES. COLUMBIA'S GREEN PLAN: A Green Plan was developed to address degradation and loss of ecosystems and biodiversity as a result of deforestation, desertification and encroachment from agriculture and illegal crops on forest lands. It was funded by the Inter-American Development Bank to regenerate critical degraded forests that provide hydrological services for municipalities. The plan has established 70,218 hectares of forests, created 18,102 jobs, and improved the livelihood of some 33,000 families. Local communities, non-governmental organizations, regional environmental authorities and a municipality implemented and funded the project, increasing the sense of ownership and commitment to the project.

4.3.5 Strengthening the Role of Van Panchayats of Uttaranchal

The recently released IPCC report on Methodological and Technological Issues in Technology Transfer, 2007 talks intensely about the adaptation mechanisms for climate change. It suggests financial incentives both at the national and international levels to increase the forest area, to reduce deforestation and to maintain and manage the forests. It also suggests overcoming the constraint of lack of investment capital to help poverty alleviation. As the tenure rights are clear in case of Van Panchayats of UIttaranchal and they have been in engaged since long in increasing the forest area and reducing deforestation, they can be a good contender in carbon credit and CER mechanisms.

4.3.6 Establishing Forest SEZs[71]

A recent announcement of the government to plan 'forest SEZs' better known as 'multi-stakeholder partnership' where the government intends to give degraded forest land to industry to produce raw material like paper pulp. The government intends to invite bids for degraded forest land, areas with a tree cover of less than 10%, under a contract to industries to 'farm' trees which can be used as raw material. The ministry believes it will help generate investment in increasing India's forest cover to 33% by 2012. Same initiative can be taken in the state to provide all round incentives to by various stakeholders as well to achieve the target of the forest policy which is still deficient as stated in the earlier section of this report.

4.3.7 Preparation of a manual to facilitate operationalization

A manual containing basic concepts, procedure for economic valuation and accounting of forests may be prepared for handy use by the end users. Necessary capacity building regarding new system of FRA should also be done amongst the personnel of Forest Departments who are expected to be involved in implementing the proposed system. In this manner the new system of FRA shall be operationalized throughout the country.

4.3.8 Ecosystem Services Valuation and Accounting Framework as a Component of Working Plan

The system proposed can be implemented at the functional unit level which may be a division or state level. Since the forest sector is a dynamic sector and ant change in it will have a multiplier effects on itself as well on the other sectors; it is essential that the exercise of valuation and accounting be taken on regular basis. For the purpose it is proposed that that the exercise should be made a component of the working plan. As the working plan is prepared every 8-10 years, the accounting framework ban also be affected. In fact if such an exercises are performed first, important signals can be generated for the new working plan for sustainably managing the forest.

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[71] Nitin Sethi, Times of India 21 May 2007.Forest SEZs to increase forest cover, says Govt

Annexure I

Green Accounting for Indian States and Union Territories Project (GIST) has conducted studies on forest ecosystem services

Table I.a: Valuing Soil Conservation Function of Uttaranchal Forests, 200372

A. Soil loss prevented by dense forest, 2003

State/ Union Territory	Dense forest (million ha)	Soil loss prevented (million tones)	Soil loss prevented (million kg)
Uttranchal	1.84	22.64	22640.64
TOTAL (All India)	39.06	482.20	482196.19

B.Concentration of nutrients (mg per g) in run off.

Land use	Nitrogen (N)	Phosphorus (P)	Potassium (K)	Organic carbon
Dense forest	2.32	0.044	8.25	22.50

C. Estimation of nutrient loss (N,P, K, organic matter), 2001

State/ Union Territory	Nutrients (Million kg)			
	N	P	K	Organic matter
Uttranchal	54.24	1.03	192.88	526.03
Total (All India)	1194.07	2.65	4246.16	11580.43

D. Estimation of nutrient loss (N,P, K, organic matter), 2003/04

State/ Union Territory	Nutrients (Million kg)			
	N	P	K	Organic matter
Uttranchal	52.53	1.00	186.79	5094.14
Total (All India)	1118.70	21.22	3978.12	108494.14

E. Economic value of nutrient loss (million rupees), 2001/03

State/ Union Territory	Economic value of nutrient loss				
	N	P	K	Organic matter	Total
Uttranchal	569.52	16.69	1433.09	263.02	2282.32
Total (All India)	12537.70	367.32	31548.94	5790.21	50244.21

[72] Pushpam Kumar et.al. 2006. Accounting for Ecological Services from Forests..GIST Monograph 7.

F. Economic value of nutrient loss (million rupees), 2003

State/ Union Territory	Economic value of nutrient loss				
	N	P	K	Organic matter	Total
Uttranchal	551.53	16.16	1387.81	254.707	2210.21
Total (All India)	11746.30	344.13	29557.42	5424.706	47072.56

G: Economic value of nutrient loss in soil erosion prevented by dense forest

State/ Union Territory	Economic value of nutrient loss (million rupees)		
	Total value in 2003 (million rupees)	Total value in 2001 (million rupees)	Change in economic value over 2003-2001
Uttranchal	2210.207	2282.32	-72.113
Total (All India)	47072.560	50244.21	-3171.654

Table I.b: Estimates of Flood Control Function from Uttaranchal Forest

A. Differential water recharge by dense forest

State/ Union Territory	Water recharge (mm)		
	Forest Area	Non-forest area	Difference (mm)
Uttranchal	307	93	214

Note: The water recharge differential has been computed for the monsoon period (June to September)

B. Economic value of differential water recharge (due to dense forest only), 2001 and 2003

State / Union territory	2001			2003		
	Dense forest area (million ha)	Total extra water recharge (million ha)	Value (Million rupees)	Dense forest area (million ha)	Total extra water recharge (million ha)	Value (Million rupees)
Uttranchal	1.90	407.09	122.13	1.84	394.23	118.27
Total (All India)	41.68	4416.94	1325.08	39.06	4128.60	1238.58

C.: Estimate of flood avoidance benefits of forest

State / Union territory	2001			2003		
	Dense forest area (million ha)	Avoided flood damage (million rupees)	Effective avoided flood damage (million rupees)	Dense forest area (million ha)	Avoided flood damage (million rupees)	Effective avoided flood damage (million rupees)
Uttranchal	1.90	15438.93	5403.62	1.84	14951.38	5232.98
Total (All India)	41.68	338600.00	118510.00	39.06	317229.28	111030.25

@ 35% of the total damage, as entire flood damage can never be mitigated by forestry alone

Table I.c: Total Value of Ecological Services rendered by Indian Forests In 2001 (million rupees)

State / Union Territory	Value of nutrient loss	Value of water recharge	Flood benefits	Total	Annuity value
Uttranchal	4649.46	1831.905	5403.62	11884.985	297124.63
Total (All India)	102356.13	19876.23	118510	240742.4	6018559.00

In, 2003 (million rupees)

State / Union Territory	Value of nutrient loss	Value of water recharge	Flood benefits	Total	Annuity value
Uttranchal	4502.57	1774.04	5232.983000	11509.59	287739.70
Total (All India)	95894.92	18578.70	111030.248000	225503.87	5637596.70

Change in Annuity value of ecological services over 2003-2001 in Indian forest (million rupees)

State / Union Territory	Annuity value		Change in annuity value over 2003-2001
	2001	2003	
Uttranchal	297124.63	287739.70	-9384.92
Total (All India)	6018559.00	5637596.70	-380962.30

When these forest ecological services loss was accounted in the national accounting system, an annual loss of 1.79 % takes place in Uttaranchal against the all India loss of 1.11%.

Table I.d : Valuing Biodiversity Function of Uttaranchal Forests, 200673

A. Area under national parks and wildlife sanctuaries

State / Union Territory	National Parks		Sanctuary		Total		Forest Area (KM2)	% of protected areas to forest
	Number	Area (KM2)	Number	Area (KM2)	Number	Area (KM2)		
Uttranchal	6	4083.30	6	2868.00	12	6951.30	34662	20.10
All India	90	36882.00	502	120052.00	592	156934.00	768436	20.40

B: Number of species in different states and union territories in India

State / Union Territory	Total flowering plants (BSI)	Medicinal plants (FRLHT)	Species of conservation importance (WCMC)- flora	Fauna (mammals and birds)
Uttar Pradesh and Uttranchal	4250	1303	202	731

BSI=Botanical Survey of India; FRLHT=Foundation for revitalization of local health traditions; WCMC= World Conservation Monitoring centre

[73]Haripriya et.al 2006.The value of Biodiversity in India's Forests. GIST Monograph 4.

C: Net consumer surplus estimates from ecotourism in different states (2001/02)

State / Union Territory	**Area protected areas (Km2) (I)**	**Average number of tourists visiting the state during 1998-2002 (II)**		**Consumer surplus / ha / tourist from the estimates (In Rs.) from Equation (1) and (2) (III)**		**Share of consumer surplus attributable to tourists visiting national park (from equation s (3) and (4) (IV)**		**Consumer surplus per hectare for tourist visiting the national park (in rupees) (V)**	
		Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
Uttar Pradesh and Uttranchal	12627.30	63028873.0	825000	0.028	0.174	0.0110	0.0100	6609.7	346.6
All India	156796.0	207054665.0	5916343	0.040	0.240	0.0001	0.0002	1113.4	240.6

State / Union Territory	Total consumer surplus for tourists visiting the national parks (rupees millions) (VI)		Cost of maintaining the parks (Rs. Million (VIII)	Net ecotourism value (Rs. Million) (VIII)	Total net present value of ecotourism (Rs. Million) (IX)	Net present value of ecotourism per hectare (Rs.) (X)
	Domestic	Foreign				
Uttar Pradesh and Uttranchal	8346.3	36.3	105.8	840.80	181891.95	64989.00
All India	17457.9	3771.8	1160.1	14164.94	3064266.69	65193.00

D. Amount sanctioned under different schemes for protection, maintenance and upkeep of national parks and wildlife sanctuaries (2001/02 – Rs. In lakhs)

State / Union Territory	Biosphere Reserve	Project Elephant	Project Tiger	Eco-Development project	Dev. Of National parks and sanctuaries	Central Zoo Authority	Protection of wildlife in India	Total expenditure released
Uttranchal	28.0	140.9	150.0	75.0	38.1	11.5	173.4	616.7

E. Implied US dollar value consumer surplus per domestic and foreign tourists

State / Union Territory	Implied aggregate US dollar value consumer surplus per foreign tourist	Implied aggregate US dollar value consumer surplus per domestic tourist
Uttar Pradesh and Uttranchal	5223	833
All India	3638	558

F.Marginal willingness to pay by the pharmaceutical companies for bioprospecting.

State / Union Territory	Forest area (Km2)	Model 1 Search based on number of medicinal plants			Net biopros pecting value /ha	Model 2 Search based on number of species of conservation importance			Net biopros pecting value /ha	Model 3 Search based on all Species			Net biopros pecting value /ha
		Density of species	Probability of a hit	Information rent		Density of species	Probability of a hit	Information rent		Density of species	Probability of a hit	Information rent	
	1	2	3	4	5	6	7	8	9	10	11	12	13
Uttar Pradesh	27988	0.47	5.5E-06	21740	22290	0.07	8.66E-07	4250.8	4364	1.52	1.82E-05	74850	76728
All India	416551				22646				3456				144539

G. NSDP and ESDP for different states

States	NSDP (million Rs.)	Dense Forest		Change in dense forest cover between two years (Km2)	Net present value of ecotourism per ha	Net Present value of bioprospecting per ha (in Rs.)	Annualized loss in non-use values per ha per year	Gain/Loss in value (in million Rs.) per year	Loss as % of NSDP per year	ESDP (Rs. Millions)	ESDP/NSDP
		(Km2) 2001	(Km2) 2003								
Uttar Pradesh	1568625	27988	24418	-3570	64989.2600	22290	-111407	-126985.80	-8.1	1441639	0.92

NSDP= Net state domestic product; ESDP= Environmental adjusted state domestic product; km = Kilometers

H.NSDP and ESDP for based on high estimate of bioprospecting values

States	**NSDP (million Rs.)**	**Dense Forest**		**Change in dense forest cover between two years (Km2)**	**Net present value of ecotourism per ha**	**Net Present value of bioprospecting per ha (in Rs.)**	**Annualized loss in non-use values per ha per year**	**Gain/Loss in value (in million Rs.) per year**	**Loss as % of NSDP per year**	**ESDP (Rs. Millions)**	**ESDP/ NSDP**
		(Km2) 2001	(Km2) 2003								
Uttar Pradesh	56603	3463	5046	1583	410785	76728	40315	93439	-8.7	1431922	0.91
Total	16387941	416551	390327	-26224	207448	144539	0	-8571003	-1.7	16112941	0.98

I:Non use values for species conservation74

State / Union Territory	Protected areas (Km2)	Area under dense forests (Km2)	Bengal Tiger (No.)	Asian elephant (No.)	One-horned rhinoceros (No.)	Asiatic lion (No.)	WTP for species preservation (Million rupees)	Per ha value of flagship species (rupees per annum)	Present value per hectare (rupees)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Uttar Pradesh	12627.3	27988	1	1	0	0	280785	100323	2508080
Total	156796	416551	19	17	4	1	1288104	30923	773077

TableI.e: The value of Timber, carbon, Fuelwood and Non Timber Forest Products in Uttaranchal Forests
A. Forest cover in different assessments (area in Km2)

State / Union territory	Assessment						
	1987	1989	1991	1993	1995	1997	1999
Uttar Pradesh **Uttranchal**	31226	33627	33609	33961	33986	10751 23243	10756 23260
Grand Total	640819	638804	639364	639386	638879	633397	637293
Percentage	19.49	19.43	19.45	19.45	19.43	19.27	19.39

[74] Haripriya et.al 2005.The value of of Timber, carbon, Fuelwood and Non Timber Forest Products in India's Forests. GIST Monograph 1.

B: Forest cover in different states of India (area in Km2)

State / Union Territory	Geographic area	Forest cover				
		Dense	Open	Total	Percentage	Scrub
Uttranchal	53483	19023	4915	23938	44.76	598
Total	3287263	416809	258729	675538	20.55	47318

C.: Statewise comparative situation of forest cover (2001 and 1999) (Km2)

State / Union Territory	2001	1999
Uttranchal	23938	23260
Total	675538	637293

D : Area accounts of timber and fuelwood for different states in India (in ha)

State / Union Territory	Opening area	Disturbance of tree	Logging/ harvest+ illegal logging	Logging damage	Forest fires	Disturbance of forest land	Shifting cultivation	Animal grazing	Forest encroach ments	Disturbance of forest area	Transfer of land to other activities	Addition of stumpage trees	Affores-	Regene- ration	Net disturbance
	(1)	(2) = (2.1+2.2+2.3)	(2.1)	(2.2)	(2.3)	(3)=(3.1+3.2)+3.3)	(3.1)	(3.2)	(3.3)	(4)=(4.1)	(4.1)	(5)	(5.1)	(5.2)	(6) = (5.-2-3-4)
Uttar Pradesh	3768400	96574.5	82463.2	8246.3	5865.0	207910.3	0	170972	36937.5	24986	24986	117630	59442.0	58188.0	-211840.8

E : Volume accounts for timber and fuelwood for different states in India ('000 cubic meters)

State / Union Territory	Opening stock	Changes due to economic activity	Logging/harvest+illegal logging	Logging damage	Afforestation	Other volume changes	Forest Fires	Stand mortality	Animal grazing	Shifting cultivation	Forest encroachments	Other accumulation	Natural growth	Regene-ration	Transfer of land to other activies	Net volume change	Closing stock
Uttar Pradesh	222881.5	-8998.4	8216.5	821.6	39.8	4900.8	0.1224	57.6	3.57	0	4839.6	3367.4	5818	38.9	2489.6	-10531.8	212349.7

E: Monetary accounts for timber and fuelwood for different states (million rupees)

State / Union Territory	Opening stock	Changes due to economic activity	Logging/harvest+illegal logging	Logging damage	Afforestation	Other volume changes	Forest Fires	Stand mortality	Animal grazing	Shifting cultivation	Forest encroachments	Other accumulation	Natural growth	Regene-ration	Transfer of land to other activies	Net volume change
Uttar Pradesh	421472.1	-4154.26	6394.3	639.4	75.2	114.5	0.2	108.9	5.4	0	6338.3	11001.9	44.2	4707.8	2108.8	423580.9
Total	11970063	-1651122.9	82387.4	8238.7	957.3	2.7	1394.0	89.9	91725.5	178929.5	251966.6	302.8	73339.6	12849.5	12849.5	11982912.0

F. Monetary accounts for carbon for different states in India (million rupees)

State	Opening stock	Changes due to economic activity	Logging harvest plus illegal logging	Afforestation	Other volume changes	Forest fires	Stand mortality	Animal grazing	Shifting cultivation	Other accumulations	Natural growth	Re-generation	Transfer of land to other activities	Net volume change	Closing stock
Uttar Pradesh	116847.2	-4243.6	4264.5	30.2	0.0324	30.2	0	0	3001.1	3050.1	3050.1	20.4	69.4	-1272.7	113035.4
Total	2226012.0	-76809.6	77065.4	14882.4	57074.7	57615.1	0	14462.2	57074.7	57615.1	171.8	712.1699	-34617.26	-34617.26	2142115.5

G : Monetary account of NTFPs (non-timber forest products) for different states in India (million rupees)

State	Value of opening stock	Net loss of NTFPs due to logging and timber & fuelwood	Value of marketed benefits gained due to afforestation and regeneration	Value of NTFPs lost due to shifting cultivation	Loss of NTFPs due to transfer of forests for non-forest purpose	Net loss
Uttar Pradesh	56847.2	1842.4	2717.0	0	577.1	297.4
Total	408611.3	31044.8	19759.2	5144.2	6336.8	-22766.6

H : Unit (net) price of timber and fuelwood as recorded in the national accounts

State/ Union Territory	Timber (1993/94) Unit price	Fuelwood (1993/94 unit price)	Timber (1994/95) Unit price	Fuelwood (1994/95 unit price	1993/94 weighted price of logging and illegal logging	1994/95 weighted price of logging and illegal logging	Average
Uttar Pradesh	2238.2	680.0	2384.9	747.0	744.8	811.7	778.2

I: Estimates of carbon in biomass, value of NTFPs (non-timber forest products) and fodder (per ha)

State/ Union Territory	Carbon in biomass	Value of NTFPs	Net present value of NTFP	Value of fodder per ha	Net present value of fodder
Uttar Pradesh	34.5	812.5	20311.3	111.5	2786.3
Average	36.5	430.5	10763.3	189.5	4736.3

J: GSDP,NSDP and ESDP of for different states in India (million rupees) for 2002/03.

State	GSDP	NSDP	Forestry and logging	Adjusted NSDP	Depletion of timber and fuelwood	Depletion of carbon	Depletion of NTFPs	Total depletion	ESDP	ESDP/NSDP	Depletion of timber as % of NDP	Depletion of carbon as % of NDP	Depletion of NTFPs as % of NDP	Total depletion as % of NDP
Uttar Pradesh	**1796014**	**1568624.70**	**21802.20**	**1628485.29**	**2138.29**	**-1272.74**	**297.42**	**-606.74**	**1627878.56**	**1.00**	**-0.13**	**0.08**	**-0.02**	**0.04**
Total	**18539942.80**	**16387845.81**	**227185.70**	**16801156.88**	**13322.05**	**-34617.26**	**-22766.57**	**-72549.05**	**16728607.83**	**1.00**	**-0.08**	**0.21**	**0.14**	**0.43**