

Natural Resources Accounting for Forestry Sector- A Case Study

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Natural Resource Accounting for Forestry Sector in Karnataka

Centre for Multi-Disciplinary Development Research (CMDR), Dharwad conducted a study on Natural Resource Accounting of Land and Forestry Sector in Karnataka

Objectives of the study, 'with regard to the Forestry Sector' were

- To identify the major environmental-related issues in Karnataka for the Forestry Sector
- To prepare physical resource accounts of the sector;
- To explore and apply appropriate valuation techniques to study
 - ✓ The extent and,
 - ✓ Impact of natural resource depletion/degradation in the Forestry Sector;
- To adjust the State Domestic Product (SDP),
 - For the changes in natural resource assets; and
- To carry out analyses to identify data gaps

Physical Accounts

- Forest constitutes around 20 percent of the total geographical area of the state constituting some of the most magnificent forests
 - Including evergreen forests, semi-evergreen forests, moist deciduous forests, dry deciduous forests, and thorn forests
- Dense forests in Karnataka and India is about 11 % of their respective geographical area
 - About 19.3 % of its geographical area as forest cover (India is 20.6 %)
 - Uttara Kannada, Dakshina Kannada & Udupi, Mysore & Chamaraja Nagara, Shimoga, Belgaum and Chikmagalur districts account for almost two thirds of the forest area
 - Uttara Kannada, Dakshina Kannada & Udupi and Mysore & Chamarajanagara account for more than 10 % of forest area
 - Districts with almost half or more than half of the forest cover are: Chamrajanagar, Chickmaglur, Shimoga, Udupi, Kannad Dakshin, Kannad Uttar, Kodagu.

Table1 : Cover Change Matrix of Karnataka in 2003
(Area in sq. kms)

	2001			2003			Change		
District/State	Dense	Open	Total	Dense	Open	Total	Dense	Open	Total
Bagalkot	225	159	384	32	182	214	-193	23	-170
Bijapur	166	12	178	1	37	38	-165	25	-140
Gulbarga	299	174	473	91	239	330	-208	65	-143
Kannad Dakshin	2969	1078	4047	1095	1302	2397	-1874	224	-1650
Raichur	112	0	211	20	87	107	-92	87	-104
Udupi	555	115	670	1443	783	2226	888	668	1556
Karnataka	26156	10835	36991	22461	13988	36449	-3695	3153	-542

Forest Valuations

- Physical accounting has been done as the change in forest cover during 2001 to 2003.
- Forests estates can be valued by multiplying the unit price of forest to the area under forest.
 - Average prices for various types of forests can be obtained from the register of transactions regarding land transfers.
- Monetary accounts have not been developed
 - Due to lack of information on the valuation of different type of forests.

Flow Accounts

- GSDP takes into account
 - Major products comprising industrial wood (timber, round wood, match and pulpwood) and fuel-wood (firewood and charcoal wood); and,
 - Non-Timber Forest Products (NTFPs) in the minor products (to some extent) that consist of a large number of heterogeneous items
 - Such as bamboo, fodder, lac, sandalwood, honey, resin, gum, tendu leaves, etc
 - However, NTFPs remain under accounted to a large extent
- Other benefits of forest such as grazing services, carbon sequestration, fuel wood use by local industries, medicinal plants, watershed benefits, and sacred groves are not accounted in GSDP

Estimation of under accounting of NTFPs and contribution of other products and services:

To estimate the under accounting of NTFPs and contribution of other factors to State Domestic Product by the forest sector, eight case studies have been carried out in valuation of select forest produce and forest services.

- (1) Non-Timber Forest Products (NTFPs);
- (2) Grazing services;
- (3) Eco-tourism (Dandeli Park);
- (4) Carbon sequestration;
- (5) Fuel wood use by local industries;
- (6) Medicinal plants;
- (7) Watershed benefits; and,
- (8) Sacred groves.

Estimation of under accounting of NTFPs and contribution of other products and services

- Total value of NTFPs has been obtained by multiplying the estimated value of **NTFPs/hectare** from the sample households by the total forest area.
- This yields the value of all NTFPs collected to be equal to Rs 16850 million.
- The recorded value of NTFPs for the state for 2002-03 is estimated to be Rs. 353 million. The estimated of unrecorded value of NTFPs is Rs 16497 million for the year 2002-03.

I. Non-timber Forest Products (NTFPs)


Types	Value of NTFPs Collected / Ha By HHs in Selected Villages (Rs)*	area in Karnataka (Ha)	Total Value of NTFPs in Karnataka (Rs. million) 2004-05	Total Value of Recorded NTFP (Rs. million) 2000-01	Total Adjusted Value of NTFP in Karnataka (Rs. million)*	Total Adjusted Value of Recorded NTFPs (Rs. million)*	Total Adjusted Value of NTFPs Unrecorded: (Rs. million)*
Evergreen	498.0	435000	217	NA	196	NA	196
Semi-evergreen	424.0	145000	61	NA	56	NA	56
Moist deciduous	424.0	578000	245	NA	222	NA	222
Dry deciduous	13979.0	727000	10163	NA	9218	NA	9218
Thorn Forests (Scrub)	9462.0	834000	7891	NA	7158	NA	7158
Total	1116.0@		18577	336#	16850	353	16497

@ Average, not total *-Adjusted value 2002-03

- Recorded value of NTFP for 2001-02 (DES)

II Grazing Services

- About 45 percent of the livestock owning households fully depend on forest for grazing their livestock. These households do not use other sources of fodder.
- The livestock of the sample households and then the animal units during different seasons grazing in the forests of villages of the study area has been used to calculate the grazing intensity during various seasons and forest types.

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- Using the average grazing intensity (Animal Units per HH) in different types of forests, animal units per hectare have been estimated in various types of forests.
 - On an average, 4.18 tonnes* of fodder per year per livestock is required
 - The study has assumed that 75 percent@ of the fodder requirement of the live stock (i.e., 3.14 ton out of total requirement of 4.18 ton) is met from the grazing facilities of the forest.
 - Using the average price of fodder in the market of Rs. 600 per ton, the estimate of the fodder supplied by various forest types in the state is of the magnitude of about Rs. 6350 million in 2003-04.

*-Reported average fodder requirement per year per live stock (Govt. of Karnataka 1996)

@- Commom property resources and rural poor in dry regions of India, Jodhe NS (1992)

Estimation of Value of Grazing Services Provided by Various Types of Forests in Karnataka State

Data and Estimates for Sample Villages						Estimates for Karnataka			
Type of Forest	Forest Area (Ha)	Total No of HHs	Animal units / HH	Total animal units in the village	Animal units/ Ha in selected villages	Forest Area in Karnataka (Ha)	Animal Units in Grazing in Forests of Karnataka	Fodder Requirement in Tons@	Value of Fodder (Rs. million)
1	2	3	4	(5) = (3)*(4)	(6) = (5)/(4)	7	(8) = (7)*(2)	9	10
Ever Green	4497	655	0.9	590	0.13	435000	57023	179052	107.4
SE & MD	18657	1881	0.68	1279	0.07	723000	49567	155641	93.4
Tropical Thorny	1257	771	1.89	1457	1.16	727000	842782	2646336	1587.8
Dry Deciduous	405	796	1.48	1178	2.91	834000	2425972	7617553	4570.5
Total	24816	4103	1.12	4595	0.19	2719000	3375344	10598582	6359.1

Note: @ = Assumption: Fodder required/ animal unit is 3.14 ton per year

III. Recreation and Tourism Services

Travel cost method used for estimating the recreational value of forests.

Based on the primary data from 300 sample visits, total recreational value was estimated using the recreational value for Dandeli Wild Life Sanctuary calculated through multiple log linear model. Visitors' statistics were collected from different sources (Govt. and private guesthouses, lodges and hotels etc.) and an approximate estimate was made of 18,000 visitors for recreational purpose.

The sample average travel expenses incurred by individuals to reach the site was estimated to be Rs. 480.2 /-per visit.

The sample average consumer's surplus per visit corresponding to log-linear and linear demand curves were estimated to be Rs.500/- and Rs.1711/- respectively.

The recreational value of forests in the study area was then estimated as Rs 37,142.86 per Sq km. Taking the wildlife area of 6319.33 Sq km in the State, recreational value of forests for the State as a whole was estimated to be Rs 211 million constituting 0.02 % of GSDP at current prices for 2002-03

IV. Carbon Sequestration

Carbon content of forests has been calculated assuming forests biomass density of 92t/Ha (Haripriya 2000) and multiplying this density i.e. per Ha biomass density (i.e. 92t) by the total forest area (i.e. 3828430 Ha).

Estimated biomass of 352215560 tonnes has been converted to carbon values by assigning a carbon content of 0.5mg per mg over dry biomass (i.e. 176107780t - $352215560 \text{ tonnes} \times 0.5\text{mg}$)

Carbon was valued at the rate of US\$20/metric tonne of carbon (Haripriya 2000). The value of dollar was around Rs. 47.33 during the year 2002-03.

The estimated value of carbon content in the forests of Karnataka is Rs. 16,6598 million.

V. Fuel Wood Used by Local Industries

A sample of 32 local producers using fuel wood for various purposes was selected for the case study.

The value of fuel wood consumed by the sample units ranges from as low as Rs. 480 per annum to as high as Rs. 25,00,000/- per annum.

Valuation of fuel wood consumption by local producers was not attempted to avoid double counting. The sale of fuel wood by government depots is already accounted for in the national income accounts and has also been included the case study on consumption of fuel wood for household purposes.

VI Medicinal Plants

- On the basis of the average willingness to pay for the preservation of medicinal plants, total willingness to pay in the selected villages was found to be Rs.8220/- and the **willingness to pay per hectare was calculated to be Rs 23.48.**
- Total willingness to pay for the preservation of medicinal plants for the State as a whole was estimated as Rs.90 million taking the total forest area as 3828430 hectares.
 - This constituted 0.01 percent share of medicinal plants in GSDP of the State for the year 2002-03.

VII Sacred Groves

The average willingness to pay to preserve the sacred groves was calculated as Rs.7280.18 per hectare on the basis of their total willingness to pay to be Rs.5,547.5 and the total area under sacred groves to be 0.762 Ha.

Total willingness to pay for state to preserve the sacred groves, the willingness to pay per ha was multiplied by the total sacred groves area of 2550 hectare .

The value of willingness to pay for Karnataka was estimated to be Rs 18.5 million for the year 2004-05.

After adjusting the value for the year 2002-03 the estimated share of sacred groves in GSDP was 0.001 per cent.

VIII Watershed Benefits

On the basis of the average willingness to pay for the watersheds calculated from the sample, **the willingness to pay per hectare was estimated to be Rs.125.45.**

Taking total forest area of Karnataka to be 3828430 hectares, the total value of willingness to pay for the preservation of watershed in the State was estimated to be Rs 480 million for the year 2004-05.

The adjusted value for the year 2002-03 was Rs 432.3 million. The share of watersheds in the GSDP was 0.04 per cent in the year 2002-03.

Domestic Product (GSDP) --- 2002-03

Karnataka

(Forestry and Logging)

(Rs. million)

No.	Products & Services	Existing system of Accounting*	Augmented Accounting	% of State GDP
1	Forestry & Logging	19,120.0	19,120	1.68
2	NTFP		16,497**	1.45
3	Grazing		6,359	0.56
4.	Fuel Wood for industries		0	
5	Medicinal Plants		92	0.01
7	Sacred groves		18	0.002
8	Watershed benefits		480	0.04
	Total Forestry	19,120.0	42,566	3.74
	Total State GSDP		1,13,929	
	Carbon Sequestration		166,600.0@	

* Including NTFPs

** Estimated unrecorded value of NTFPs

@ Carbon Sequestration is a stock concept and not a flow concept. Only flows can be used in national income accounting, while the stock concept can be used in the context of Natural Resource Accounting.

NRA Framework for forests in Karnataka

	Methodology	Multiplier	Variable 2003-In the present study OR Latest Year	Formula
1	2	3	4	5
Forestry & Logging	As estimated under existing system of national accounting			
NTFP	<ul style="list-style-type: none"> Estimation of value of NTFPs in the selected villages per Ha by forest type 	Value of NTFPs Collected/Ha (Rs) Evergreen 498.0 Semi-evergreen 424.0 Moist deciduous 424.0 Dry deciduous 13979.0 Thorn Forests 9462.0 (Scrub)	area (Ha) Evergreen 435000 Semi-evergreen 145000 Moist deciduous 578000 Dry deciduous 727000 (Scrub)	$\Sigma (3) * \text{Area}$
Grazing Services	<ul style="list-style-type: none"> Estimation of Animal units per Ha in the selected villages Average fodder required per year per animal unit = 3.14 tonnes (Govt of Karnataka, 1996). Average price of fodder in the market is about Rs. 600 per ton 	Animal Units per Ha Evergreen 0.13 Semi-evergreen 0.07 & Moist deciduous Tropical Thorny 1.16 Dry deciduous 2.91	area (Ha) Evergreen 435000 Semi-evergreen 723000 Moist deciduous Tropical Thorny 727000 Dry deciduous 834000	$\Sigma (3) * \text{Area} * 3.14 * 600$
Recreational Value of Wildlife Sanctuaries	<ul style="list-style-type: none"> Estimation of recreational value of Dandeli wildlife sanctuary 	Recreational value of wildlife sanctuaries = Rs. 37142.86 per Sq Km.	Wildlife sanctuary area of the state = 6319.33 Sq Km	$(3) * \text{Wildlife sanctuary area}$

NRA Framework for forests in Karnataka: (Contd..)

	Methodology	Multiplier	Variable 2003-In the present study OR Latest Year	Formula
1	2	3	4	5
Carbon Sequestration	Estimation of Carbon content of forests of Karnataka assuming: <ul style="list-style-type: none"> •Biomass density per hectare = 92t/Ha (Haripriya 2000) •Carbon content 0.5mg per mg over dry biomass •Value of Carbon = US\$20/metric ton 	Carbon content per Ha = 92*0.5	Total forest area = 3828430 Ha	(3)* Forest Area*20* Value of US\$
Valuation of Medicinal Plants	<ul style="list-style-type: none"> • Estimation of willingness to pay for preservation of medicinal plants in the selected villages per Ha 	Willingness to pay for preservation of medicinal plants per Ha = Rs.23.48	Total forest area =3828430 Ha.	(3)* Area
Valuation of Sacred groves	<ul style="list-style-type: none"> • Estimation of willingness to pay for preservation of sacred groves in the selected villages per Ha 	Willingness to pay for preservation of sacred Groves per Ha= Rs.7280.18	Total sacred groves area = 2550 Ha	(3)* sacred groves area
Valuation of Watershed benefits	<ul style="list-style-type: none"> • Estimation of willingness to pay for preservation of watershed in the selected villages 	Willingness to pay for preservation of watershed per Ha = Rs. Rs.125.45	Total forest area =3828430 Ha	(3)* Area