

Forest Resource Accounting: New Approach in Developing Better System of Forest Accounting in India

- Introduction
- Assessment of Gap in the Present system of forest resource accounting
- Development of Better system of FRA
- Case: Sikkim

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Forest Resource Accounting (FRA)?

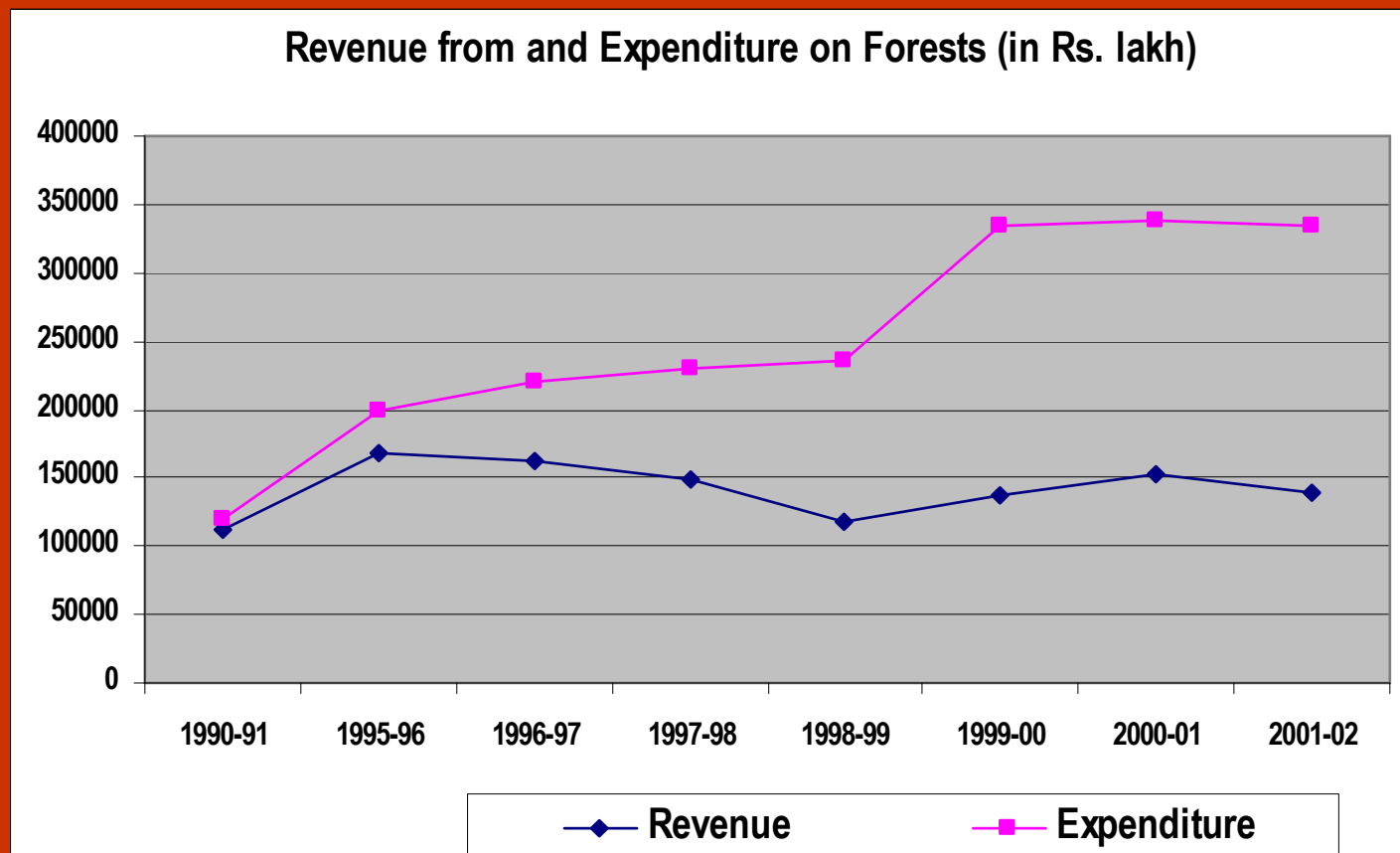
A process of identifying various benefits and costs of forests, putting value tags on them, and recording them in appropriate sets of accounts/statements.

- It comprises both Physical and Monetary Accounts
- In India there exist some semblance of FRA, which may be called the conventional system of FRA

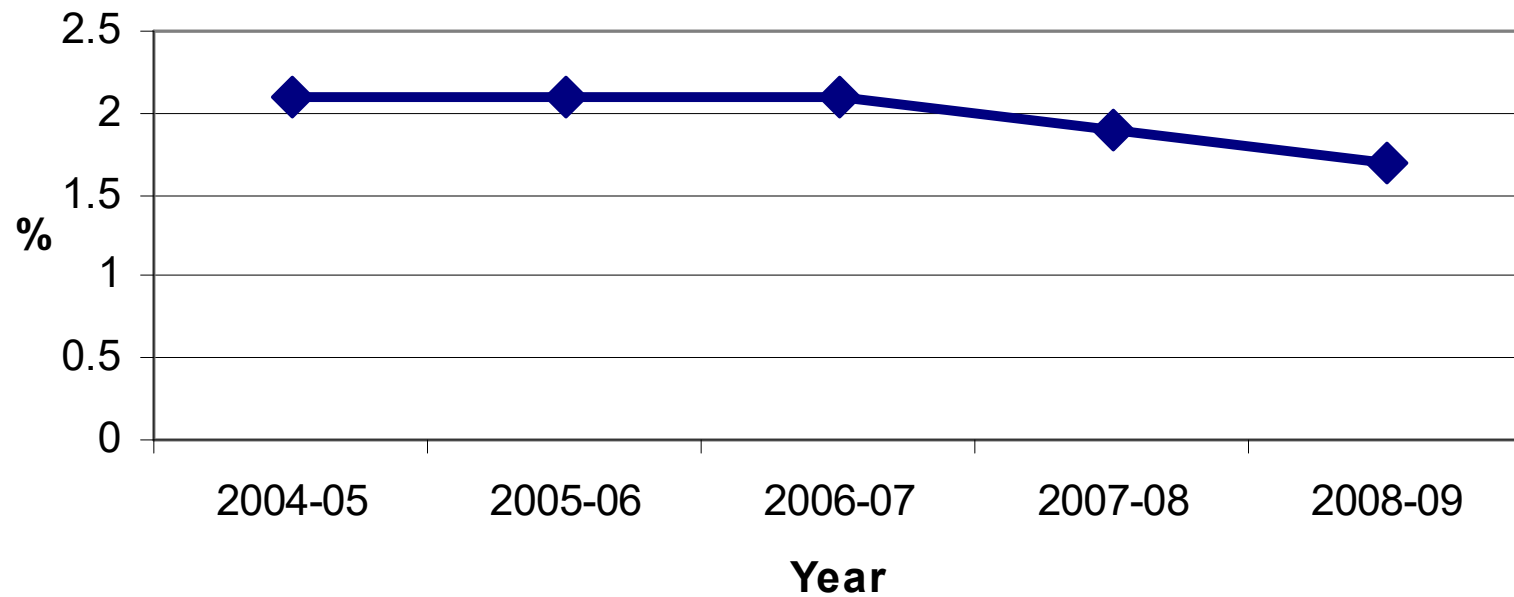


Need and importance of Forest Resource Accounting

■ **Complete Reflection in GDP-** In the year 2008-2009 the contribution of forestry sector to GDP was 1.7% (Rs. 88823 crore), which is an underestimate because of incomplete recording of forest products. This adversely affects the budget allocation to the forestry sector due to non-recording of all the forest benefits (CSO, 2010).



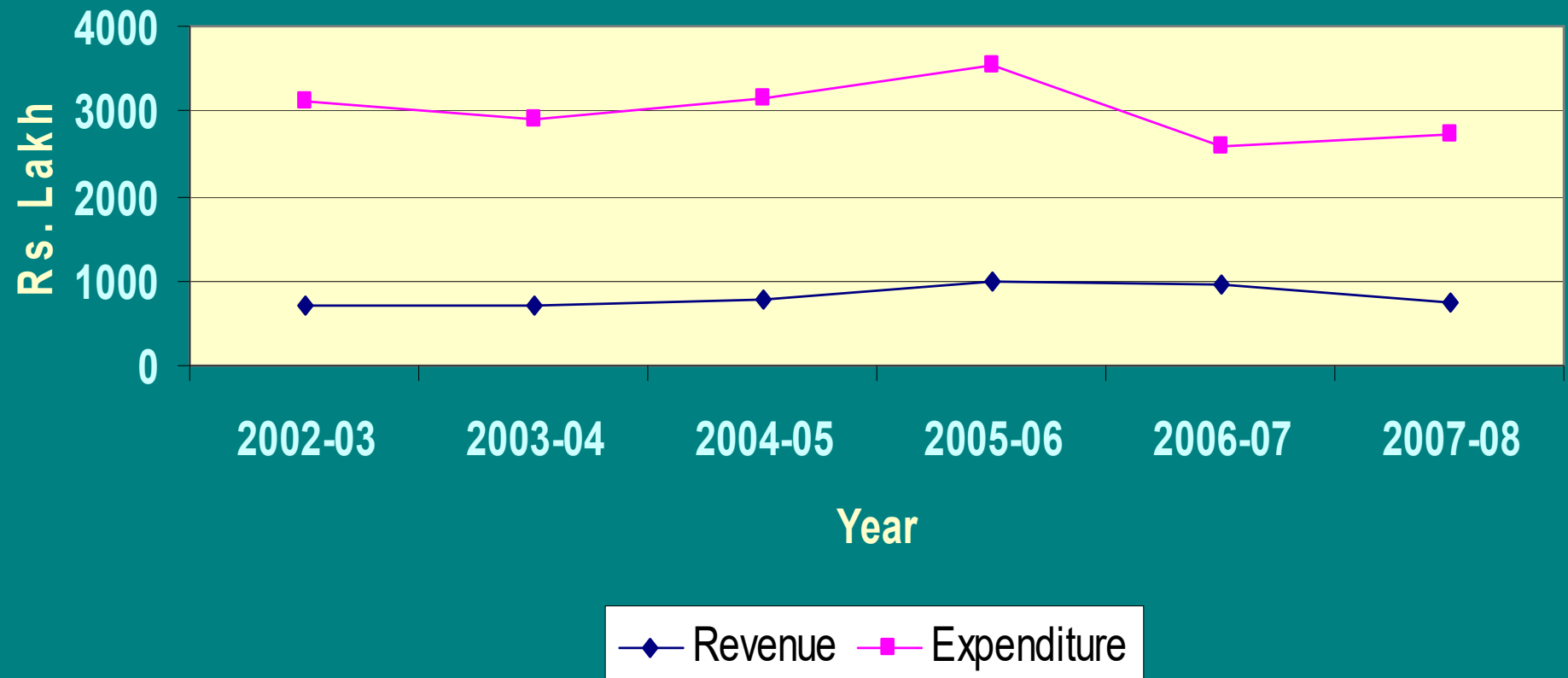
Percentage contribution of forestry and logging to GDP at current prices



Base year 2004-05

Source: CSO, 2010

Revenue from and expenditure on forestry sector in Sikkim



Percentage contribution of forestry and logging to GSDP in Sikkim



Source: DESME, 2007



Need and importance of FRA

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- Forest Resource Accounting (FRA) is one of the several measures that could be used to reform the existing governance system through a better Management Information System (MIS), leading to higher degree of efficiency, accountability, and transparency.
- Estimation of economic value specially the intangible ones and their inclusion in the national accounting system is essential to substantiate the positive impacts of forestry projects and programmes not only on local economy but also in the regional and global economies.
- It could also greatly help the policy makers in taking appropriate decisions regarding conversion of forests for non-forestry purposes and to assess if the logging or other uses increases or decreases the intangible benefits.



Indian Scenario of FRA

In the early part
of the 20th
century

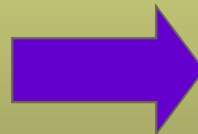
Forestry was one of the few
sectors, which had its own
accounting system
comprising:

But in the Post World War II
and post-independence
period, FRA was neglected
and later in some cases
discontinued due mainly to

- Forest Working Plans;
- Compartment register/Histories,
Timber Accounts;
- Annual Administrative Reports;
- Growth and Yield Studies;
- Research Reports;
- Reports of Periodic Surveys; and
- Revenue and Expenditure
Statements.

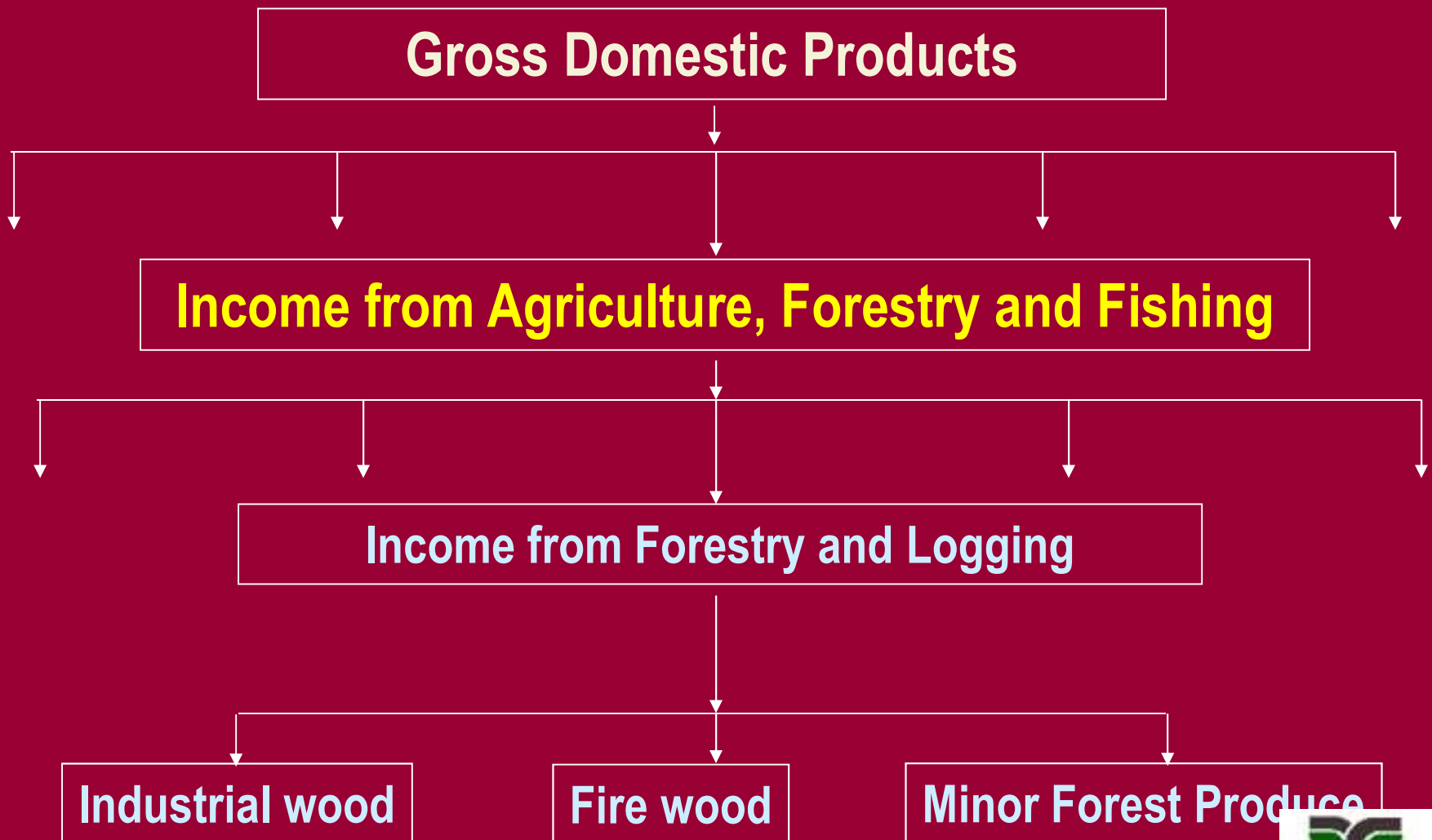
High priority given to exploiting the
forest resources to generate maximum
revenue for funding economic
development projects

Consequently, when the System of National Accounts (SNA) was established, there was no adequate system to record forestry information into the SNA under the aggregated headings.

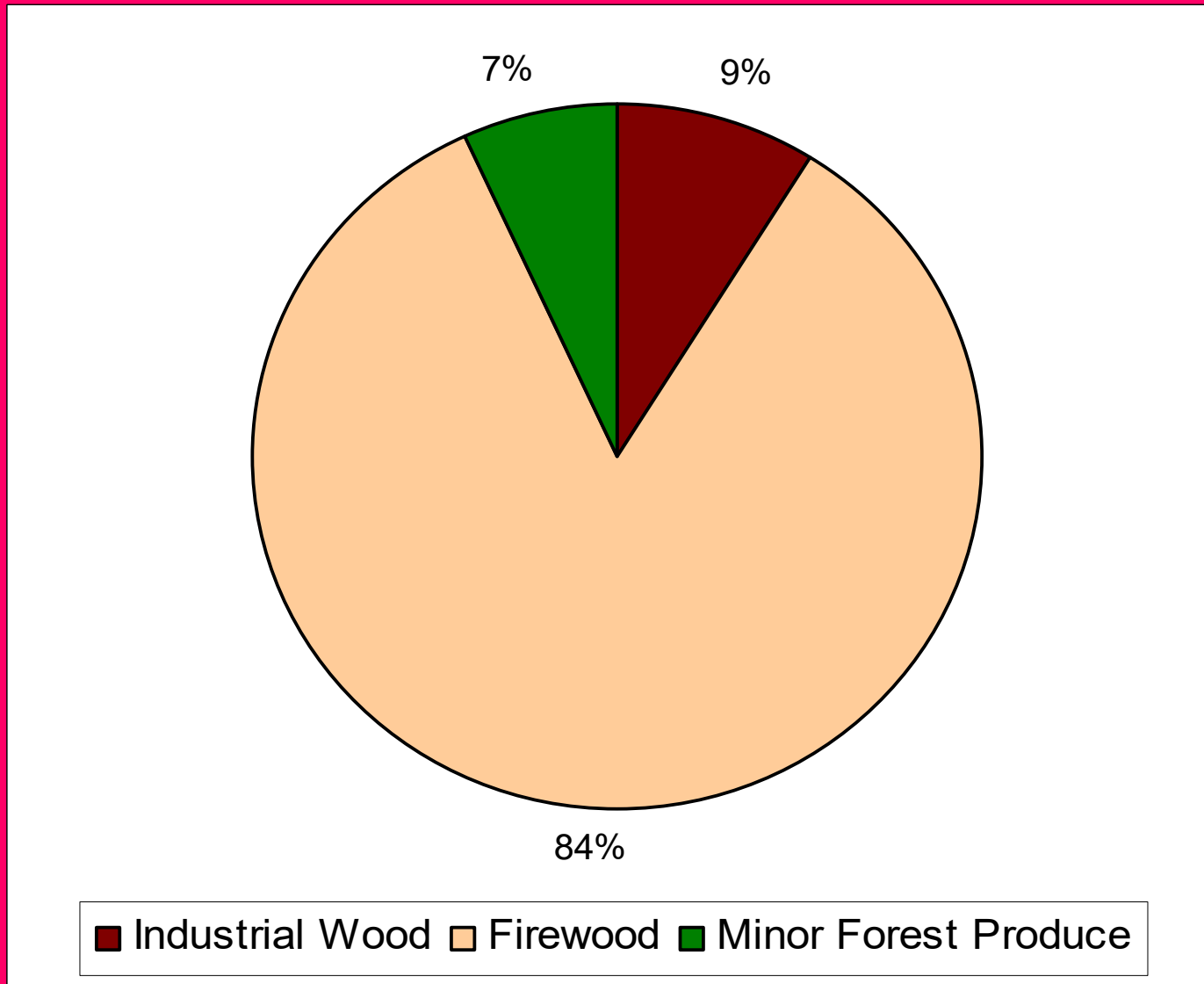


which eventually led to distortions and omissions e.g., omission of timber, firewood, bamboo, fodder and Non-Wood Forest Products (NWFPs) utilized by the people and other related information on forest capital

System of Incorporation of Forestry Accounts in National Accounts



Percentage contribution of Industrial Wood, Firewood and MFPs (Average of 1999-2000 to 2007-2008 at current prices)



Computation of GDP and Net Domestic Products (NDP) from Forestry Sector

GDP = Value of output – (Repairs + Maintenance + Other
Operational Costs, @10
% of the Gross Value of output
from forest products)

NDP = GDP – Consumption of Fixed Capital

Composition of State Domestic Product according to industry of origin

State Domestic Product- 115 sectors

Primary sector 32 sub sectors

Agriculture (including animal husbandry)-20

Forestry and logging-1

Fishing-1

Mining and quarrying-10

Secondary sector- 66 sub sectors

Manufacturing (Registered)

Manufacturing (Un-registered)

Construction

Electricity, gas and water supply

Tertiary sector-17 sub sectors

Railways

Transport by other means and storage

Communication

Trade, hotels and restaurants

Banking and insurance

Real estate, ownership of dwellings, legal and business services

Public administration

Other services

Computation of State Income

At the state level, the State Directorates of Economics and Statistics (DES) prepare the estimates of State Domestic Product (SDP) using the following two approaches:

- Production approach
- Income or Expenditure approach

In Gujarat, SDP from the forestry sector is estimated by DES by following the production approach for timber and expenditure approach for fuel-wood.

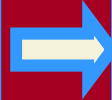
Unrecorded production is estimated @10% of the recorded production



Production data

- DES obtains production data of timber, industrial wood and NWFPs from the office of the PCCF
- Estimation of requirement and value of fuel-wood

Fuelwood requirement is estimated based on the results of NSSO consumption expenditure survey



The estimates so derived are reduced by the actual amount of agriculture by-products, namely, cotton sticks, arhar sticks, jute sticks and bagasee which is taken into account in the agriculture sector, to avoid double counting since these by-products are consumed as fuel by the households.



These estimates are then inflated by 6 percent to account for consumption of fuelwood by the industries and on funerals

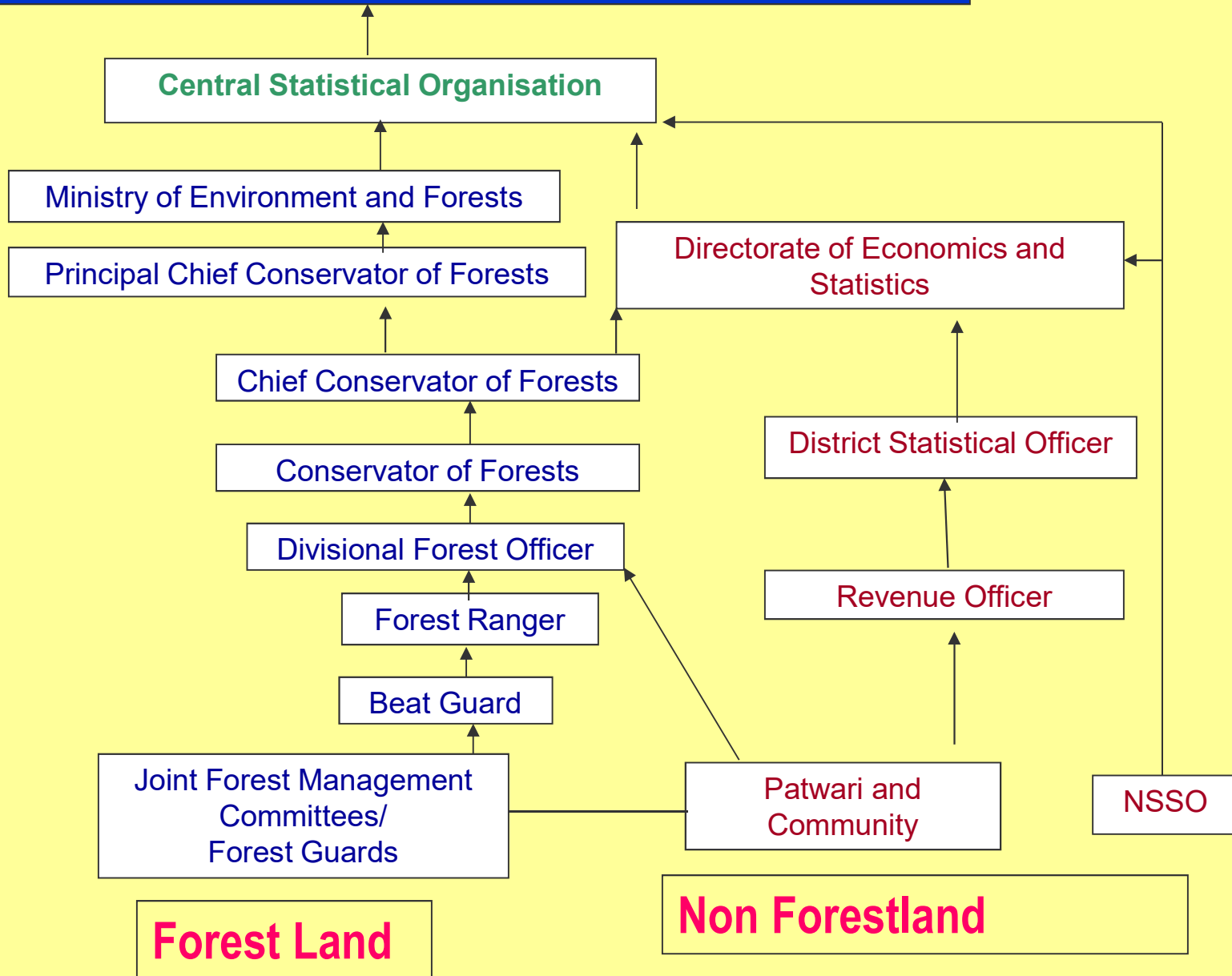
The value of fuel wood is estimated using the prices as supplied by the office of the PCCF

Production of field crops including Jhum cultivation and extraction of minor and major minerals from forests are included in agriculture and mining sectors respectively (CSO, 2007).



Existing system of Flow of Accounting Information

Ministry of Statistics & Programme Implementation



Drawbacks of the Conventional System of FRA

1. Unrecorded and under-valued tangible benefits

Norm by CSO

Unrecorded production = 10% of the value of recorded production of timber.

This is a gross under-estimation of the true economic value of the forest produce.

e.g.

In India, Forest produce worth Rs. 19,72,935/- million was not reported and accounted for properly

This accounts for 71 times the value of the industrial wood reported for the year 2000-01

NORM

This is only Rs. 2779/- million in absolute terms.

Besides, there is no proper recording of the output of timber, fuelwood, pulpwood etc. produced from tree plantations under social forestry, farm forestry and other similar programme.

MoEF, 1999



1. Unrecorded and under-valued tangible benefits

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Programmes of social forestry, farm forestry and agro-forestry implemented on a massive scale with public participation

Yield huge quantities of timber, firewood, fodder, and other benefits.

For example- Contribution from trees grown in non-forest areas

According to the first ever census of trees conducted by the Gujarat State Forest Department in 2004

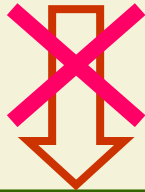
More than 25 crore trees grown in non-forest areas in Gujarat produced per annum

- nearly 1.49 crore MT of timber
- Nearly 1.75 crore MT Fire wood

For the country as a whole, the quantity of forest produce thus produced would be huge indeed.

2. Unrecorded and unaccounted for intangible benefits

Conventional FRA



All intangible benefits and services are not recorded and valued

Valuation of intangible benefits

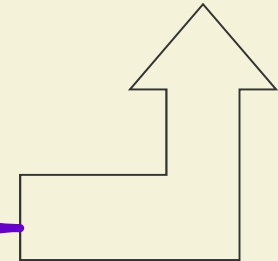
Prospects of up-scaling from such case studies is very limited.

On the basis of small scale case studies

Ecotourism

Soil conservation

Carbon store



3. Recorded but unaccounted for costs

There are many losses taking place, which are recorded but are not accounted for properly

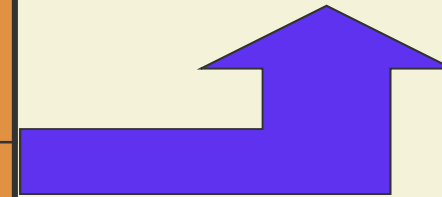
For example : Loss due to forest fires



Year	Nos. of cases	Area involved (Ha)
2000-01	6,370	1,18,148
2001-02	5,583	1,98,101

Source: Forestry statistics India 2003

damages caused due to forest fires are recorded only in terms of area burnt

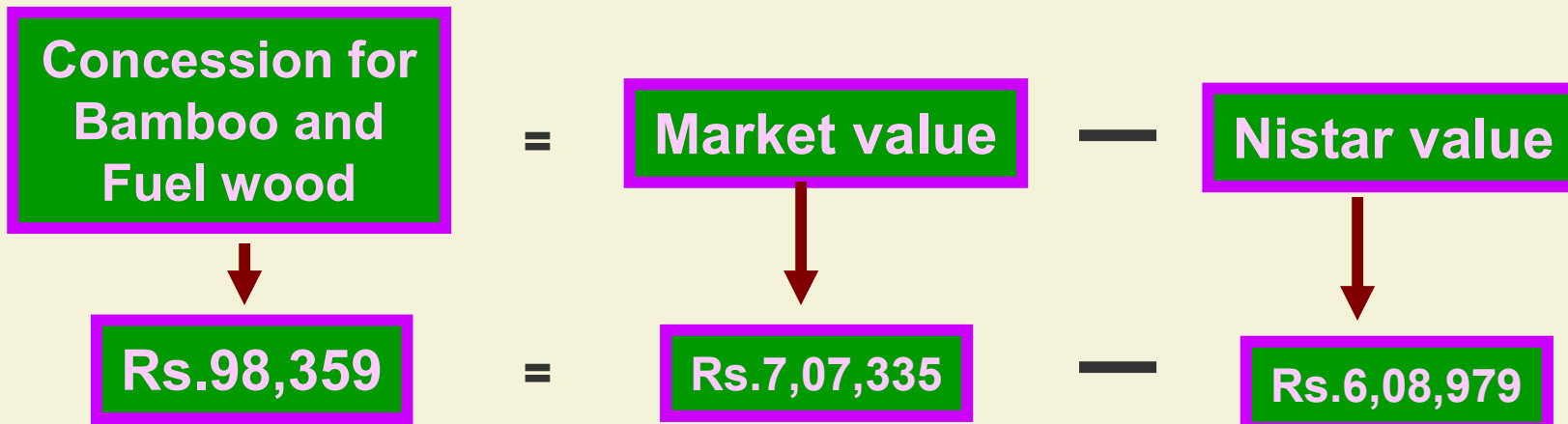


In all cases the extent of damage in monetary terms is not recorded.



Cost accounting

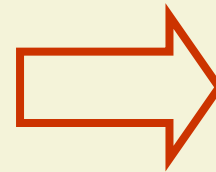
4. Recorded but under-valued benefits



Source: The Dangs Forest Division, 2005-06

5. Inadequate accounting of the value of standing stock (forest capital)

Standing stock of trees is a natural capital



Produces numerous goods and services

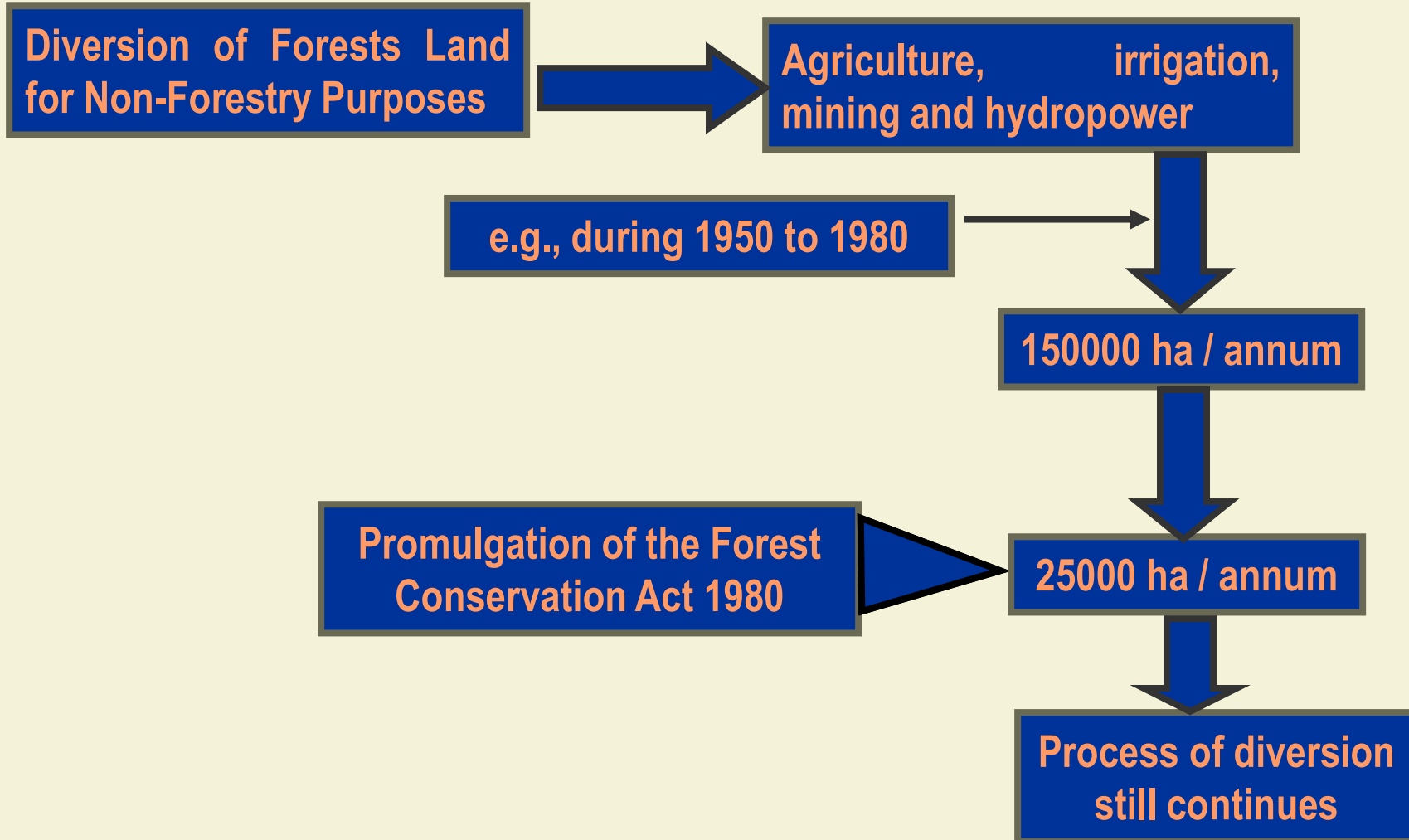


Potential capacity of the forestland is reflected in Working Plans in terms of site quality and growing stock but not value



Conventional FRA

6. Uncompensated or inadequately compensated land transfers



Such land transfers are made easier due to under-valuation of forestland

7. Failure to account for the value of the forestland

Forestland has several alternative uses in other sectors, e.g.

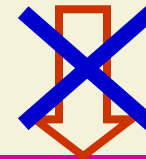
Agriculture

Industry

Irrigation

Mining etc.

Opportunity cost of Forestland



Conventional FRA

Inflates the contribution of the forestry sector to GDP

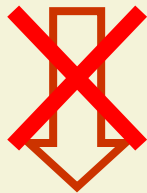
Leads to underestimation of the real value of the forest wealth

8. Failure to account for deforestation and forest degradation

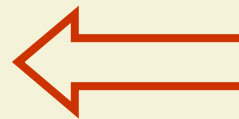
There has been a lot of deforestation and forest degradation in India over time

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This cost is similar to the depreciation of man-made assets

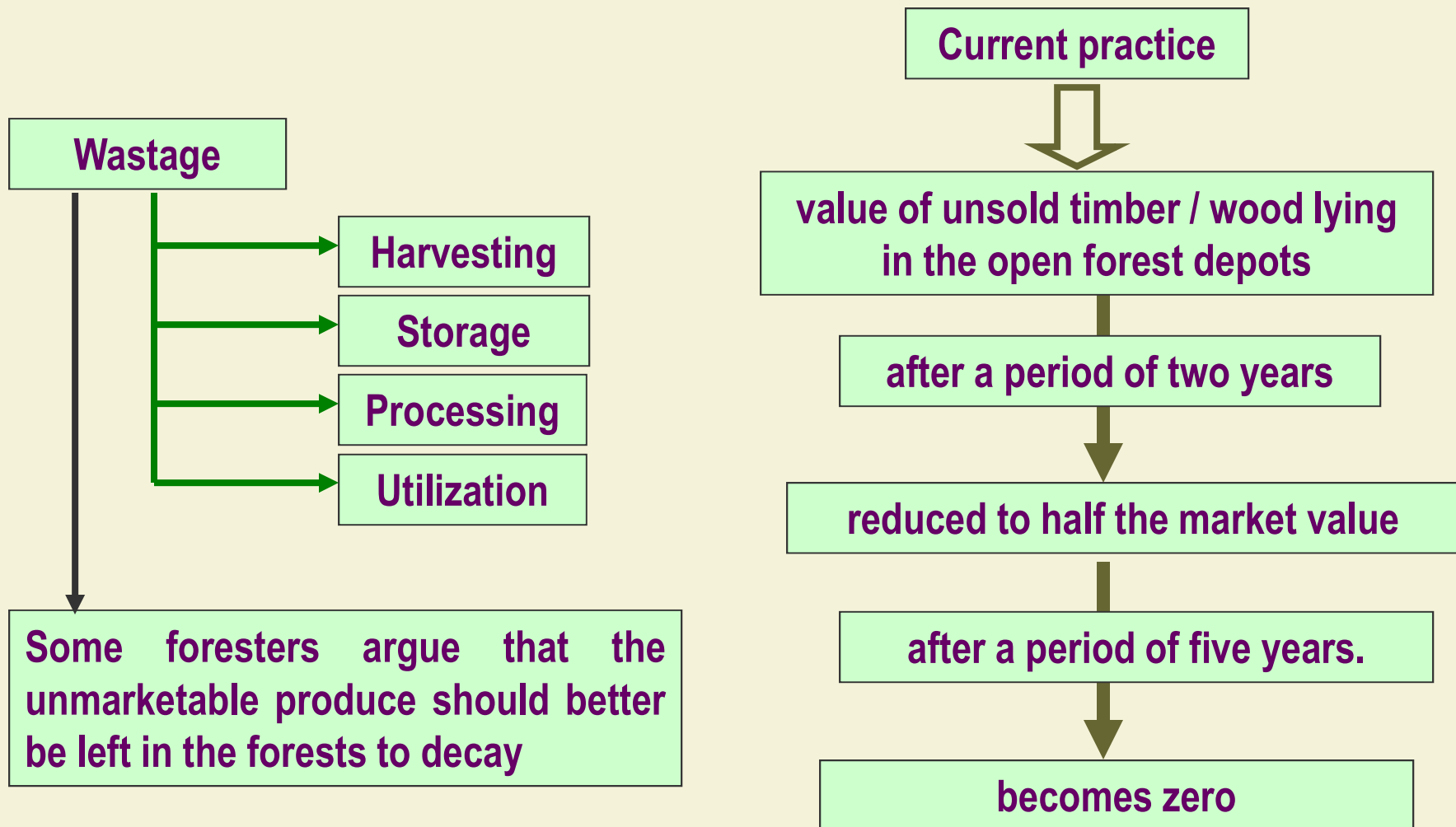


Conventional FRA



Therefore should be factored in while computing the contribution of forestry sector to GDP.

9. Failure to account for wastage in harvesting, storage and processing



Financial loss due to this is tremendous which is not reflected in the current system of FRA

e.g. Loss of revenue due to wastages of grass in Godhra Forest Division

Year	Wastage (kg)	Auction rate (Rs./unit)	Loss of revenue (Rs.)
2003-04	26240	3	78720
2004-05	2629	2.9	7624
2005-06	-	-	-
Average	14434.5	2.95	43172

Other Limitations

I. The main drawback in the compilation of forestry statistics is the delay in the availability of data.

II. Estimates of unrecorded production of industrial wood are based on discussions with the forest officials and are generally considered to be underestimates.

Other Limitations ...contd

III. The forestry products have a lot of variability with regard to their quality and their prices vary even within the same species.

Depending upon the climatic and other factors, trees belonging to the same species may belong to different quality classes. The products of these various quality classes may also fetch prices, which vary from one quality class to another.

Thus, for proper valuation of forestry products, it is necessary to have the production as well as price data, not only species-wise but also quality/class-wise for the same species.

However, in the present system of reporting of forestry statistics, many State Forest Departments report only a single figure for production and a single price against that volume. The data on firewood is estimated through indirect methods from consumption approach, which is not really scientific. The price data reported by the States on firewood also shows considerable variation from state to state, which may not be realistic.

Other Limitations ...contd

IV. The information available from the SFDs on MFPs is also considered to be an underestimate, being based on royalty values and there is no way to verify its accuracy

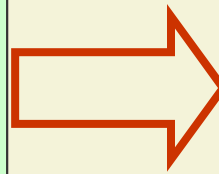
Data availability position for the MFPs needs considerable improvement.

As far as possible, the State FDs should collect data on production as well as prices of all such products, which are important for their states so that the economic value of the MFPs can be worked out.

There is no realistic price deflator for MFPs in the item basket of wholesale price index (WPI), as such proxy price deflators are used for this item to obtain constant price estimates.

Implications of the distortions at the national level

As a result of various distortions in the existing system of FRA



Contribution of forestry to India's GDP is grossly under-estimated

It has been estimated that the value of forest reflected in the India's National Accounts represents less than 10 % of their real value

The difference between the actual and recorded contributions will increase further if an imputed value were assigned to the environmental contribution of the forests to the society.

Application of Better System of Forest Resource Accounting

Components of System of Integrated Environmental, and economic accounting (SEEA): Forestry Accounts

1. Forest Related Asset accounts

- **Wooded land-** land area and economic value by main species, natural and cultivated forest land, available for wood supply or not available etc.
- **Standing timber-**volume and monetary value of by main species, natural and cultivated forestland, available for wood supply or not available etc.
- **Depletion and depreciation of standing timber.**

Components of SEEA Forestry Accounts ...contd

2. Flow accounts: Forest goods and services (volume and economic value)

Forestry and logging products

- Market and non-market production
- Non-timber products - output of edible plants, medicinal plants, and wild animals etc.

Forest services

- Direct intermediate inputs to other sectors, e.g., livestock grazing
- Recreation and tourism
- Carbon sequestration
- Protective services
 - Biodiversity and habitat conservation
 - Protective services such as prevention of soil erosion.

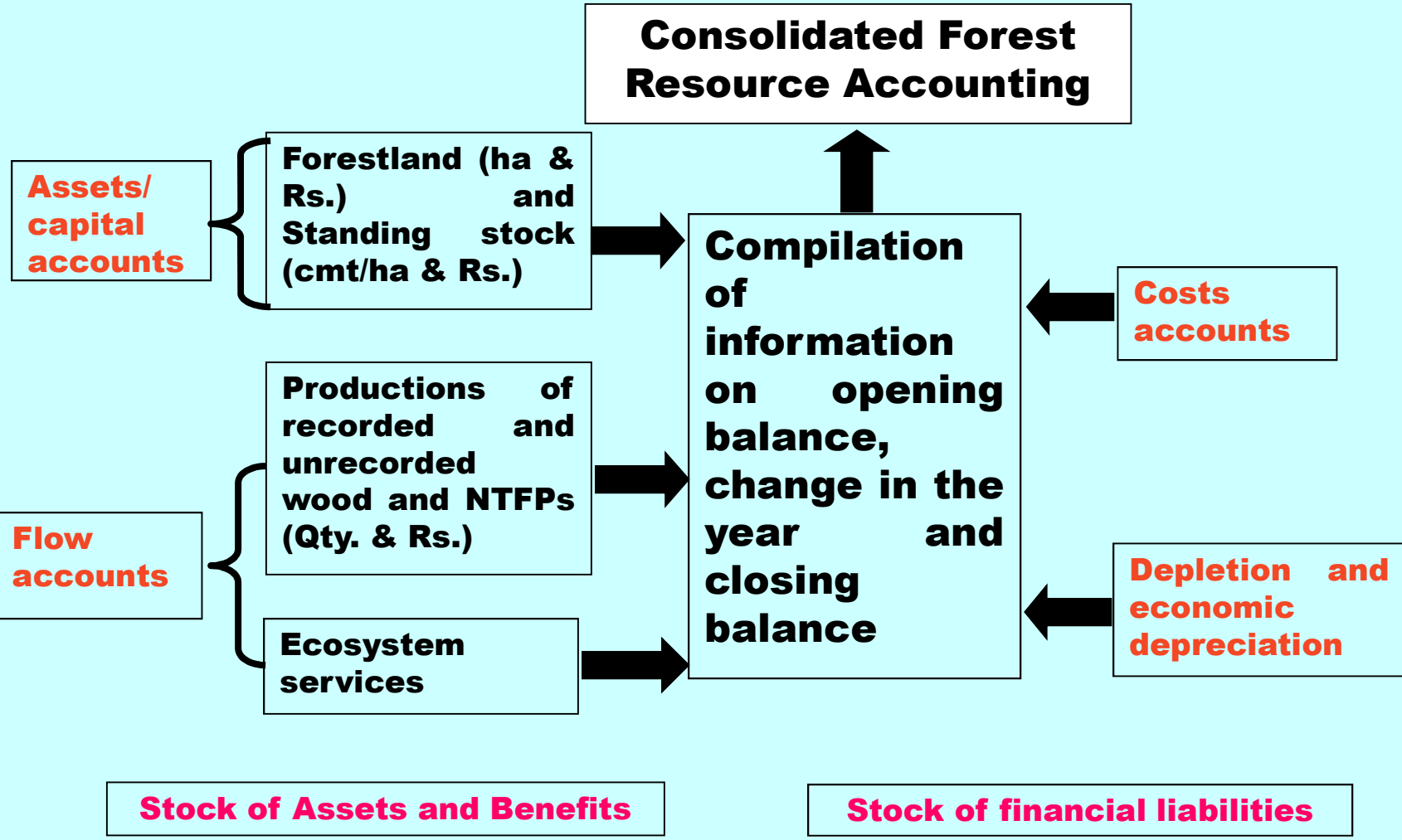
Components of SEEA Forestry Accounts ...contd

3. Expenditure on forest management and protection

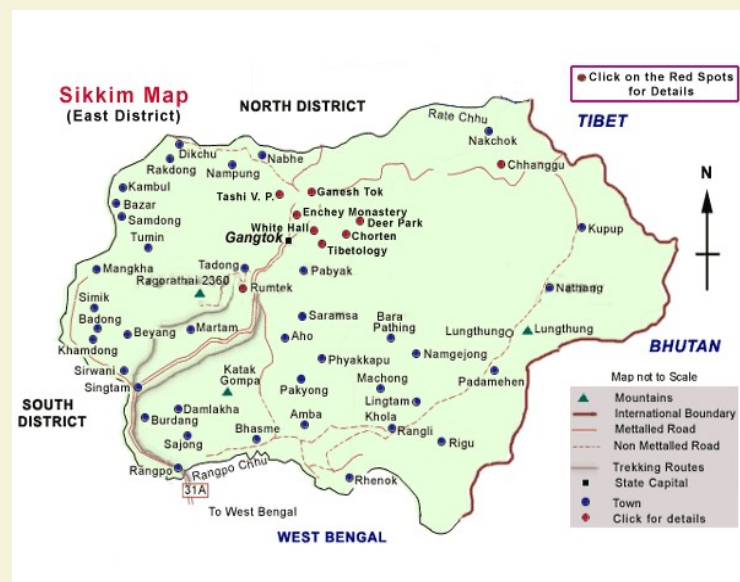
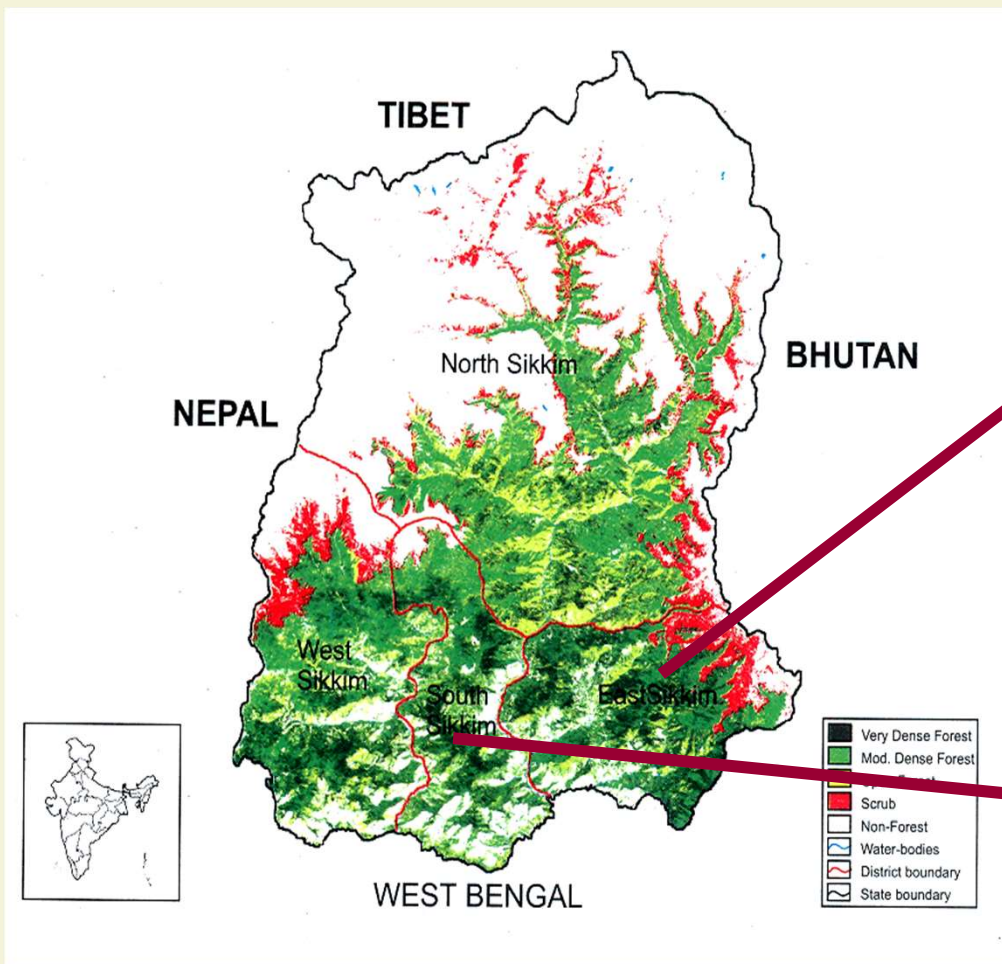
- Government expenditures
- Private sector expenditures

4. Macroeconomic aggregates

- Value of forest depletion and degradation
- Measures of national wealth, national savings and Net Domestic Product adjusted for forest depletion/accumulation



Study site



Latitudes: 27°08'2.88" to 27°25'32.28" North
 Longitudes: 88°26'26" to 88°54'25" East



Latitudes: 27°21' to 27°30' North
 Longitudes: 88°17'30" East to 88°32'30" East

South Sikkim Forest Division

South Sikkim- location

- In North - West Sikkim Forest Division
- In South - Darjeeling district of West Bengal,
- In Southeast - Kalingpong town of the Darjeeling district
- In East - East Sikkim Forest Division
- In West - West Sikkim Forest Division.

Altitude

- The altitude ranges from 300 meters in the Melli range to about 5825 meters in the Narsing peak.

Forest type

- The Tropical Ecoregion extends roughly from the foothills of the Outer Himalayas to an altitude of about 1,200 m.
- The Sub-Tropical ecoregion extends from about 1,800 m to 3,000 m
- The Temperate ecoregion extends from 3,000 m to 4,000 m.

Other types of forests characteristic of Sikkim are:

- i. **Gumpa forest:** Located near temples or Gumpa. They were previously under the custody of Monks for collection of revenue against grazing permits, punji etc but now are under the control of Forest Department.
- ii. **Road reserves:** Land on both sides of the highways, measuring such distances as may be decided by the Forest Department from the centre of the nearby road (27 feet in South Sikkim as reported by DFO)
Permission for felling of trees for widening of roads is issued by the Forest Department only.
- iii. **River reserves:** A distance of 60 meters from the centre of major streams on either side falls under river reserve.
- iv. **Land slide reserves/slip forest:** Slip reserves include all lands, which are denuded or are in the process of denudation. These areas are notified and managed by the Forest Department

Forest Area (Ha.)

Two sub-divisions are Namchi and Rabong with 5 Ranges and 12 Blocks

Three Ranges in Namchi sub-division – Melli, Namthang and Namchi.

Two Ranges in Rabong sub-division – Rabong and Lingmoo.

The division comprises a territorial division, a social forestry division, a land use & environment and wildlife division

Sl.No	Type of Forest land	Area (in ha)
1	Reserve forest	36,510.6934
2	Khasmal	9,777.5700
3	Gaucharan	1,081.9640
Total		47,370.2274

Source: Office of the DFO

METHODOLOGY

Collection of primary data

Five villages viz., Temi, Damthang Jaubari, Chuba Perbing, Rameng Niz Rameng and Salghari were purposively selected from the South Sikkim Forest Division.

From each selected village, a sample of five households was selected randomly. Thus a total sample of 25 households was selected from the South Sikkim Forest Division.

Criterion used for selection

- Existence of Joint Forest Management Committees (JFMCs) and
- One of the sites selected for operationalising the concept of sustainable forest management with community participation under the IIFM-ITTO research project.

METHODOLOGY

Collection of primary data

Primary data were collected through personal interviews with the heads or representatives of selected households using a pre-structured questionnaire

The data collected included

quantity of forest products collected from the forests by the sample households

cost of collection of forest products

requirement of wood and non-wood forest products

number of households, human and livestock population, literacy rate, main occupation etc in each village

sources of income and employment

Methodology

....contd

Secondary data were obtained from:

- **Office of the PCCF, Sikkim**
- **Central Statistical Organisation and Department of Economics, Statistics, Monitoring and Evaluation**
- **Data on revenue and cost of the last three years were compiled from the records available in the Office of the Divisional Forest Officer (DFO)**
- **Reports maintained in various sections of the Division**
- **Annual Administrative Report**
- **Working Plan of the Division**

Methodology

....contd

Nistar (No profit no loss basis) provided by the Forest Department to the communities residing within the radius of 5 kms of the forest area

**Subsidy/
Concession**

=

**Market value of
a particular
forest product**

-

**Revenue obtained at
Nistar price of the
forest product, viz.,
poles, bamboos and
fuel wood**



Method of pricing of forest produce

Prices of timber, poles, firewood, grasses and NTFPs collected by sample households were ascertained on the basis of

- Sale price of the products actually realized by the households

- In some cases the validity of the prices so determined was cross - checked or verified with the corresponding figures given in the records of forest department

Method of valuation of free grazing

Indirect substitute approach

Numbers of different types of livestock

Consumption
of fodder from
forests

=

Per day average
quantity of fodder
consumed by
livestock when they
are not sent in the
forest for grazing

X

number of
animal days
of grazing in
the forest

Methods of costing

Cost of labour used by the villagers in collection of various forest products was based on the prevailing wage rate.

The annual administrative and operational costs incurred by the forest department were based on the actual expenditure as reported by the forest department.

Data on standing stock and forestland

There is some data available on the volume of standing stock and forest area with different types in the annual administrative reports of the Forest Department and FSI reports.

Based on that information we estimated the value of the standing stock using the consumption value method.

The value of forestland was estimated on the basis of the land prices fixed by the Supreme Court of India for pricing of forestland that is diverted for non-forestry uses.

Recorded forest benefits

Commercial extraction of timber, small timber, fuelwood, bamboo, canes/reeds from the forest land is strictly prohibited. Therefore, no revenue is generated from sale of timber from forest land.

Collection of NTFPs like Ningro, Sisnoo, Chirato, Harra, Amala, Behada, Thotney and Mushroom from the forest land by the department for commercial purpose is strictly prohibited. Hence, no revenue is generated from commercial exploitation of NTFPs.

Revenue from sand, stones and stone chips

Year	Revenue (Rs.)
2005-06	1219227
2006-07	1308009
2007-08	1794596
Average	1440611

Recorded revenue and expenditure statements

Year	Revenue* (Rs)	Expenditure (Rs.)			Net revenue (Rs.)
		Plan	Non-Plan	Total	
1	2	3	4	5 (3+4)	6 (2-5)
2003-04	1853421	550000	10980000	11530000	-9676579
2004-05	2380386	638000	12320000	12958000	-10577614
2005-06	2764704	713000	14851000	15564000	-12799296
2006-07	3115651	805000	14338000	15143000	-12027349
2007-08	2441048	813000	14947000	15760000	-13318952
Average	2511042	703800	13487200	14191000	-11679958

*Includes revenue obtained from extraction of stones, chips, and sand from quarry, auction of naturally fallen trees and transit permits

Unrecorded Benefits

Total number of villages within periphery of 5 kms	60
Total number of households (average 325 households/village)	19500
Average no of members per family	6

Estimates of forest products collected free of charge by people and their value

Total Number of household = 19500

Forest Product	Total number of households	Households benefited		Per household requirement	Total quantity	Local rate (Rs./Unit)	Value (Rs.)
		Percentage	Number				
Wood collected for construction of new houses	19500	5	975	0.5 cmt	487.5	Rs.6500/cmt	3168750
Wood collected for repairing of houses	19500	10	1950	0.25 cmt	487.5	Rs.3000/cmt	1462500
Wood collected for agricultural implements, carts and rituals	19500	50	9750	0.25 cmt	2437.5	Rs.2500/cmt	6093750

Estimates of forest products collected free of charge by people and their value

Total Number of household = 19500

Forest Product	Total number of households	Households benefited		Per household requirement	Total quantity	Local rate (Rs./Unit)	Value (Rs.)
		Percentage	Number				
Poles	19500	52	10140	10 Nos.	101400	Rs.55/pole	5577000
Fuel wood	19500	50	9750	08 quintals	78000	Rs.2/kg	156000
Grass (free grazing of livestock inside forests and head load collection)	19500	25	4875	35 quintals	170625	Rs.1.5/kg	255938

Estimates of forest products collected free of charge by people and their value

Total Number of household = 19500

Non Timber Forest Products (NTFPs)					
Name of NTFPs	Total number of households	Households benefited		Value (Rs./Household)	Total value (Rs.)
		Percentage	Number		
Funchi wild fruit, <i>Polygonum molle</i> (thotne), <i>Urtica dioica</i> (Sishnoo), Nigru, Chiping, <i>Tupistra nutan</i> (Nakima), <i>Terminalia chebula</i> (Harra), <i>Terminalia bellerica</i> (Behada) and Misc. NTFPs like <i>Arundinaria intermedia</i> (Tite), Kesari, Uras, <i>Zanthoxylum</i> spp (Timur), Khanapa, Urchur, <i>Berginia ciliata</i> (Pakanbed), Bhuichampa, <i>Swertia chiraita</i> (Chiraita) and <i>Emblica officinalis</i> (Aonla)	19500	23	4485	1000	4485000
Gross value of unrecorded benefits (Rs.)					2,11,98,938

Cost of collection of Wood and NWFPs

The estimates of cost of collection of wood and NTFPs based on our sample survey are as follows:

(i) Cost of collection of wood, fuelwood, fodder and bamboo was Rs. 1,23,98,100/- (computed on the basis of 20 mandays / household / year and the wage rate of Rs. 85/ manday)

(ii) Cost of collection of NTFPs was Rs. 22,87,350/- (computed on the basis of six mandays / household / year and the wage rate of Rs. 85/manday)

Total unrecorded cost was Rs. 1,46,85,450/-

Estimates of value of all recorded and unrecorded benefits and costs

(Rs. Lakh)

Particulars	Benefits	Costs	Net benefit
Recorded*	25.11	141.91	-116.80
Unrecorded	211.99	146.85	65.14
All	237.1	288.76	-51.66

It is important to note that almost all the unrecorded benefits are realized by the people whereas the Forest Department incurs the average cost of Rs. 141.91/- lakh annually in managing and protecting the forests.

On average, the value of net benefits from forests accruing to the local people is Rs.3026/- per year per household.

Employment generated and total benefits from forests

On average, each of the households was engaged for twenty person days in collection of forest products. At the current wage rate of Rs. 85/- per person per day, average benefit in terms of employment generated from forests was Rs. 1,46,85,450/- or Rs. 2152/- per household per year.

Synthesis of case studies

Two selected sites



South
Sikkim

East
Sikkim

Two Forest Divisions were selected out of the total of four Forest Divisions. The size of the sample works to be approximately 50%. This size seems to be acceptable from statistical design point of view.

Recorded benefits and costs

S. N.	Name of Forest Division	Forest area (ha)	Recorded benefits		Recorded costs		Net benefits	
			Total (Rs. lakh)	Per ha (Rs)	Total (Rs. lakh)	Per ha (Rs.)	Total (Rs. lakh)	Per ha (Rs.)
1	South Sikkim	47370.2274	25.11	53	141.91	300	-116.80	-247
2	East Sikkim	65490.0000	141.55	216	206.39	315	-64.84	-99
All		112860.2274	166.66	148	348.30	309	-181.64	-173

Recorded benefits and costs

...contd

Negative net benefits

South
Sikkim

East
Sikkim

Average net
benefits

Rs.-173/ha

Average net benefits / ha range from

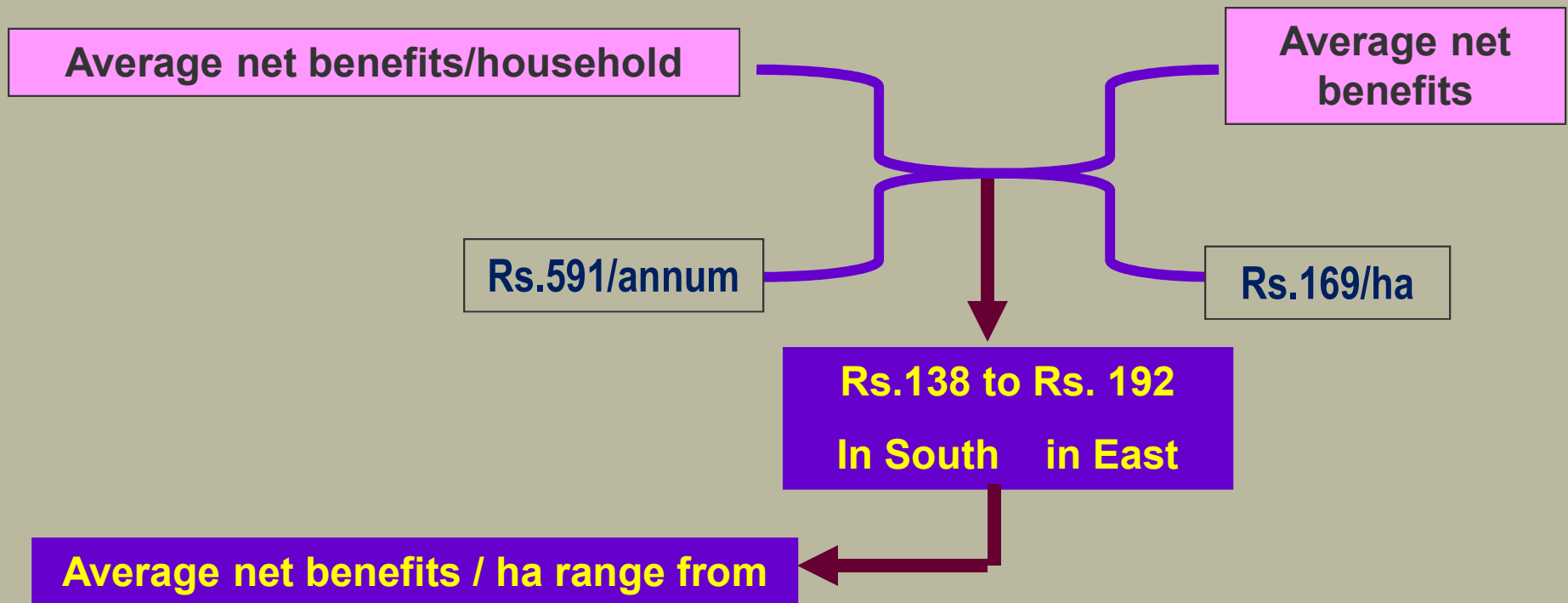
Rs.- 247 to
Rs. - 99 (loss)

Unrecorded benefits and costs

S. N.	Name of Forest Division	Forest area (ha)	Unrecorded benefits		Unrecorded costs		Net benefits	
			Total (Rs. lakh)	Per ha (Rs)	Total (Rs. lakh)	Per ha (Rs)	Total (Rs. lakh)	Per ha (Rs)
1	South Sikkim	47370.2274	211.99	448	146.85	310	65.14	138
2	East Sikkim	65490.0000	899.64	1374	774.18	1182	125.46	192
All		112860.2274	1111.63	985	921.03	816	190.59	169

Unrecorded benefits and costs

...contd



Projections of benefits at State level

Forest area* (ha)	Average recorded net benefit (Rs/ha)	Total recorded net benefit (Rs. crore)	Average unrecorded net benefit (Rs/ha)	Total unrecorded net benefit (Rs. crore)	Recorded and unrecorded benefit	
					Total (Rs. crore)	Per ha (Rs.)
584100	(-) 161	(-) 9.40	169	9.87	0.4673	8

* FSI, 2005

Extent of distortions

Official estimates of net revenue (Rs. crore)	Estimates based on the study			Distortion (Rs. crore)
	Recorded (Rs. crore)	Unrecorded (Rs. crore)	Total (Rs. crore)	
1	2	3	4 (2+3)	5 (4-1)
-13.64*	-9.40	9.87	0.4673	14.11

* Average of last six years from 2002-2003 to 2007-2008

- The extent of distortions for the state was Rs. 14.11 crore
- The corresponding per ha figure for the state was Rs.242/-

Valuation of state's forest assets

The value of forestland and growing stock represents a type of stock benefit

While incorporating the value of forestland in the SNA, the annual incremental difference in the value of forestland should be considered.

The estimates of flow of benefits from these two natural assets could be made by estimating the change during the year in the stocks in these two assets.

Valuation of state's forest assets ...contd

The changes in their values are to be included in the forest resource accounts under the head, 'Flow Benefits'.

For example

In case of forest land if there is a diversion of forestland for non-forestry purposes or encroachments, the area diverted or encroached will represent the diminution in the stock of forest land and its value would be considered as cost.

In case of growing stock, the value of annual increment in the growing stock is to be considered as a benefit accruing in the particular year.

Value of forestland

Class of forest	Area* (ha)	Price (Rs.lakh/ ha)	Total value (Rs.crore)
I. High conservation value (Very dense forest)	49800	9.2	4581.60
II. Medium conservation value			
a. Moderately dense	191200	7.5	14340.00
b. Open forest	85200	7.5	6390.00
III. Low conservation value area (scrub and barren forest area)	257900	5.8	14958.20
Total	584100	7.5**	40269.80

*FSI, 2005 ** Average price of forestland

High conservation (evergreen and natural forest) value= Rs. 9.2 lakh/ha

Medium conservations (plantations) value = Rs. 7.5 lakh/ha

Low conservation (barren land) value = Rs. 5.8 lakh/ha

Encroachment

Year	Total area encroached (ha)	Encroachment evicted (ha)	Net area under encroachment (ha)
2002-2003	3613	-	3613.0000
2003-2004	3613	-	3613.0000
2004-2005	3613	156.9374	3456.0626
2005-2006	3456.0626	8.00	3448.0626
2006-2007	3448.0626	2.00	3446.0686
2007-2008	3448.0626	-	3446.0686
Average	3531.864633	27.8229	3503.7104

Diversion of forest area to non-forestry purposes

till 31st March 2008

Particulars	Name of districts				Total
	North	East	South	West	
Number of cases approved for diversion	46	68	66	26	206
Total forest land diverted (ha)	469.36	294.26	283.95	72.76	1118.34

Fire damage

Year	Number of fire incidents in forest area			Forest area affected by fire (ha)			Loss of timber	
	Within Protected Areas (PAs)	Outside PAs	Total	Within PAs	Outside PAs	Total	Volume (cmt)	Value in Rs. lakhs
2002	4	28	32	16	154	170	2	1
2003	5	18	23	12	110	122	2	1
2004	5	16	21	18	100	118	2	1
2005	6	36	42	30	332	362	3	1
2006	8	50	58	100	308	408	3	1
2007	2	29	31	25	75	100	1	0.5
2008	3	48	51	8	338	346	2	1
Average	5	32	37	30	202	232	2.1	1

Value of growing stock

Consumption value method

The consumption value method requires data for different age classes from 1 to n. The area, quantity and price for timber of age t are shown by a subscript t. Using the consumption value method the value of the stock of standing timber, V, is given by:

$$V_0 = \sum_{t=1}^n A_t p_t Q_t$$

Where:

V = asset value of standing timber; A = total forest area in hectares; p = average stumpage price per cmt of timber; and Q = quantity of timber (cmt) per hectare.

Value of growing stock

Estimate based on findings of the study 'Assessment of Growing Stock, Biomass and Carbon in India's Forests' conducted by MoEF in 2001

The study estimated the growing stock of forests area with forest crown density more than 10%.

Over 82.31% of the total geographical area of the state is recorded as forest land comprising forest land, tree cover, road reserve, rivers/major streams, dry river beds, glaciers, lakes, alpine pasture and scrub and land under perpetual snow cover.

The state supports luxuriant tropical, temperate and alpine vegetation.

The major forest types are subtropical deciduous monsoon forest, subtropical evergreen hill forest, lower temperate broadleaf forest and upper temperate conifer forest, Oak-Rhododendron forest, sub-alpine forest and moist alpine scrub.

Biomass estimation

The volume or growing stock estimated for various strata was multiplied with the specific gravity (Rajput et al., 1996; Limaye & Sen, 1956) of the dominant tree species, of those strata, to get the biomass, of those particular strata i.e.,

$$\text{Biomass (tonne)} = \text{Volume (000, cmt)} \times \text{Specific Gravity}$$

Carbon estimation = Ash methods.

Estimate of growing stock, biomass and carbon in Sikkim

Year	Forest cover (sq. km)	Per ha growing stock (cmt/ha)	Growing stock (000, cmt)	Biomass per ha (tons/ha)	Biomass (000, tons)	Carbon per ha (tons/ha)	Carbon (000, tons)
1989	3041	126	38347.81	62	18895.47	28	8524.96
1994	3129	126	39535.59	62	19481.35	28	8789.05
2005	3262*	126	41101.20	62	20224.40	28	9133.60

* FSI, 2005, consist of forest cover with forest crown density more than 10%

Source: www.fsi.nic.in/fsi_projects

The rate of annual increment of growing stock of various forest strata was assessed by applying Von Mantel's formula, $t = 2GS/R$ where, GS=Growing Stock, R=Rotation and t=Increment.

Total growing stock, annual increment in it and its value

Total forest cover (sq.km)	Growing stock (000, cmt)	Asset value of growing stock @ Rs. 3200*/cmt (Rs)	Annual increment in growing stock (cmt/ha)	Total annual increment** (000,cmt)	Annual incremental value of growing stock @ Rs.3200/cmt
3262	41101.20	131523840000	2.4	767	2454400000

* Assuming one cmt of growing stock constitutes half cmt of biomass. The average (average of last eight years from 1997-1998 to 1998-1999 and from 2003-2004 to 2007-2008) price of timber was Rs. 6400/cmt, therefore average stumpage price is taken as Rs.3200/cmt

**Source: Extent, Composition, Density, Growing Stock and Annual Increment of India's Forests. Forest Survey of India (1995), downloaded from <http://www.envfor.nic.in/nfap/chap05.html>.)

Logging and harvesting : annual extraction of timber from forest for the years 1997-1998 to 2007-2008

Particulars	Years											Average (cmt)
	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	
Quantity of timber extracted (cmt)	60	28	43	48	330	373	135	107	94	52	28	118

Source: Annual Administrative Report 2007-08, Sikkim Forest, Environment and Wildlife Management Department, Gangtok, Sikkim

Illicit felling

The estimates of loss in timber along with the loss in value due to illicit felling

Year	Number of cases of illicit felling	Number of trees illicitly felled	Loss of timber (cmt)	Value of losses (Rs. lakhs)
2002-03	41	41	51	5.0
2003-04	30	35	35.14	3.33
2004-05	40	45	47.29	5.35
2005-06	25	65	45.36	3.78
2006-07	15	92	83.40	10.10
2007-08	15	29	30	5.0
Average	28	51	48.70	5.43

Source: Annual Administrative Report 2007-08, Sikkim Forest, Environment and Wildlife Management Department, Gangtok, Sikkim,

Carbon estimation

One of the important benefits of forests is carbon sequestration, i.e., their ability to store carbon

Conifers of temperate region, stocked maximum carbon in their woods from 28.88 to 65.21 tonnes carbon/ha

Mangrove forests, 28.24 tonnes carbon/ha

Dipterocarp forests, 28.00 tones carbon/ha

Shorea robusta forests, 24.07 tones carbon/ha

Boswellia serrata with 0.22 million ha forest area stocked only 3.91 21 tones carbon/ha

Carbon sequestration of growing stock of Sikikm's forest

Total forest cover (sq.km)	Per ha carbon (Tonnes/ha)	Total carbon sequestration (000, tonnes)	Asset value of carbon* @ Rs. 240/tons (Rs.)	Annual increment in carbon (tonnes /ha)	Total annual increment in carbon (tonnes)	Annual incremental value of carbon @ Rs.240/tonnes (Rs.)
3262	28	9133.60	2192064000	0.5	170444**	40906560

*@US\$5/tonnes of carbon, 1 US \$=Rs.48

** Assessment based on the norm that 41101200 cmt of growing stock consist of 9133600 tonnes of carbon. Therefore 767000-cmt annual increments in growing stock sequester 170444 tonnes of carbon.

Forest assets (forest area and growing stock) account

Particulars	Opening	Change	Closing
Physical account of forest area			
Total forest area (Ha)	584100		579533.59
Encroachment (-ve) (Ha)		3448.0686*	
Diversion for non-forestry purposes (-ve) (Ha)		1118.34**	
Area subjected to forest fires in 2008 (Ha)		346	
Monetary account of forest area			
Present value of forest area (Rs. crore)	40269.80		39927.31
Loss in value due to encroachment (@ Rs.7.5 lakh/ha***) (Rs)		2586051450	
Diversion for non- forestry purposes (-ve) (Rs)		838755000	
Loss due to fires (Rs.)		100000	
Total (Rs.)		3424906450	

*Total area under encroachment from 2002-2003 to 2007-2008, **Total diversion till 31-03-2008 with highest diversion in North Forest Division 467.36 ha, followed by East Forest Division 294.26 ha, South Forest Division 283.95 Ha and West Forest Division 72.76 ha.

Forest assets (forest area and growing stock) account ...contd

Particulars	Opening	Change	Closing
Growing stock			
Physical account of growing stock			
Growing stock ('000 cmt)	41101.20		41868.123
Logging and harvesting of timber in 2007-2008 (-ve) (cmt)		28	
Average illicit fellings cmt/year (-ve) (cmt)		48.70	
Annual increment (+ve) ('000cmt)		767	
Monetary account of growing stock			
Growing stock (Rs. crore)	13152.38		13397.75
Logging and harvesting of timber in 2007-2008 (-ve) (Rs.)		191000	
Average illicit fellings cmt/year (-ve) (Rs)		543000	
Annual increment (+ve) (Rs.lakh)		24544	

The capital value of forest estate (forest area and growing stock) of Sikkim forest was Rs.53325.06 crore for the year 2007-2008.

Flow accounts: Recorded and unrecorded forest goods and services

The values of recorded and unrecorded forest benefits together form the total value of flow benefits from forests

Value of recorded and unrecorded forest goods and services in the year 2007-2008

(Rs.lakh)

Particulars	Recorded forest benefits	Unrecorded forest benefits	Carbon sequestration	Total
Opening value of forest benefits	4178.29*	-	21920.64	26098.93
Change in the year 2007-2008	750.00	5753.38	409.06	6912.44
Closing value	4928.29	5753.38	22329.70	33011.37

* Cumulative revenue of the five years from 2002-2003 to 2006-2007

Note: In the year 2007-2008, the unrecorded forest benefits are nearly 8 times the recorded benefits.

Expenditure on forest management and protection

Recorded and unrecorded expenditure

(Rs.lakh)

Particulars	Recorded expenditure	Unrecorded expenditure	Total
Opening expenditure	11118.44*	-	11118.44
Change in the year 2007-2008	1993.33	4766.26	6759.59
Closing expenditure	13111.77	4766.26	17878.03

* Cumulative expenditure of the five years from 2002-2003 to 2006-2007

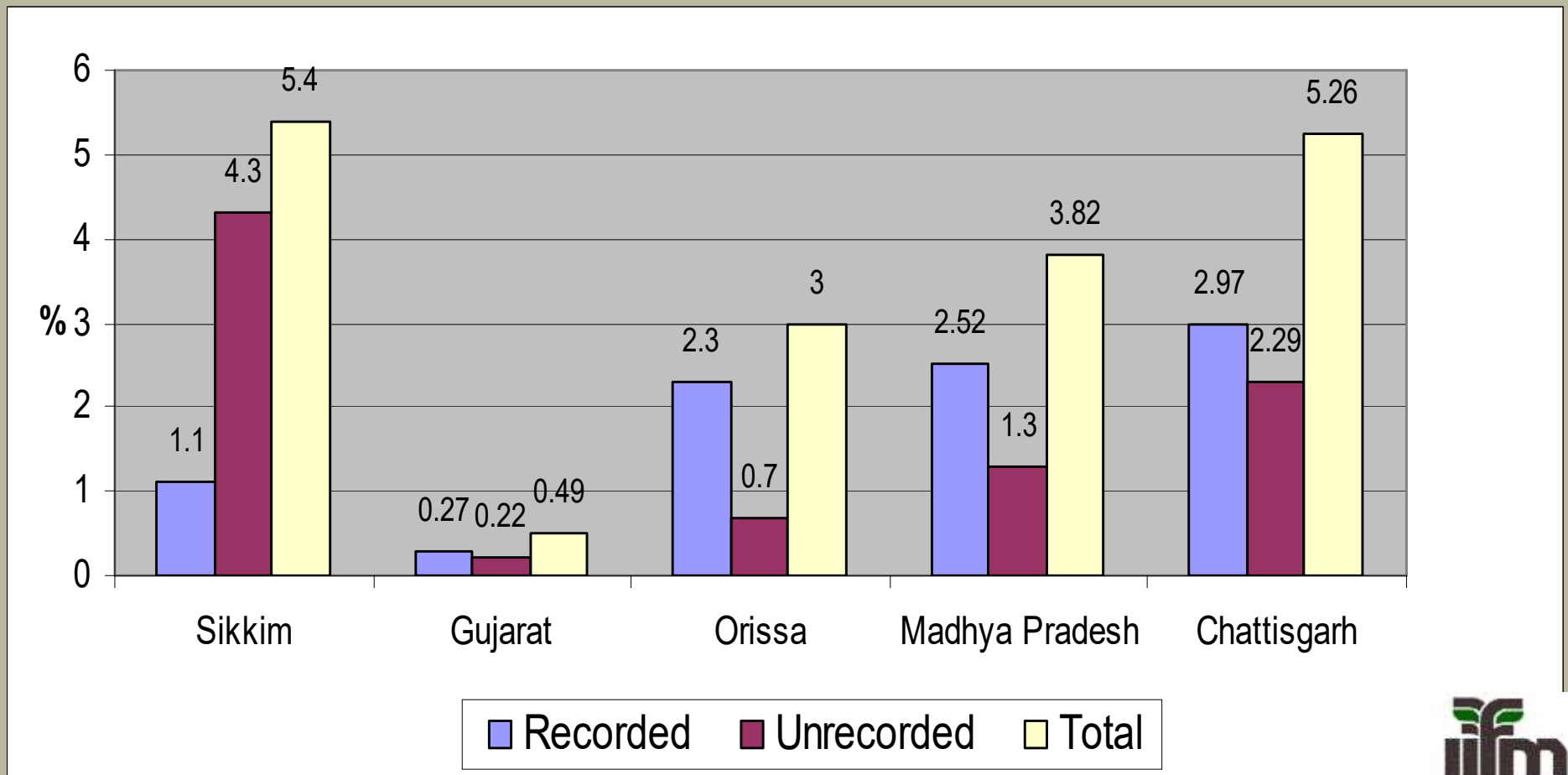
Consolidated forest resource accounts

Particulars	Forest assets account				Flow account value (Rs.lakh)	Expenditure (Rs. lakh)	Net value*** (Rs. lakh)
	Forest land		Growing stock				
	Area in Ha	Value Rs. lakh	Volume (000,cmt)	Value (Rs. lakh)			
1	2	3	4	5	6	7	[(3+5+6)-7]
Opening stock	584100	4026980.00	41101.20	1315238	26098.93	11118.44	5357198.49
Change in the stock in year 2007-2008	1118.34*	8387.55* (-ve)	766.923**	24536.66	6912.44	6759.59	16301.96
Closing stock	582981.66	4018592.45	41868.123	1339774.66	33011.37	17878.03	5373500.45

* Forest area of 1118.34 ha diverted for non-forestry purposes, valued at Rs. 8387.55 lakh, was considered as expenditure, **Positive change due to increment and ***value of forest assets + flow value – expenditure.

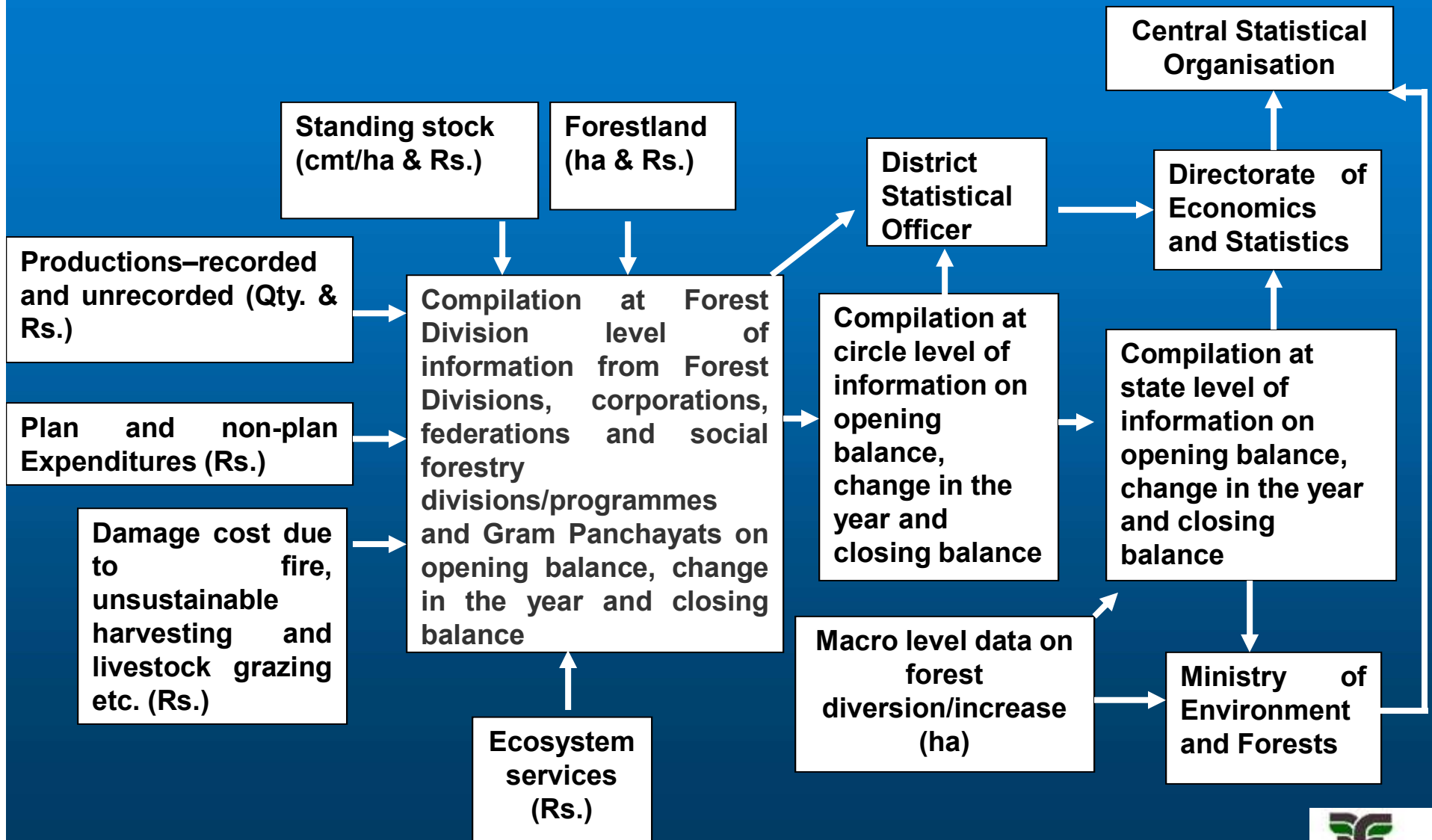
Major Findings from the States of Sikkim, Gujarat, Orissa, Madhya Pradesh and Chhattisgarh ...contd

Recorded and unrecorded contribution



Adjusted Net Domestic Product (NDP) = Conventional GDP
+ Non-market Values of Forest Benefits
– Depreciation of Human Made Capital
+ Net Accumulation of Natural Capital

A proposed flow diagram of the process of integration of forest resource accounts with other sectoral accounts in India





Thank you

Source: SFM Project, IIFM, Bhopal

Acknowledgement: Co- Coordinator, Dr M D Om Prakash

Dr. Katar Singh, Ex. Director, IRMA, Anand (Gujarat)

Mr. Kiran P Mali, Forest Resource Economist, SFM Project, IIFM.