

**POVERTY AND DEFORESTATION NEXUS IN
JOINT FOREST MANAGEMENT REGIME:
A STUDY IN CHANDAKA WILDLIFE DIVISION OF ORISSA
STATE IN INDIA**

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STATE IN INDIA**


*Dissertation submitted in partial fulfilment of the requirements for the
Degree of Master of Philosophy in Applied Economics
of the Jawaharlal Nehru University*

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M.Phil Programme in Applied Economics
2004-06**

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Thiruvananthapuram
June 2006**

I hereby affirm that the work for the dissertation, Poverty and Deforestation Nexus in Joint Forest Management Regime: A Study in Chandaka Wildlife Division of Orissa State in India, being submitted as part of the requirements of the M.Phil Programme in Applied Economics of the Jawaharlal Nehru University, was carried out entirely by myself. I also affirm that it was not a part of any other programme of study and has not been submitted to any other University for the award of any degree.

June 30, 2006


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Certified that this study is the bona fide work of Amarendra Das, carried out under my supervision at the Centre for Development Studies.



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To
The Memory of my Loving Grandmother
Late Sukumari Das

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ABSTRACT OF THE DISSERTATION

POVERTY AND DEFORESTATION NEXUS IN JOINT FOREST MANAGEMENT REGIME: A STUDY IN CHANDAKA WILDLIFE DIVISION OF ORISSA STATE IN INDIA

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The complex relationship between poverty and deforestation has been extensively discussed in the economic literature. The popularity of co-management system (Joint Forest Management in India), during last two decades, to conserve forests has brought a new dimension to this debate. The present study theoretically as well as empirically explains the factors that influence the individual decision to indulge in low-yielding forest cutting activities. Based on a survey of 140 households in three forest fringe villages of Chandaka Wildlife Division of Orissa in India, the study reveals that lack of human capital, landlessness and low environmental awareness significantly influence the individual decision to be involved in forest degrading activities. The implementation of JFM or co-management system merely transfers the dependence of local community from one patch of forest to another, unless and until the opportunity cost of rural household is not increased. Thus, even though the communities are successful at unit level to conserve forests, they fail at aggregate level. It implies that until the source of livelihood for the rural poor households is ensured, they would go for forest degrading activities to meet the same. In order to check this depressing scenario, the provision of other means of livelihood is very important. The present study conveys that the rise of opportunity cost by providing other employment opportunities, developing human capital and, if possible, allocating land to the landless would help a great deal to halt forest degradation by the local poor households.

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LIST OF ABBREVIATIONS

APL	Above Poverty Line
BPL	Below Poverty Line
CPR	Common Pool Resources
DFO	Divisional Forest Officer
FAO	Food and Agricultural Organization
FD	Forest Department
FGD	Focus Group Discussion
FSI	Forest Survey of India
GDP	Gross Domestic Production
HH	Household
JFM	Joint Forest Management
LPG	Liquified Petroleum Gas
MPC	Marginal Private Cost
MSC	Marginal Social Cost
MSY	Maximum Sustainable Yield
NGO	Non Governmental Organization
NTFP	Non Timber Forest Product
OBC	Other Backward Caste
SC	Scheduled Caste
SFR	State of Forest Report
ST	Scheduled Tribe
TOF	Trees Out side of Forest
UTs	Union Territories
VSS	Vana Samrakshana Samiti

CHAPTER 1

INTRODUCTION

1.1 The Context

Conservation of environment is a prerequisite for attaining sustainable development. In this regard, one of the major concerns of researchers, policy makers and environmentalists has been how to halt deforestation and forest degradation. Much emphasis has been laid to protect the existing forests and create new forests. Apart from environmental concern, which can be viewed as *global need*, importance of forest resources also emanates from the heavy dependence of rural populace on it for their livelihood, which can be viewed as *local need*. Although there is no accurate estimation of the number of people dependent upon forest, there is a consensus that a huge proportion of rural households are directly or indirectly dependent upon forest for various purposes. This heavy dependence of a huge population, particularly in most of the developing nations, on forests leads to its degradation. Thus poverty has been seen as one of the most important reasons behind massive deforestation.

At the very outset it should be recognized that poverty is not the sole cause of massive deforestation in most of the developing nations. A host of other factors like heavy population pressure, commercial logging, government policy, and various developmental projects play prominent role for forest degradation.

In most of the developing countries where a huge section of people are languishing in poverty trap, vast *de facto* open-access forest resources, *inter alia* other common pool resources, provide an important source of livelihood. Moreover, population pressure in most of these countries is also tremendous. Therefore, it could be logically derived that when the rate of resource extraction exceeds the rate of resource regeneration it leads to degradation of forest and other natural resources. Nonetheless, this poverty-deforestation nexus cannot be fully explained in such a simplistic framework. A whole range of factors like, demographic, institutional and market forces interact between poverty and environment to establish the link in a very complex manner.

Realising the heavy dependency of rural folk on the forests for various purposes and their physical presence in proximity to it, a number of developing countries have evolved co-management (where local community and the government agencies are joint stakeholders in forest protection) system to protect the forest. Therefore, many countries are putting their best efforts to bring more and more forest cover under the co-management system.

In India the co-management system, known as Joint Forest Management (JFM), came into vogue since early 1990. Since then all the States have been trying to bring more and more forest area under this system. As on September 10, 2003, 84,632 JFM committees have been formed and 17331955.1 hectares of forests area have been brought under this management system (Govt. of India 2003-04).

The implementation of JFM brings a new dimension to the poverty and deforestation debate. How do the poor people participate in forest conservation? Will this system of co-management be able to halt deforestation and conserve the existing forests? If not, why do they fail to do so? What are the factors that influence the individual/community participation in forest conservation or depletion? These are a few important questions, which strike any intellectual mind. Our study seeks to explain these questions theoretically as well as empirically.

1.2 Objectives of the Study

The objectives of the present study are as follows:

1. To trace out the factors that influence the individual decision to participate in forest degrading activities and
2. To examine the nature of participation of the poor (forest dependent) rural households in forest conservation during JFM regime.

For empirically examining the research questions this study relies upon primary data sources, gathered from household survey, focus group discussions (FGD) held in three forest fringe villages and information collected by having special discussions with the Forest Department (FD) officials of Chandaka Wildlife Division of Orissa State in India. Based on the information collected from a pilot survey of 19 forest fringe villages of Chandaka Wildlife Division, the features of villages were clubbed under three categories. 140 households were selected by systematic random sampling method from three villages (having those three distinct

characteristics) and they were administered with a systematically designed interview schedule (for detailed Interview Schedule see Appendix-D).

1.3 Outline of Chapters

The outline of the chapters is as follows. Chapter 1, which is the introductory chapter states the context and the objectives of the study. The following sections portray the status of forest in India vis-à-vis its' major counterparts across the globe and forests within India and its' different States and Union Territories. A special analysis is also carried out for the State of Orissa and its districts. Changes in forest policies in India and the State of Orissa have also been illustrated in this chapter. Chapter 2 reviews the literature on poverty and environment (deforestation) nexus. In Chapter 3 theoretical framework for the present study is construed. Methodology for the study, study area and sampling design are explained in Chapter 4. Chapter 5 analyses the data collected from the field survey and narrates the major findings of the study. Chapter 6 concludes with summary of research findings, policy implications and issues for further research.

1.4 State of Forest

This section portrays the status of forest in India as a whole and State of Orissa in particular. At the outset we shed light on the state of India's forest cover vis-à-vis a few other major developed and developing nations of the world. Then we move on to look at the status of forests in different States of India. Finally we shed light on the health of forest in Orissa as whole and in different districts of the State.

1.4.1 India Vs World

Massive deforestation and rampant forest degradation¹ have been a matter of serious concern all over the world. More specifically, rate of deforestation and forest degradation in many of the developing nations are showing very disturbing pictures. Forest cover in many of these countries have come down to a very low level A close look on the data on forest cover in the major developed and developing nations reveals the huge disparity of forest cover among these

¹ There is a lot of confusion while using the terms deforestation and forest degradation. Many times the terms deforestation and forest degradation have been used interchangeably. In true sense, these are two different terminologies and hence needs more clarification. For more explanation on it see the Appendix-A.

countries. Table-1.1 depicts the picture of forest cover and other wooded land in major developing and developed nations of the world.

Table-1.1: Extent of Forest and Other Wooded Land in Major Countries of the World During 2005

Country / Area	Land area				
	Forest		Other wooded land	Other land	
	1000 ha	% of land area		Total	with tree cover
	1000 ha	% of land area	1000 ha	1000 ha	1000 ha
South Africa	9203	8	21409	90835	-
China	197290	21	87615	647837	0
Japan	24868	68	-	11582	-
Bangladesh	871	7	58	12087	343
India	67701	23	4110	225508	815
Indonesia	88495	49	-	92662	9648
Malaysia	20890	64	-	11965	-
Nepal	3636	25	1897	8767	-
Pakistan	1902	3	1389	73797	-
Sri Lanka	1933	30	0	4530	-
Thailand	14520	28	-	36569	-
Total Asia	571577	19	191291	2325168	11951
France	15554	28	1708	37748	269
Germany	11076	32	-	23819	-
Greece	3752	29	2780	6358	-
Norway	9387	31	2613	18625	-
Sweden	27528	67	3257	10377	1353
Switzerland	1221	31	67	2667	-
UK	2845	12	20	21223	24
USA	303089	33	-	612807	32899
Australia	163678	21	421590	182962	-
Brazil	477698	57	-	357858	-
Total World	3952025	30	1375829	7724998	75779

Source: FAO (2005), Global Forest Resources Assessment.

Note: The figure for Australia on the extent of other wooded land for year 2005 is a FAO estimate, based on the assumption that the area of other wooded land has been constant since 2000.

The forest cover in India as compared to that of world average is much less. In aggregate, 30% of the total land of the world is covered with forests. Forest cover in many of the developed countries like USA, Japan, Germany, France, Sweden, Malaysia is much higher than that of a

number of other developed as well as developing nations. On the one hand, countries like Japan, Malaysia and Sweden have forest cover of 68%, 64% and 67% of their total geographical area respectively, which are more than the double of the world average. Similarly, Brazil possesses forest cover of 57% of total land area, which is just close to double the world average. On the other hand, countries namely, South Africa, Pakistan, Bangladesh and United Kingdom have much less forest cover, which amounts to 8%, 3%, 7% and 12% respectively. These countries possess forest cover of even less than half of the world average. Countries like USA, Germany, Norway, Indonesia, Switzerland, Sri Lanka have forest cover close to world average or even higher than that. A few other countries, which are just below the world average, are India, China, Nepal, Thailand, France, Greece, and Australia.

1.4.2 India and its' States

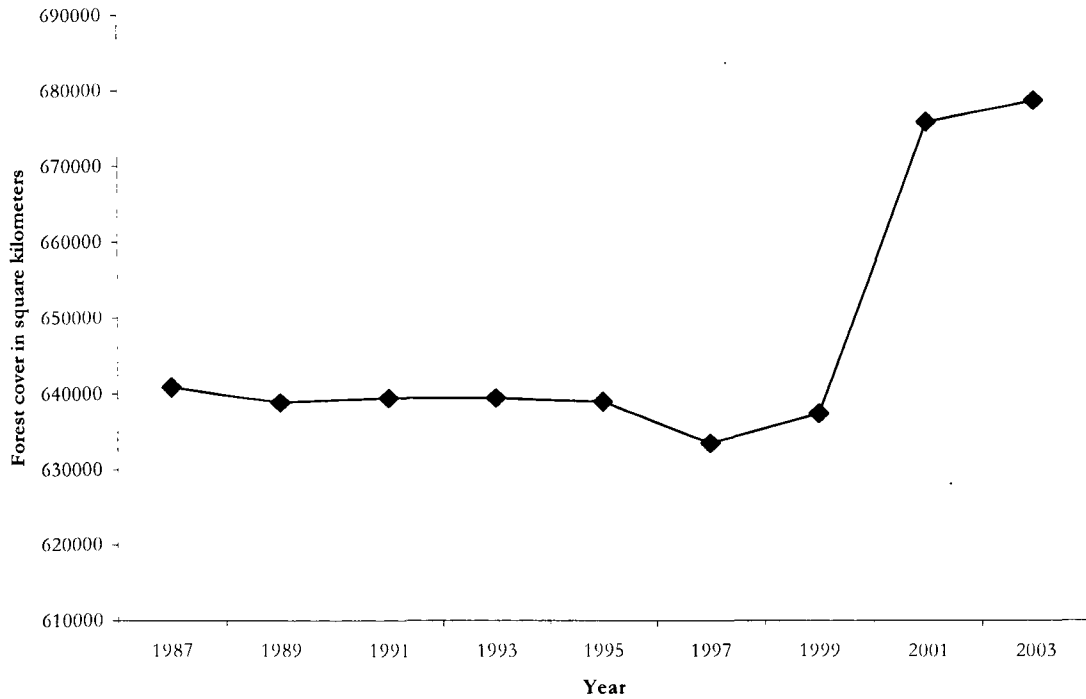
Having observed India's (disappointing) status of forest vis-à-vis that of major developed and developing countries of the world, it is imperative to look at its internal dynamics by inquiring into the status of forests in her different States and Union Territories. Although there are a number of problems with data, which constrain us to analyse the statistics relating to forest cover over time period, the cross section data on the forest cover give much valuable information and vital implications. (For more elaboration on various problems with data see Appendix B). Table-1.2 shows the forest cover in India as a whole and in different States and Union Territories. In percentage terms, total forest cover in India as a whole has slightly come down from 19.49% of total land area in 1987 to 19.23% in 1997 and then it has slightly risen to 19.39% in 1999. But the absolute figure (in square kilometres) on forest cover gives a very disturbing picture. Rate of deforestation between the 1987 and 1997 is as high as 742.20 square kilometres per year. On an average, during this period, 203 hectares of forest have been cleared away on daily basis. Compared to the forest cover in 1997, in subsequent years forest cover in India has increased (see Fig-1.1). The rise was very low in the year 1999 and a sudden jump is observed in the year 2001 and 2003. However, the years 2001 and 2003 coincides with the change in scale for analysing the satellite picture to assess forest cover. Hence we could presume that the increase in forest cover in last two estimates – 2001 and 2003 - by FSI is due to upgradation of measurement techniques, rather than real increase in forest cover.

Table- 1.2 Forest Cover In The States And Union Territories Of India (in square km)

States/UT	1987	1989	1991	1993	1995	1997	1999	2001	2003
Andhara Pradesh	49,573	47290	47290	47256	47112	43290	44229	44637	44419
Arunachal Pradesh	64132	69002	68757	68661	68621	68602	68847	68045	68019
Asam	25160	24832	24751	24508	24061	23824	23688	27714	27826
Bihar	28482	26668	26668	26587	26561	26524	26474	28357	28274
Delhi	15	22	22	22	26	26	88	111	170
Goa	1240	1255	1255	1250	1250	1252	1251	2095	2156
Gujarat	11991	11921	11907	12044	12320	12578	12965	15152	14946
Haryana	513	513	513	513	603	604	964	1745	1517
Himachal Pradesh	12480	12480	12480	12502	12501	12521	13082	14360	14353
Jammu& Kashmir	20905	20449	20449	20443	20433	20440	20441	21237	21267
Karnataka	32268	32104	32199	32343	32382	32403	32467	36991	36449
Kerala	10292	10292	10292	10336	10336	10334	10323	15560	15577
Madhya Pradesh	130099	135541	135541	135396	135164	131195	131830	133713	132427
Maharashtra	45606	44044	44044	43859	43843	46143	46672	47482	46865
Manipur	17475	17685	17685	17621	17558	17418	17384	16926	17219
Meghalay	16466	15645	15875	15769	15714	15657	15633	15584	16839
Mizoram	19084	18170	18853	18697	18576	18775	18338	17494	18430
Nagaland	14394	14399	14321	14348	14291	14221	14164	13345	13609
Orissa	53253	47227	47205	47145	47107	46941	47033	48838	48366
Punjab	943	1338	1343	1343	1342	1387	1412	2432	1580
Rajasthan	12758	12884	12889	13099	13280	13353	13871	16367	15826
Sikkim	2756	3041	3041	3119	3127	3129	3118	3193	3262
Tamil Nadu	17472	16992	16992	17005	17045	17064	17078	21482	22643
Tripura	5959	5535	5535	5538	5538	5546	5745	7065	8093
Uttar Pradesh	31226	33627	33609	33961	33986	33994	34016	37684	38583
West Bengal	8432	8015	8015	8186	8276	8349	8362	10693	12343
Andaman & Nicobar	7601	7622	7622	7624	7615	7613	7606	6930	6964
Chandigarh	2	5	5	5	7	7	7	9	15
Dadra & N. Haveli	238	206	206	206	204	204	202	219	225
Daman & Diu	0	0	0	0	0	0	0	6	8
Lakshadweep	0	0	0	0	0	0	0	27	23
Pondicherry	0	0	0	0	0	0	0	36	40
Grand Total	640819	638804	639364	639386	638879	633397	637293	675538	678333
Percent	19.49	19.43	19.45	19.45	19.43	19.27	19.39	20.55	20.64

Source: FSI (2003) State of Forest Report

Fig-1.1: Trend of Forest Cover in India from the year 1987 to 2003



A careful look at the status of forest in different States and Union Territories of India reveals the wide differences. Table-1.2 shows the State-wise forest cover in India since 1987 to 2003 and Table-1.3 shows the net change in forest cover, percentage change and annual percentage change for different States. While a few States are showing a declining trend, others are showing an increasing trend in forest cover. Forest cover in Andhra Pradesh is showing a sharp decline over last 16 years (1987 to 2003). Similarly, other States/UTs, which have recorded a decline in forest cover over this period, are Orissa, Bihar, Nagaland, Mizoram, Manipur, Andaman and Nicobar Islands and Dadra and Haveli. The States/UTs, which have registered a growth, more than 1% annual rate, in forest cover, are Haryana, Kerala, Punjab, Delhi, Chandigarh, West Bengal, Uttar Pradesh, Goa, Gujarat, Tamil Nadu, Sikkim, Rajasthan and Tripura. Similarly, States/UTs, which have also registered a growth but less than 1% annual rate are Himachal Pradesh, Arunachal Pradesh, Assam, Karnataka, Madhya Pradesh, Jammu & Kashmir, Maharashtra and Meghalaya.

**Table-1.3 Change of Forest Cover in the Indian States and UTs over 16 Years
(from 1987 to 2003)**

States/UT	Change From 1987 to 2003	% Change From 1987 to 2003	Annual % Change Over 16 Years
Andhara Pradesh	-5,154	-10.40	-0.65
Arunachal Pradesh	3,887	6.06	0.38
Asam	2,666	10.60	0.66
Bihar	-208	-0.73	-0.05
Delhi	155	1033.33	64.58
Goa	916	73.87	4.62
Gujarat	2,955	24.64	1.54
Haryana	1,004	195.71	12.23
Himachal Pradesh	1,873	15.01	0.94
Jammu& Kashmir	362	1.73	0.11
Karnataka	4,181	12.96	0.81
Kerala	5,285	51.35	3.21
Madhya Pradesh	2,328	1.79	0.11
Maharashtra	1,259	2.76	0.17
Manipur	-256	-1.46	-0.09
Meghalay	373	2.27	0.14
Mizoram	-654	-3.43	-0.21
Nagaland	-785	-5.45	-0.34
Orissa	-4,887	-9.18	-0.57
Punjab	637	67.55	4.22
Rajasthan	3,068	24.05	1.50
Sikkim	506	18.36	1.15
Tamil Nadu	5,171	29.60	1.85
Tripura	2,134	35.81	2.24
Uttar Pradesh	7,357	23.56	1.47
West Bengal	3,911	46.38	2.90
Andaman & Nicobar	-637	-8.38	-0.52
Chandigarh	13	650.00	40.63
Dadra & N. Haveli	-13	-5.46	-0.34
Daman & Diu	8		
Lakshadweep	23		
Pondichery	40		
Grand Total	37,514	5.85	0.37

Source: Estimated from FSI (2003), Forest Status Report.

1.4.3 Forest in Orissa

The present study focuses primarily on the State of Orissa. Therefore, it is imperative to have a look on the overall picture of the status of forest in Orissa. During 1993-94 the 13 districts of Orissa were reorganised into 30 districts. Hence, for the district wise analysis, only data from 1995 onwards are taken. Data on total forest cover of Orissa, however, are given from 1987 to 2003. The total forest cover in Orissa is showing a sharp decline from 1987 to 1989 and then from 1989 to 1997 it has fallen steadily but at a slower pace (See Fig-1.2). Like All-India figure, forest cover in Orissa has slightly increased in 1999 and in the year 2001 it has increased substantially. But unlike the sudden rise in forest cover as seen in case of All-India figures, which coincides with the change in measurement scale, forest cover of Orissa shows a relatively mild shift. But in contrast to the All-India trend in the year 2003, forest cover in Orissa has declined as compared to 2001. The average annual rate of deforestation in Orissa from 1987 to 1997 was 631.20 square kilometres, when for All-India it was 742.20 square kilometres. Similarly, during this period of 10 years, in Orissa, on an average 173 hectares of forestland have been cleared everyday. It implies that reflects that Orissa has contributed considerably to the total deforestation in India.

Orissa Forest Status Report-2003-04 records that, of its' total 1,55,707 square kilometres geographical area, 58,135.47 square kilometres area is recorded forest² which constitutes 37 % of the States' total geographical area. However, in reality only 48,366 square kilometres area is covered by forest, which is only 31% of total geographical area (SFR 2003). A district wise anatomy of forest cover in the State (see Table-1.4) shows that out of 30 districts 20 have shown a rise in forest cover and 10 other districts have shown a net fall in forest cover. The districts, which have registered an increase in forest cover, are Angul, Balangir, Baleswar, Bhadrak, Cuttack, Dhenkanal, Gajapati, Ganjam, Jajpur, Jharsuguda, Kalahandi, Kandhamal, Khorda, Koraput Nawapara, Nayagarh, Rayagarh, Sambalpur, Sonapur and Sundargarh. The 10 districts, which have registered a fall in forest cover, are Baragarh, Boudh, Deogarh, Jagatsinghpur, Kendrapara, Keonjhar, Malkangiri, Mayurbhanja, Nawarangapur and Puri.

² While reading the data on forest cover it should be kept in mind that there is a difference between recorded forest cover and actual forest cover. For more elaboration see Appendix-B.

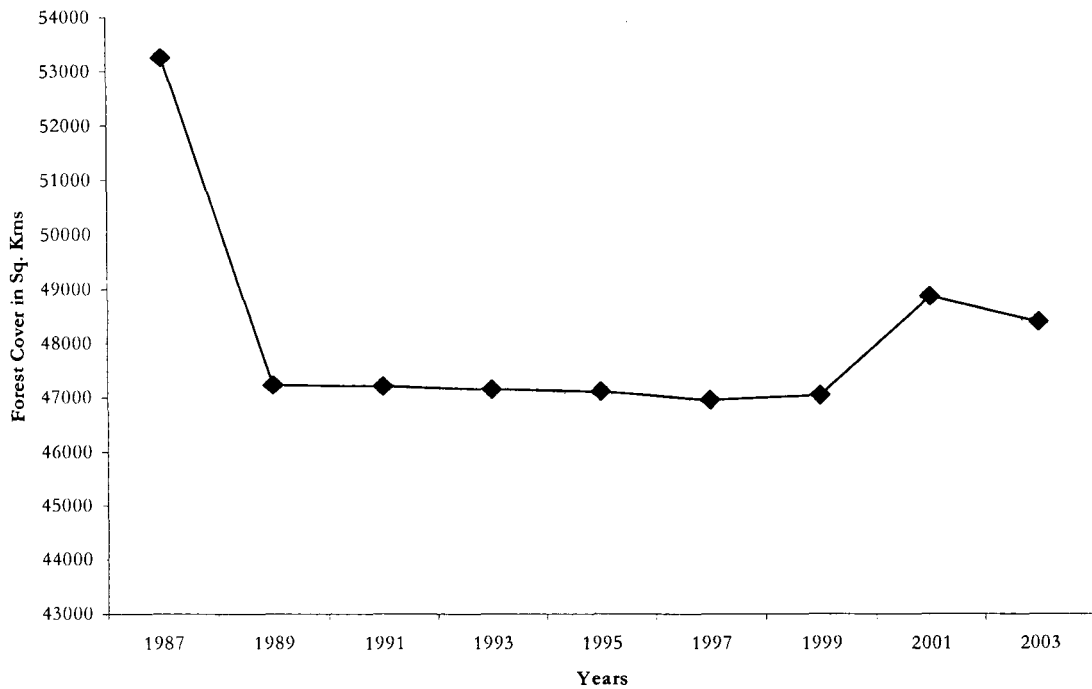
**Table-1.4: District-Wise Change in Forest Cover
in Orissa from 1995 to 2003**

Districts	1995	1997	1999	2001	2003
Angul	2,442	2,511	2,511	2,650	2,656
Balangir	819	865	875	992	952
Baleshwar ^T	306	306	306	306	309
Bhadrak	19	17	18	31	29
Bargarh	914	924	923	904	871
Boudh	1,308	1,309	1,312	1,280	1,252
Cuttack	540	555	555	656	624
Deogarh	1,381	1,381	1,381	1,358	1,374
Dhenkanal	1,052	1,081	1,063	1,266	1,281
Gajpati	2,448	2,450	2,445	2,552	2,484
Ganjam ^T	2,164	2,160	2,160	2,188	1,950
Jagatsinghpur	31	28	28	24	18
Jajpur	168	174	174	259	262
Jharsguda	284	282	282	276	289
Kalahandi ^T	1,924	1,919	1,915	2,139	2,260
Kandhamal ^T	4,989	5,117	5,116	5,390	5,451
Kendrapara	198	195	198	217	206
Keonjhar ^T	3,691	3,543	3,546	3,378	3,236
Khorda	294	317	317	434	362
Koraput ^T	1,395	1,344	1,344	1,484	1,557
Malkangiri	2,379	2,285	2,285	2,188	2,212
Mayurbhanj ^T	4,058	3,852	3,942	4,132	4,005
Nawapara	1,145	1,143	1,148	1,237	1,213
Nawrangpur	1,244	1,223	1,222	1,150	1,123
Nayagarh	1,603	1,640	1,640	1,705	1,605
Puri	122	116	124	211	99
Rayagada	2,688	2,701	2,700	2,733	3,061
Sambalpur ^T	3,180	3,172	3,172	3,289	3,288
Sonepur	308	320	320	313	312
Sundergarh ^T	4,013	4,011	4,011	4,096	4,025
Total	47,107	46,941	47,033	48,838	48,366

Source: FSI (1997, 1999, 2001,2003) State of Forest Reports

Note: T marked districts are declared as tribal districts

Fig-1.2: Trend of Forest Cover in Orissa from 1987 to 2003



1.5 Changes in Forest Policy

In this section we illustrate the changes in forest policies brought in from time to time. We start with narrating the major policy revisions brought about by the Central government and then we move on to describe the same for Orissa.

1.5.1 Forest Policy in India

In India forest conservation has been a major concern for the Governments at Centre and State level since Independence. It is well reflected by the existence of a separate ministry for this (now named as Ministry of Environment and Forest). Government of India and its different States have formulated various policies to protect forest from time to time. Immediately after Independence, Government of India retained the property rights of all the forest resources by nationalising all the forests and continued the command and control approach like British regime to preserve forests. Realising the importance of forests, through National Forest Policy 1952, Government of India envisaged maintaining forest cover over one-third of its' total geographical area. However, the policy stressed upon meeting the need of timber and other forest produce required for defence, communications and industry; and the realisation of the maximum annual revenue from forest. Environmental concern and the

dependence of rural poor on forest resources for their livelihood were not paid much heed by the government policy. Rather, Government of India perceived the dependence of rural poor on forest as a major cause of deforestation and forest degradation, and accordingly it formulated the forest policy to check the human intervention into forests. In a very strong tone Forest Policy 1952 stated the existence of human settlements in the vicinity of forests as an accident and in no event the use of forest by these communities be permitted at the cost of national interest. Nevertheless, the heavy dependence of these communities on forest for their livelihood and their non-involvement in forest protection led to massive deforestation.

Forest policy in India underwent a minor change with the recommendation of National Commission on Agriculture-1976 to meet the basic needs of the community for fuel wood and fodder from the non-forest area. The recommendation took the shape of Social Forestry Programme. This Programme was launched all over India to plant trees on village and private lands. The Social Forestry Programme was also seen as a means to release industrial forestry from social pressure. However, the spread of the Social Forestry Programme was confined to a few regions and it was successful only in some parts of India – North-west India, Gujarat, and Karnataka (Arnold and Stewart, 1991). Moreover, much attention was not paid to meet the demand of the poor for fuel wood and fodder, and the pressure on forest perpetuated. The policy reflected that the forestlands were to meet the commercial needs of the economy and farmlands were to produce 'fuel wood and fodder'. This could be a significant reason for the failure of Social Forestry Programme (Saxena, 2000)

A paradigm shift in the forest policy was seen with the formulation of Forest Policy 1988. The importance of forest for environmental services and the role of community to protect forests were accorded more weightage by the government in its' policy formulation. Such a shift in the forest policy was probably an outcome of a series of incidents in 1970s and 1980s. For example, the protest by different communities, e.g. the well-known Chipko Movement in 1973, Tree Movement in 1978 and the success of a few pilot projects with community participation, mainly the Arabari experience in West Bengal are prominent. Forest Policy 1988 showed a major change in terms of its' objective and approach. Environmental concern was accorded more importance than the commercial purpose. Similarly, the approach changed from Forest Departments' monopoly control to community participation. The dependence of community

on forest and the role of community in forest management were given due importance to conserve the forests. As a result Joint Forest Management (JFM) came into vogue. The popularity of JFM is well reflected in the growing number of forest protection committees and the total area managed by them over the years. As on September 10, 2003, 84,632 JFM committees have been formed and 17331955.1 hectares of forests have been brought under this scheme (Government of India 2003-04).

1.5.2 Forest Policy in Orissa

Orissa was the pioneering State in India to implement Joint Forest Management programme. While the JFM programme was formally launched by the Central government in 1990, the Government of Orissa came out with a resolution in 1988 to involve local people in the forest fringe villages to regenerate and manage the degraded reserved forests. In the year 1990 Government of Orissa further extended this programme to Protected Forests. Government of Orissa passed a comprehensive resolution in July 1993 to institutionalise JFM schemes. This resolution provided for converting the Village Forest Protection Committees into Vana Samrakshana Samiti (VSS). The Gram Panchayat constitutes a VSS on the recommendation of DFO/Range Officer/Forester either in one village or a group of hamlets or villages depending on the location of the forest to be regenerated. Two adult members from each family – one male and female – become the members of the VSS in each village. The executive Committee of the VSS consists of Sarapanch, Ward member, Forester, Forest guard, local NGO and 6-8 local members. The Forester is the ex-officio secretary of the VSS. Further, in a major announcement in its' new JFM guidelines issued in February 2000, Government of India proposed to bring the self-initiated Forest Protection Committees under the purview of JFM by a formal registration. As on March 31, 2003 in Orissa, 6,820 VSSs have been formed and 652257.82 hectares of forest land have been brought under this co-management system. (Government of Orissa, 2003-04).

CHAPTER 2

POVERTY AND DEFORESTATION: REVIEW OF LITERATURE

This chapter reviews the literature on poverty and environment nexus and basically focuses on deforestation. Then it explains the role that rural poor play in degrading forests. It narrates the complex relationship between poverty and deforestation by classifying the types of poverty and environmental degradation and explains the web of factors that influence this relationship. It also describes the reasons due to which forest dependent people remain poor. Finally this chapter illustrates how the vicious circle of poverty and deforestation operates.

2.1 Poverty and Environment

The relationship between poverty and environment has been extensively discussed in the economic literature, where each has been seen as the cause of the other. The most famous Brundlant Commission Report (1987, pp. 24) recognises poverty as an important cause of environmental degradation and emphasises the eradication of poverty to conserve environmental resources. Similarly, the World Bank (1992) explicitly states that poor families who have to meet short term needs degrade the natural capital by excessively cutting trees for firewood, mining land resources and failing to replace soil nutrients. Degradation of environmental resources, which provides a source of livelihood to rural people, also causes destitution among them. This leads to a cumulative causation where poverty, high fertility, rates and environmental degradation act upon each other creating a vicious circle (Dasgupta and Maler, 1994).

2.2 Dependence on Natural Resources

In rural areas common property resources (CPR) e.g. forest, common pastureland, ponds, rivulets, etc. provide sources of livelihood to the poor households. Directly or indirectly almost all the households are dependent upon them for one reason or another. Different studies have attempted to comprehend the nature and degree of such dependence and quantify them in monetary terms (Jodha, 1986; Reddy and Chakravarty, 1999; Cavendish, 2000; Pattanayak and Sills, 2001; Adhikari, 2005). Jodha (1986) based on an extensive household survey of 80 villages in 21 districts in dry regions of seven Indian States finds that (i) rural households

heavily depend upon CPR for fuel and fodder, (ii) CPRs provide an important source of employment when other employment opportunities are not available, (iii) CPR provides around 14 to 23 percent of total household income (which the study quantifies to be Rs. 530 to Rs. 830 in the current price of 1986). Sometimes the income share from CPR in the aggregate household income also exceeds this amount and varies across spatially. For instance, Cavendish (2000) from field survey in Zimbabwe shows that open access environmental goods contribute roughly 35 percent of average total household income. Moreover, the figure for the poorest quintile is 40 percent.

The degree of dependence on common property resources however varies among different rural households. While rural poor households derive a greater share of their total income from common property resources, richer households derive a relatively smaller proportion from the same (Reddy and Chakravarty, 1999; Cavendish, 2000). Although richer households derive a lower proportion of their total income from CPRs, the absolute amount they take is larger (Cavendish, 2000). In a just contrasting finding Adhikari (2005) demonstrates that poorer households are less dependent on forests than the rich. Both in aggregate and proportion (in aggregate income) terms poor households derive less benefit from forests than rich households. This difference in findings could be due to differentiation of basket of commodities or services the households derive from forests at different places. Price factor might also play a role to reflect the varied degree of dependence at different places. The nature of products collected from these sources varies across region, households and time period. By and large it depends upon the household's asset holding structure, and the nature of risk they are exposed to, climatic condition and other market indicators (Cavendish, 2000). For example households facing greater risks and negative agricultural production shocks are likely to take more forest collection trips, *ceteris paribus*. Households with fewer livestock would take fewer forest collection trips since their fodder requirement will be less. Moreover, households who have more knowledge on the forest and expertise in collecting various products due to their long stay close to forest and inherited expertise from their ancestors would take more forest trips to extract different resources. (Pattanayak and Sills, 2001).

The purpose of using the common pool resources and the level of utility derived from them varies across households and region. Some households use these products as a safety net

during crisis period. Poorer households, who don't have any other option to smooth consumption (through the possession of livestock, children in off-farm activities), during crisis period, rely more on forest. These products can have important roles in overcoming different unpredictable shortfalls (such as, family illness, political turmoil, macro economic crises or ecological disasters) either as a reservoir of auto-consumption goods or as a resource of 'quick-cash' raised from collecting forest products and taking them to market place (Angelsen and Wunder, 2003). This way it helps poor people to ameliorate the incidence of poverty and destitution (Reddy and Chakravarty, 1999). Therefore, Angelsen and Wunder contend that we cannot simply quantify these benefits by summing up their average contribution to subsistence and monetary incomes because the 'safety nets' imply more than that. The utility of forest products for the households who use it as a safety net would be much higher than that of the households who use it to add up their total income or general consumption. Although poorer people depend more on forest, it is not strictly restricted to them. More or less, wealthy households in rural areas also rely on it (Pattanayak and Sills, 2001). Rich households use common property resources to meet the household requirement for fuel wood and fodder, or to add to their total household income by selling other valuable products.

In a rural set up environmental resources are also important for other key economic activities (Cavendish, 2000). For example, people collect manure, bamboo for making boundary, and many other products from forests for agricultural activities. Many other products also act as complementary goods for other economic activities.

While analysing the contribution of CPR to rural economy it could also be conceived that these resources act as a natural aid to the poor people. Therefore, it should have some over all (positive) impact. For instance Jodha (1986) finds that inclusion of income from CPR in their total income from other sources reduces the income inequality in rural areas. In contrast Reddy and Chakravarty (1999) based on a study of 233 households in the Nainital district in the foothills of Kumaon Himalayas in the north Indian State of former undivided Uttar Pradesh don't find any significant contribution of CPRs to the reduction of income inequality. Nonetheless, in a major policy implication they show that the poor would be doubly disadvantaged without open access to forest products. More importantly they also find that the

effect of forestry income to ameliorate poverty is much higher than that of increasing the rewards in other non-forestry sources of income.

2.3 Why do Poor Depend upon Forest?

Poor often use forest products due to the lack of better alternatives (Angelsen and Wunder, 2003). Poor people lack capital and access to credit to be self-employed. At the same time collection of most of the Non Timber Forest Products (NTFPs) need low or zero capital, low skill and must also be available in an open or semi-open access situation. Therefore, it seems attractive to the poor unskilled labourers who have a very low opportunity cost.

2.4 Role of Poor in CPR Degradation

In economic literature the role of poor in CPR degradation has been highly contested. While one group (Southgate and Pearce, 1988; Mink, 1993) argues that poor are the main agents behind CPR degradation, another group (Jaganathan, 1989; Jodha, 1990; Tiffen, 1993) strongly opposes it. At the same time some studies also don't find any such significant relationship between poverty and environment³ (Dasgupta Susmita, 2003). Therefore, the relationship between poverty and environment needs to be confirmed with a detailed theoretical analysis and empirical evidence.

Poverty caused due to exogenous reasons forces the poor people to depend upon forest and other open access natural resources to derive their livelihood. In absence of other provisions to meet their basic requirements they show a short run time preference and discount the future highly. This causes over extraction of forest or excessive mining of other natural resources causing resource degradation. This is how poor act as the agents of forest degradation (Southgate and Pearce, 1988; Mink, 1993). A few other studies (Jaganathan, 1989; Jodha, 1990; Tiffen, 1993) also argue that poor do not have the resource to adopt unsustainable deforestation activities and neither do they exhibit the short time preferences, which would force them to adopt the unsustainable activities. Greed for wealth and luxury consumption of rich people is mainly responsible for forest degradation. Generally the rich people's demand

³ Dasgupta Susmita (2003) in Cambodian case does not find any causal relationship between poverty and deforestation.

for timber products for luxury consumption – e.g. furniture making and showcasing their buildings – is high. However, they are not the direct participants in forest cutting. Timber smugglers serve the role of middleman to feed the rich men's appetite and derive a huge profit. Therefore, the rich and the commercial agents also play very important role in forest degradation (Anderson 1989; Binswanger, 1989; Jaganathan, 1989; Lutz and Daly, 1990; Repetto, 1990; Goodland, 1991; Somanathan 1991). But it is rural poor who ultimately is directly involved in forest cutting but gets a very small share and languish in the low-level equilibrium trap. Moreover, due to degradation of the total resource stock poor are the ultimate sufferers. This way environmental degradation caused by the actions of the wealthy and powerful groups leads to poverty and decline in the welfare of agents living at the margin (Bandyopadhyay, 1987; Green, 1994; Repetto et al, 1994; Streeten, 1994; Kadekodi, 1995).

The difference between the two groups – who argue that poor are the agents of forest degradation and who argue that poor don't have the resource to adopt unsustainable way of resource extraction – gets abridged when institutional and market structures are normalised in the analysis (Duraiappah, 1998). For instance weak enforcement of forest protection law and wide network of rich and timber smugglers help them to escape away. Similarly, in rural areas land tenure system plays a crucial role in determining the time preference factor for all groups, especially the lower income groups.

The relationship between poverty and environment cannot be seen in a very simplistic framework. A complex array of factors – demographic, social, economic and institutional – play very crucial role for linking poverty and environment. Therefore, while analysing the relationship between poverty and environment we should see how all these factors interact.

A whole range of socio-cultural, institutional, and demographic factors act upon impoverishing the poor and forcing them to heavily depend upon common pool resources. For example, Jodha (1992) explains the important reason behind the shrinkage of CPR in India and its consequences on the people who were dependent earlier upon these resources. The main reason behind the shrinkage of CPR is privatisation of common land. In most of the cases the intention of helping landless rural poor ended up with handing over the common land to the rich. The study showed that although the proportion of poor household who received land is

higher, the total amount received by them is less than that of any other group. Furthermore, due to lack of complementary resource the poor households consequently lost their land to the rich people. When people are dependent upon common pool resources, during period of crisis they would exploit more resources. But once the CPR is privatised the ownership of the piece of land is confined to certain households. In this situation if any poor household lacks other complementary resources, during crisis period they can no more depend on CPR. Hence the ultimate option left for them is to sell the piece of land they own. It makes the poor more vulnerable than the earlier situation. Moreover, sometimes parcelisation of some environmental resources reduces the total productivity and causes resource degradation (McKean, 2000). At the same time if the household is investment poor it cannot check the degradation of resources. This way loss of productivity of the CPRs also worsens the condition of poor. Breakdown of traditional social organisations, erosion of social norms, and the weakening of social management system, due to the formation of modern institutional set up play crucial role for the degradation of CPRs. Similarly, a slew of other factors – like side effect of other developmental activities, demographic, ecological and market forces – played important role behind the degradation of CPRs. Ultimately, shrinkage and degradation of common pool resources impoverish the condition of poor who solely depend upon it for livelihood and again it forces them to degrade the common pool resources that are left at their disposal. Thus the vicious circle of poverty and environment nexus is complete.

Endogenous poverty is the important reason of environmental degradation caused by the marginal or poor groups (Jaganathan, 1989; Somanathan, 1991). Environmental degradation due to endogenous poverty creates the most vulnerable condition leading the household and economy in a downward spiral.

2.5 Types of Poverty and Environmental Degradation

Broadly poverty could be defined in two ways – one is welfare poverty and another is investment poverty (Reardon and Vosti, 1995). The oft-discussed *welfare poverty* line is measured with the scale of ability to get a basic requirement, which varies, from country to country. For example, in Indian context poverty line is fixed by the ability to get a certain amount of calorie with the intake of a certain food basket. *Investment poverty* is defined with a cut-off point, which enables individual/households to make minimum investments to maintain or enhance the

quantity and quality of the resource base, to forestall or reverse resource degradation (ibid.). Unlike welfare measure of poverty cut-off, investment-poverty is site-specific. It depends upon a whole range of factors like nature of resource, climatic condition and institutions in existence. A household may be above the welfare-poverty line but may fall below the investment poverty line. In the long run, if a household is investment poor but not welfare poor, it may lead to natural resource degradation that eventually causes the household to become welfare-poor hence creating a vicious circle again.

Poverty could also arise due to various reasons and it could be of different nature. Therefore, different types of poverty could exert different levels of influence on environment (Reardon and Vosti, 1995). In a very simplistic way we can conceive that poverty could arise due to lack of different assets, like (i) natural assets, (ii) human resource assets, (iii) on-farm physical and financial assets, (iv) off-farm physical and financial assets. However, ownership or access to such assets is not independent of each other. Many times possession of one asset is itself determined by other assets. Poverty caused due to lack of any specific or a group of assets altogether will have different consequences. For instance, possession of land and its' natural fertility determines the surplus one household derives, which could be used for further investment. Getting off-farm job depends upon the possession of human resource assets. But for investing in human resource assets one needs initial savings, which comes from holding of other assets. Lack of different assets will have different implications for natural resource degradation. Lack of land with rural poor will induce them to encroach common land and sometimes clearing forests. In case household is in possession of land, which lack natural fertility, if the household cannot invest to increase its fertility due to lack of financial assets and human resource assets, then it would cause soil erosion as well as clearing of forest for new land. Similarly, lack of on-farm and off-farm activities will force poor people to heavily depend upon common pool natural resources causing their degradation and worsening own destiny.

Similarly, types of environmental problems could have important implications for understanding the poverty environment link. For instance, deforestation would bring consequences like, decline of water table, and moisture of topsoil. It will bring down the agricultural productivity. For the marginal farmers problems will be graver and they might fall into poverty trap. Similarly, due to decline in water table in the locality, people may have to

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spend more time since they have to go a long distance for fetching drinking water and also for domestic animals during shortage time in the locality. It will reduce their disposal time for other (income earning) works. It brings down the households' income and impoverishes them. Moreover, if outside agents cause forest degradation then they might not realize the nature of dependency of local people on the forest and degrade all types of forests. In such cases local people would lose the inputs or resources those were used for other economic activities. It will have over all negative impact on the economic status of rural households. Other types of environmental degradation would also cause forest degradation. For example, investment poor households would cause soil erosion and it will bring down the total agricultural productivity. As a result poor households will go for clearing forests for new land. Therefore, different types of environmental problems will have different implications. While going for policy recommendations it needs special attention.

To understand the dynamics of the causal links between poverty and environment, insights on farm household economics and household food security strategies are also important. In a broad frame village income, land use practice and investment strategies determine the link between environment and poverty. In turn, this is conditioned by a series of factors such as price, interest rate policy, village infrastructure, and technology. The existence, conduct and performance of labour, capital and product markets condition the fungibility of assets, which in turn determines how easily households can convert one form of wealth to another. In case, farmers are illiterate or ignorant of new agricultural technologies, they will have less productivity in agriculture. Lack of market information on price will also yield low return from their products. Farmers will have a few surplus at their disposal. Hence they will be unable to go for further investment and getting productivity boosting technologies. Further, use of obsolete technologies will give low return. This way rural farmers might perpetuate in a low level of equilibrium trap. Therefore, market plays an important role to determine the poverty and environment nexus. The institutional factors that play major role to determine the links between poverty and environment could be summarised as, (i) the existence, structure and performance of market (ii) availability of production and resource conservation technologies (iii) relative, input prices, output prices, wage and the interest rate (iv) community wealth in the form of physical and social assets.



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2.6 Ambiguous Relationship Between Poverty and Environment

Some studies also show that there is an ambiguous relationship between poverty and environment. For example, Wunder (2001) with the analysis at macro and micro level concludes that we cannot generalise any particular relationship between poverty and deforestation. The empirical evidence from Thomas et al (2000) shows that forest loss is positively correlated with both economic growth (818 countries) and with poverty reduction (26 countries) – though neither coefficient is significant. Comparing GDP growth of the Brazilian economy with forest lost, Wunder (2001) finds a pro-cyclical pattern of deforestation: the high economic growth periods (1977-94) coincides with high forest loss. Conversely, deforestation slowed down during the years of severe economic crisis. For such an economic picture he explains the reasons to be postponement of public projects and cut in agricultural subsidies and decline in private investment in agriculture.

Macroeconomic wealth may or may not reduce forest loss and degradation, depending on whether price-incentive-reduction effects dominate over capital-endowment-expansion effects (ibid.). One possibility is that the forest outcome is inversely proportional to the fate of land-extensive agricultural sectors. If extensive agriculture or cattle ranching is promoted by an economic crisis and by accompanying government policies, then forest loss will rise. Agriculture also often benefits from currency devaluation, and price liberalisation and increased rural labour supply. Therefore, the outcome depends on which effect is strongest.

At micro economic level Wunder also finds an ambiguous relationship. For example, welfare poverty makes the labour cheap and people go for more labour-intensive works like deforestation. On the other hand, with the reduction of poverty, labour becomes costly and it is expected that people's participation in labour-intensive works (deforestation) would come down. Nevertheless, reduced poverty could go together with higher rural investments that require land clearing. Therefore, alleviation of asset-poverty could bring in both positive and negative impact on forest. The over all impact depends on the nature of poverty, their changed incentives, their asset constraints and how these assets are linked to forests.

2.7 Vicious Circle of Poverty and Deforestation

Theoretically it is explained that poor are dependent upon natural resources for their livelihood and due to over extraction (through demographic pressure) it causes natural resource degradation and further degradation of natural resource makes the poor more vulnerable (Dasgupta and Maler, 1994). Demographic pressure takes a leading role to perpetuate the cumulative causation between poverty and environment (ibid.). The investment-poor households adopt labour-intensive method for household production and consumption activities. For example for agriculture they completely rely on manual activities. Similarly, most of the domestic activities like collecting fuel wood, fodder, fetching drinking water they follow time-consuming methods since they do not have easy access to these basic necessities. Therefore, they rely on more labour forces. It is obvious that they cannot afford to hire labour for their production activities. Therefore, they go for a larger family size. In case of poor household the cost of nurturing a child is very less. Children are considered as assets in these households since from a very young age they get into the work force. This way the population pressure on natural resources increases and if the rate of resource extraction exceeds the rate of regeneration it leads to degradation of natural resources. Degradation of natural resources, on which poor people are dependent for their livelihood, causes destitution. Thus the vicious circle of poverty and environment degradation goes on.

However, the poverty and deforestation vicious circle argument could be contested by bringing in the use of non-timber forest products. It follows the reasoning that forest dependent rural people extract the NTFPs at a sustainable rate and it helps them to withstand during the crisis period. Moreover, the use of NTFP by the poor households is also seen as an instrument for poverty prevention. Therefore, labeling this dependency as poverty trap could not be valid. For instance, Angelsen and Wunder (2003) contend that it would be unfair to explain the relationship of poor's vulnerable economic condition and their dependency on environmental resources as poverty trap. They argue that *although most NTFPs are poor instruments for poverty reduction, some are important for poverty prevention. Preventing extreme poverty and helping poor people survive can hardly be called as poverty trap.* Further, they state that the 'trap' label would be justified in those cases where alternative development options actually exists but where policies, donor projects or other external agencies seek to maintain people in their low yield forest extraction

activities, based on romanticized visions about the alleged ecological sustainability and large income generation potential of NTFPs.

Angelsen and Wunder miss out the poverty trap by merely looking at the poor people's dependency on NTFPs and considering it as 'gap-filling'. In many cases NTFPs not only help as gap filling, rather it is the only source of livelihood. In other cases there is zero NTFPs and people depend upon fuel wood business, which Angelsen and Wunder find falling into no man's land. In such cases the relationship would result in poverty trap. For instance, due to lack of other alternatives poor people go for fuel wood collection, which provides low returns and need zero or very low level of skills and capital to meet their subsistence requirements. If the number of people involved in such activities is less it would not be unsustainable and it would fetch them more return (by putting more effort) also. However, when a huge population is engaged in such activities and resultantly the rate of harvest exceeds the rate of regeneration. It causes forest degradation. Now individuals have to spend more time and energy to meet the subsistence requirement. Eventually it leads to a fall in income. Thus poverty forces forest dependence and forest dependence causes poverty and the circle completes.

2.8 Why are the Forest Dependent People Poor?

Why are the forest dependent people poor? The answer to this question lies in the low returns from most of primary resource -e.g. NTFP-collection activities. Angelsen and Wunder (2003) explain following reasons for the poor economic condition of forest dependent people. First, is the nature of resource. For instance, low per hectare densities of commercially valuable species imply that extraction tend to be spread over large areas, triggering high costs of harvesting and low net returns to extractive labours. Second reason is inaccessibility of market due to poor physical infrastructure. It results in waste of perishable NTFPs and loss or fall in price of it. Third the market for some forest product is characterized by monopsony and involves exploitative marketing chains due to one or several reasons.

2.9 Co-Management and Poverty and Deforestation Nexus

Since last two decades community participation in forest management (known as co-management) has come into vogue. Different Governments have framed policy accordingly to form more and more forest protection committees making community members as

stakeholder in this venture. In India and other developing countries where co-management has been adopted to conserve the forest resource, one of its' primary objectives is to halt forest degradation by the community members by allowing the community to part with some benefits derived from the forest and creating other gainful employment opportunities in exchange of their services devoted to conserve the forest. The main objective of such mechanism is to reduce the over all dependency of community on the forest. For example Forest Policy 1988 of India in one of its' objectives states that *a primary objective of all the agencies responsible for forest management ...should be to associate the tribal people closely in the protection, regeneration and development of forest as well as to provide gainful employment to people in and around forest.* Under this backdrop, it is imperative to re-examine the poverty and deforestation nexus.

A couple of studies on JFM have attempted to conceive its functioning by assessing the level of common action achieved and tried to link it up with different factors like community heterogeneity, cost and benefit sharing mechanism, environmental awareness etc. within the forest protection committee itself. For instance, theoretically, Olson (1971 2nd Print, pp.34) explains that *in smaller groups marked by considerable degrees of inequality.....there is the greatest likelihood that a collective good will be provided....* Nevertheless, the empirical evidences show that at low level of such disparity higher degrees of common action could be achieved (Saha, 2004) and some times no such significant relationship is found (Somanathan et al, 2002). A couple of other studies on JFM explain various factors that influence the success or failure of JFM. The major factors being size of the community (Agrawal 2000), social norms, identification of boundary (Agrwal 2000), legal status of the Protection committee, role of the stakeholders in decision making (Dutta et al, 2005), environmental awareness of the community members (Hussain & Bhattacharya, 2004), accountability of bureaucracy (Vira 2005), and agencies behind the inception of JFM (Ghate 2003). All these studies have also come up with very contrasting findings. For example Saha (2004), in his study on 57 Forest Protection committees in West Bengal, India, finds that community with members belonging to similar ethnicity and having less disparity in income achieve higher levels of collective action. On the other hand, Somanathan et al (2002), with a study on the Van Panchayats in the Kumaon and Gharhwal regions in the State of Uttaranchal in Northern India finds no correlation between caste heterogeneity and indicators of the collective action or forest cover. Similarly, in contrast to the

analysis of Mancur Olson's theory of collective action⁴, Agrawal (2000) comes with empirical evidence from the field that the larger communities are more efficient than small communities to protect forest. Therefore, the findings from different case studies are site specific and remain handicapped for generalization.

Nonetheless, a higher level of common action does not necessarily mean that community's dependency on forest has come down. Many times the well performers of common action at unit level seem to be failing at aggregate level. Even the successful participants of JFM are engaged in forest degradation from de facto open access forests. It brings a new dimension to the poverty and environment (deforestation) nexus. Hardly is there any study, which discusses the poverty and environment nexus in such a context. What are the implications of poverty and environment nexus in this context? How do the poor people participate in forest conservation? Will this system of management (co-management) system be able to halt deforestation and conserve the existing forests? If not, why do they fail to do so? What are the factors that influence the individual/community participation in forest conservation or depletion? These are a few important questions, which requires further analysis. This study seeks to explain these questions. It relies on information gathered from the household survey conducted in three forest fringe villages of Chandaka Wildlife Division of Orissa State in India.

For deriving policy implications it is also crucial to trace out the factors that influence the individual participation in forest degradation. A whole range of economic (like land holding, and possession of other tangible assets) social and cultural factors would play an important role in this process. There is also limited prior knowledge on socio-economic determinants of forest dependency and the nature of their impacts (Gunatilake, 1998 as cited in Adhikari, 2005 pp.22). In next section we shall theoretically explore how all these factors influence the individual's decision to be indulged in forest conservation or depletion. Next we'll move on to empirically examine these hypotheses from our field study.

⁴ Olson (1965) states that Indeed, unless the number of individuals in a group is quite small, or unless there is coercion or some other special device to make individuals act in their common interest, *rational, self-interested individuals will not act to achieve their common or group interest.*

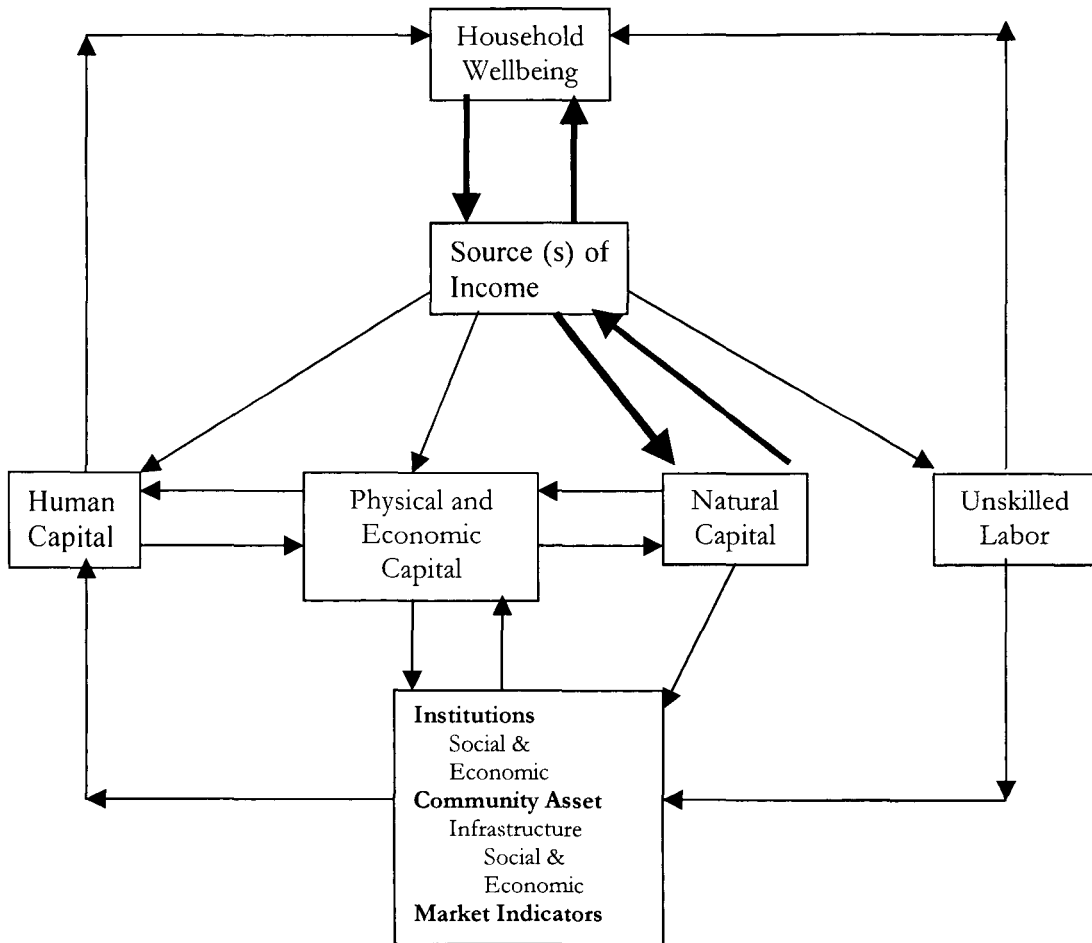
CHAPTER 3

THEORETICAL FRAMEWORK

This chapter narrates the channels through which poverty and deforestation nexus continues and explains the factors that are responsible to force the individual to go for forest cutting. Therefore, it also explains the factors that help individuals to get out of poverty and environmental degradation vicious circle. In section one we explain the relationship with the help of a diagrammatic model and in section two with a mathematical model using rational decision framework

3.1 Poverty and Deforestation

Fig-3.1: Poverty and Deforestation Nexus



To understand the relationship between poverty and deforestation and to know whether there operates a vicious circle we have explained the complex process in this diagrammatic model. In a simplistic framework we can presume that the overall household well-being depends upon the level of income, which, by and large, hinges upon the source of income. In reverse way also the well-being of household determines the source of income. A household could derive its' income basically from four sources. First source is the possession of income generating physical and financial assets, like land, bonds, and many such other assets. Second is possession of human capital. People can earn income by working as a skilled labour. Third source of income could be working as unskilled labour. People who lack education can work in the sector where there is no need of any skill. Fourthly, people could rely upon common pool natural resources to meet their livelihood requirements. But in most cases common pool natural resource serve as the last resort to derive the income. Nonetheless, households could derive their income from all the sources together, by different proportion. Poor households who lack physical and financial assets and lack skill work as unskilled labour. But in absence of such work poor households are forced to rely upon common pool natural resources. Heavy dependency upon such common pool resources by a huge population leads to degradation of these resources. It affects the well being of the households. Again they are forced to depend upon common pool resources. This way the vicious circle of poverty and resource degradation (deforestation) completes. This relation is shown in the model with the thick arrows.

However, this is a very simplistic framework of analysing the poverty and environment nexus. There are many other-exogenous and endogenous factors- help the households to come out of such vicious circle. People do transform one resource into another and get out of any particular trap. For instance, people form human capital by using various physical and financial capitals and income from unskilled labour. Similarly, they can transform some natural capital into physical and financial capital or human capital. It will help them to come out of a low-level equilibrium trap. However, for the smooth transformation of one capital into another capital many institutional (social and economic) and market forces play significant role. As a complementary input, community assets (both social and economic) help the households to easily transform one capital into another. The absence of community assets, imperfect market condition and the absence of (or presence of inefficient) institutions could result in perpetuation of the vicious circle among vulnerable sections. Households by their own

endeavor also could break the vicious circle of poverty and environment. But such process could take a longer time than otherwise it would have happened in an ideal condition. It also can't be well expected from all the households depending upon the risk taking behaviour of the individual or household members. Therefore, role of exogenous forces like government intervention is called for to help out the poor households to come out of the vicious circle of poverty and deforestation trap.

In the following section mathematically we conceptualise the conditions under which an individual goes for the illegal forest felling activities using rational decision framework

3.2 Individual Participation in Deforestation Under Differential Opportunity Cost and Cost of Penalty

Let the total deforestation function be

$$q = f(L) = f\left(\sum L_i\right) \dots (1)$$

Where, q is the total forest felling, L_i is time spent for felling by the i^{th} individual and $L = \sum L_i$ is the total time spent for forest felling. The i^{th} individual's felling q_i is

$$\frac{q_i}{q} = \frac{L_i}{L}$$

$$q_i = \left(\frac{L_i}{L}\right) f(L) \dots (2)$$

The assumptions underlying are that everyone is equally skilful, and can cut forest anywhere in the forest. Hence the proportion of the total felling made by i is simply the proportion of total felling effort accounted for by i 's labour input. Alternatively, output per unit of labour is (q/L) and so L_i hours spent to yield a felling of $L_i(q/L)$.

We assume that variations in total forest output from the forest have no effect on the price of forest product p . Each individual wishes to maximize his or her individual profit.

$$\Pi_i = pq_i - [w_i + \beta_i(M)]L_i \quad 0 \leq \beta_i \leq 1$$

Where, Π_i is i 's profit. w_i is the individual's opportunity cost, β_i is the probability of i^{th} individual being caught by forest department and varies between 1 and 0, and M is the total penalty charged by forest department in terms of money⁵

Hence each individual sets L_i so that:

$$\begin{aligned}\frac{d\Pi_i}{dL_i} &= \frac{d}{dL_i} \left[\frac{\{pL_i \cdot f(L)\}}{L} - \{w_i + \beta_i(M)\}L_i \right] \\ &\Rightarrow p \left[\frac{q}{L} + \left(\frac{L_i}{L} \right) \left(f'(L) - \frac{q}{L} \right) \right] - [w_i + \beta_i(M)] = 0 \dots (3) \\ &\Rightarrow p \cdot \frac{q}{L} + \left[p \frac{L_i}{L} \left(f'(L) - \frac{q}{L} \right) \right] = w_i + \beta_i(M) \dots 4\end{aligned}$$

When (3) is satisfied each individual maximizes profits and earns a positive profit. Here we are assuming a strictly concave production function (with respect to individual effort). Therefore, at the optimal point marginal yield is less than average yield. Hence the part of the equation-4 in parentheses has a negative value and will vary according to the value of marginal yield of the individual (being higher when marginal yield is less or negative and lower when marginal yield is higher). Price⁶ of forest product is equal for all the individuals. However, opportunity cost and expected cost penalty⁷ varies for all the individuals. Therefore, individual's profit to be positive, the value of average revenue less the product of price and proportion of individual's effort to the total effort with the difference between marginal and average yield should be higher than the total individual cost (opportunity cost plus expected cost of penalty). When individual's opportunity cost is lower and expected cost of penalty is less or zero, any small amount of revenue realized from felling will be profitable for the individual. On the other hand when opportunity cost is higher and expected cost of penalty is higher it will not be profitable for the individual and hence won't participate in felling. Similarly, when the average revenue is

⁵ We can also express years of imprisonment or other forms of penalty in terms of money.

⁶ Due to oligopsony nature of the market, sellers are unable to exert more pressure on the price of forest products. The price of forest products is largely influenced by the demand forces (and less by supply forces). Moreover, due to inelastic demand for such products the price level also remains at a very low level.

⁷ Expected cost of penalty for different individual varies due to weak enforcement and the variation of information available with the individuals on the activities of the enforcement agency (forest officials) from various sources.

much higher than the opportunity cost due to negligible or zero expected penalty individual would be involved in smuggling of timber.

Therefore, from equation (4) we infer that opportunity cost of individual and expected cost of penalty, which is determined by the nature of enforcement play an important role to determine whether individual will participate in deforestation or not. Nevertheless, the nature of market for forest products will also largely influence its' price (revenue) and thus ultimately will have bearing on the individual decision.

3.2.1 Determinants of Opportunity Cost

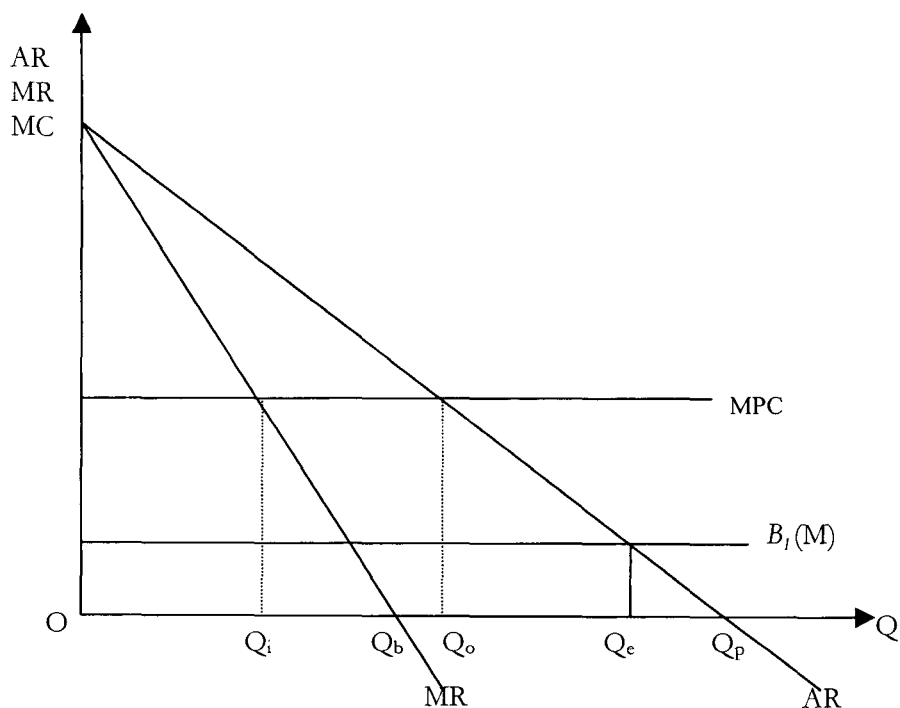
Opportunity cost of an individual is determined by slew of factors. Five important factors are asset possession, educational attainment, availability of unskilled off-farm job in the locality, social network and availability of credit. Among rural households land is the most valuable asset. Possession of land provides employment, income and social status to the members of household. Therefore, their opportunity cost remains higher. Similarly, education increases the employability of an individual by increasing the skill and mobility. For unskilled labours availability of off-farm unskilled jobs in the locality also keeps the opportunity cost of individual high. Social network has enormous positive externalities. It increases the mobility of the labour and reduces the transaction cost of being employed in unorganised sector and earning income. Availability of credit also could increase the opportunity cost of individual by enabling them to be self-employed⁸. Credit market is thin in rural areas. Landlessness and thin credit market narrows the scope of rural households being self-employed. Dearth of information owing to weak social network and lack of education keeps the mobility of labour depressed. In absence of mobility and other gainful economic opportunities of external world individual is completely dependent upon the works available in the locality- such as wage labour, share cropping etc-for employment and income. In rural areas, more specifically in forest fringe villages, common pool natural resources provide a resource base to the poor household (Jodha 1986; Dasgupta 1993). In presence of unlimited supply of labour and limited or no job opportunities the wage rate remains much lower. Therefore, the opportunity

⁸ Of course it is true that merely availability of credit will not help people to be self employed unless some provision is made by the government for allocating the fund to the asset-less households

cost of individual remains low. Due to weak enforcement and low penalty rate, the expected cost of penalty for individual remains low. Common pool natural resources are of easy access to the household in the forest fringe village. In comparison to their much lower aggregate cost (opportunity cost plus expected penalty cost) the revenue generated from forest is much higher. This provides an incentive to them to go for depletion of natural resources. Ultimately the rural poor households depend upon common pool natural resources to meet their bare necessities of livelihood, which results in massive resource degradation. Although the above analysis seems very sound on the basis of rational behaviour of individual we can explain the poor man's forest dependency as "*distressed dependency*". People are poor, hence they degrade the natural resources and this way their condition becomes more vulnerable.

3.2.2 Diagrammatic Explanation

Fig-3.2 Individual Optimisation under Differential Opportunity Cost and Expected Cost of Penalty



The excessive extraction of forest under low opportunity cost and expected cost of penalty is shown in fig-3.2. In this figure, MPC curve is the marginal private cost, which sums up the individual opportunity cost and the expected cost of penalty (charged by the FD). β_i (M) line shows the expected cost of penalty for illegal felling. The intersection of AR and MPC curves determines the open access⁹ equilibrium, under positive opportunity cost of individual and expected cost of penalty, at OQo level of output. This level of resource extraction dissipates all economic rent¹⁰ and reveals an unsustainable level of extraction of forest.

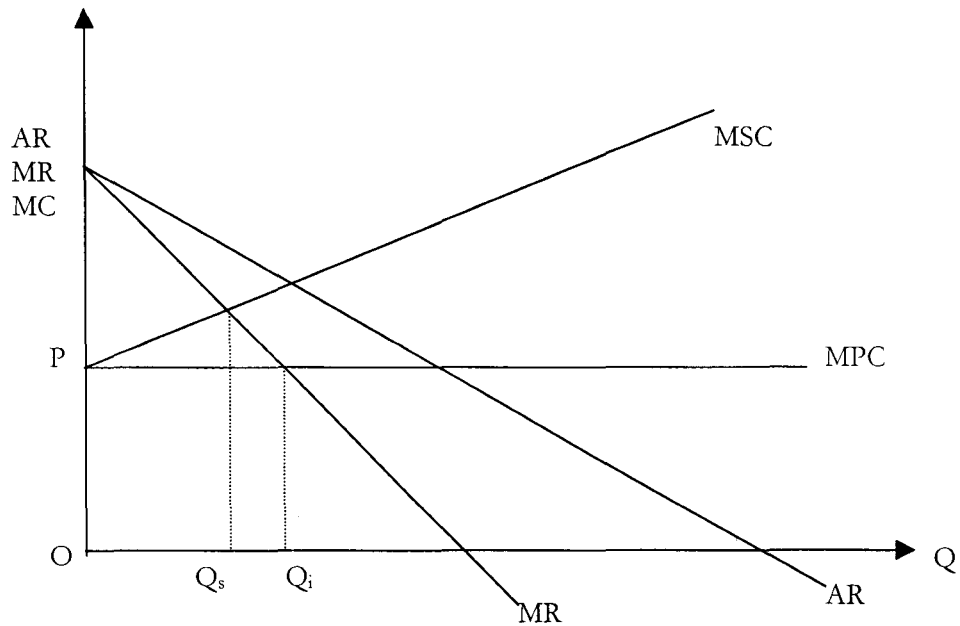
In the extreme case when there is zero opportunity cost and zero cost of penalty the equilibrium will be reached at OQp level of output. Similarly, with zero opportunity cost and positive penalty cost¹¹ the extraction level will be OQe level. All these conditions show much higher level of extraction than the biologically sustainable (MSY) level of extraction (at OQb level) and economic level of extraction (OQi level). Nonetheless, here we have ignored the social cost of deforestation. If that cost gets added up to the marginal private cost, marginal social cost (MSC) becomes much higher. Marginal social cost is an increasing function of the level of deforestation. The intersection of MSC and MR curve in fig-3.3 determines the socially optimal level of extraction at OQs, which is less than the individuals' optimal level of extraction at OQi.

⁹ In case of India the property right of forest is vested with the government. Nevertheless, due to failure of enforcement of this property right it has created *de facto* open access situation.

¹⁰ For a much earlier and similar kind of work in fishery see Gordon (1954)

¹¹ Although, in case of Indian forestry it has created *de facto* open access situation, yet there is institutional mechanism to enforce the property right. Forest Department of each state has been assigned this job. Therefore, in case of detection of the person involved in illegal felling there will be positive cost of penalty.

Fig-3.3 Individual and Social Optimization in Presence of Externality



From this diagrammatic representation we get the insight that at low level of Marginal Private Cost (MPC), which is a sum of individual opportunity cost and expected cost of penalty the aggregate level of deforestation will be higher. Similarly, the exclusion of MSC in MPC also causes higher level of deforestation than socially desired and biologically sustainable (MSY) level. Therefore, a rise in MPC, by increasing the individual opportunity cost and expected cost of penalty and internalising the social cost¹² into private cost (MPC), would help us to reduce the aggregate level of deforestation.

¹² Social cost could be internalized into private cost by increasing the people's awareness on the negative impact of deforestation on environment.

CHAPTER 4

METHODOLOGY

Due to unavailability and inaccuracy of the secondary data needed for analysis the present study completely relies upon primary data sources. A survey was carried out in three forest fringe villages under Chandaka Wildlife Division of Orissa State in India. One systematically designed interview schedule was administered to one member of the household above 18 years age in each household. The interview schedule¹³ contained a host of questions on the basic housing conditions and facilities therein, total income of the household, occupation of each household members, their land holding, its' nature and total yield from it, educational attainment of each members, participation in forest conservation, functioning of the forest protection committee in the village, role of forest department and NGO in their forest protection committee and overall role to protect forest, their environmental awareness and suggestions to stop their involvement in deforestation.

4.1 Area of Study

Chandaka Wildlife Division lies in two coastal districts-Khordha and Cuttack-of Orissa State in India. The wildlife division is known as an elephant sanctuary. However, the sanctuary also abodes a host of other wild lives. The location of the sanctuary, area, forest type, climate and species of wild animals seen in this sanctuary are shown in Table-4.1 (also see the location maps in fig-4.1 and 4.2).

Table-4.1: Brief Introduction on Chandaka Sanctuary

Location	Located in the District of Khurda & Cuttack.
Latitude/ Longitude	20° - 12' to 20°-26' N, 85°- 34' to 85°- 49' E
Date of notification	21 Dec. 1982
Area	175.79sq.km excluding mining area of 17.6sq.km
Forest type	Sal, Piasal, Asan, Bamboo etc.
Villages	47 villages
Climate	Air temp 10°C- 41°C, Rainfall 1200 mm. To 1400 mm.
Wild animals to be seen	Elephant, Spotted Deer, Barking Deer, Mouse Deer, Ratel, Sloth Bear, Leopard, Crested Serpent Eagle, etc.

Source: <http://www.wildlifeorissa.org.in/SANTURIESATAGLANCE.htm#CHANDAKA>

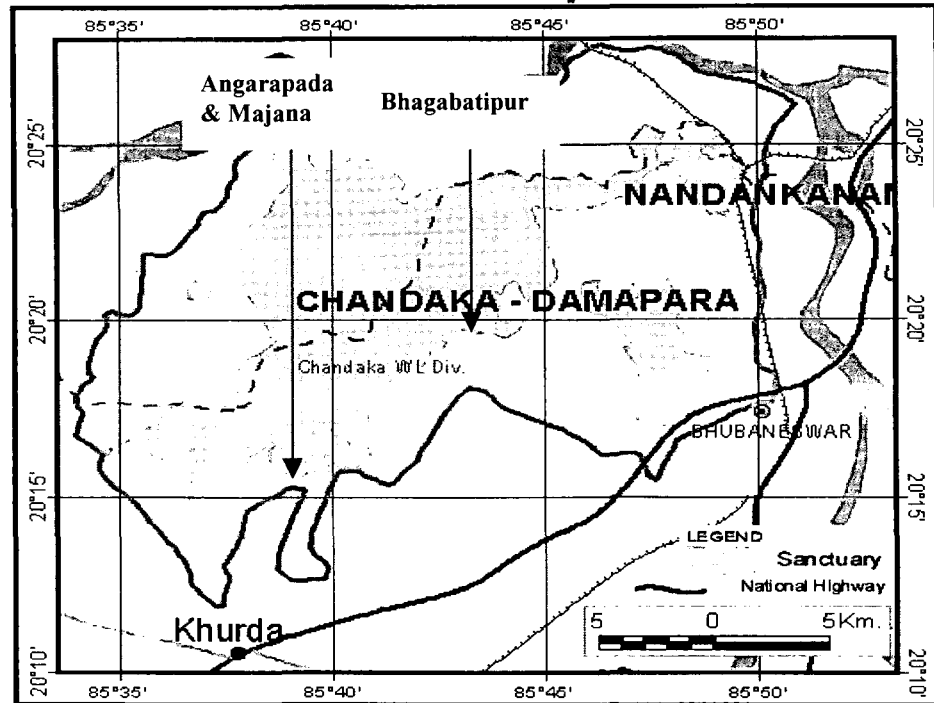
¹³ For the detailed interview schedule see the Appendix D.

Fig-4.1 Location Map of Chandaka Wildlife Division in Orissa and India



Fig-4.2: Location Map of Villages studied in Chandaka Wildlife Division

Chandaka - Damapara & Nandankanan Sanctuary



There are 47 villages in the total geographical area of the sanctuary. Out of that 5 villages are located in the core area of the sanctuary and other 42 villages are in the buffer area. As per the official record and discussion with the forest officials there is no strict demarcation of core and buffer area in this sanctuary. Therefore, these 42 villages are forest fringe villages and those 5 villages are in the core area of the sanctuary. The sanctuary is adjoined to 3 cities of Orissa- Bhubaneswar, Cuttack and Khordha- and caters to the need of these cities for fuel wood and timber.

For the protection of forest and wild lives, forest guards appointed by the government are at work. Due to its' failure Forest Department has formed 19 Van Sarankshana Samaities (VSSs) by October 2005 in this division. Along with that FD has undertaken several Eco-development works in the forest fringe villages; like fitting solar light, construction or repair of village public house.

4.2 Selection of Villages

To pick up the appropriate villages with good representation of the distinguished characteristics of the forest division a pilot survey was conducted in 16 forest fringe villages. During the pilot survey focus group discussion (FGD) was held in each village to trace out the economic and social characteristics of the households in the village and their involvement in forest protection and (or) depletion. Out of that three villages were selected purposefully for our study. Those three villages are Angarapada¹⁴ (Sabar Sahi), Bhagabatipur and Majana and have distinct characteristics. Village Majana has been protecting forest since last 40 years and hardly is their any household involved in forest felling. Similarly, Angarapada (Sabar Sahi) village has been protecting a patch of forest very well since last 30 years but almost all the households are engaged in massive degradation of forest from other patches to meet their bare necessities of livelihood. The third village-Bhagabatipur is completely involved in deforestation for their livelihood.

4.3 Selection of Sample

From these three villages a total of 140 sample households were selected for carrying out survey. Although the selection of villages was purposeful households within the village were selected randomly. The total number of households in the village and the proportion selected for our sample study are given in Table-4.2.

Table-4.2: Selection of Sample

Name of the Village	Total no. of households	Number of households selected	% of HHs selected
Angarapada	35	33	99.05
Majana	60	34	56.66
Bhagabatipur	250	73	29.2
Total	345	140	40.57

¹⁴ Angarapada village has two parts. The upper caste people stay away from the tribal people who stay in Sabar Sahi. Though both parts come under Angarapada village in Official records there is no such unity among them. Only the households of Sabar Sahi protect a patch of forest close to village as well as cut forest from the sanctuary. However the upper caste people neither protect forest nor do they cut forest for selling.

4.4 Socio-Economic Profile of Sample Villages:

4.4.1 Angarapada (Sabar Sahi)

Angarapada village comes under Jatni Block of Khordha district in Orissa. As per the Forest Department's record, it comes under Minchinpatna Forest beat of Haladia range of Chandaka Wildlife division. As per the official record Angarapada village has around 70 households. Out of that, 35 households belong to tribal category and rest 35 households belong to general category or other backward caste (OBC). The Sabar Sahi is located around 300 meters far away from the upper caste settlement. Hardly these two communities come together. In forest protection only Sabar Sahi is involved. Hence for our study the upper caste settlement has not been taken into account and only Sabar Sahi is chosen. Due to small size of the village a census survey was proposed. Although, there are 35 households in the Sabar Sahi 33 households could be studied in an attempt to do a census study of the village. The village (hence forth it is referred to as Sabar Sahi) was, earlier, located at a different place and 35 to 40 years ago they have shifted to the present place. Therefore, no household has Patta (land record) for their house plot. All the 33 households are below poverty line (BPL). 25 households (76%) are landless and other 7 households (21%) have one or less acre of agricultural land and only one household have 2 acre of land. Paddy is the single crop grown by the agricultural landholders. Again the harvest is not guaranteed all the years since those are dry lands and many times elephants damage the crop. They are able to harvest crop only in khariff season due to unavailability of irrigation facility. There is no electricity in the village. Some 10 years ago, electricity was connected to this village. However, the upper caste people opposed it vehemently saying that they will get low voltage if the Sabar Sahi gets electricity connection. Therefore, all the households use kerosene for lighting. For cooking, all the households use firewood and all of them collect it from the nearest forest, except one household who buys firewood from others since the head of the household is working in Forest Department. Not a single household has a toilet. For drinking water all the households depend upon one public well in the village. Though there is a tube well in the village hardly does anybody use it. Only 5 households reported to use tube well water. Replying to the question why don't they use tube well water, all the respondents reply that it smells rusty. A few households have received money for Indira Awas Yojana. Nonetheless, not a single household has been able to complete the construction work due to non-issuance of the balance money.

4.4.2 Majana Village

Majana village comes under the Angarapada Panchayat of Jatni Block, in Khurda district of Orissa State. In forest department's record the village comes under Manapur forest beat and Haladia range of Chandaka Wildlife Division. The village is completely different from other two villages. There are 55 households in the village and people belong to different castes- Karan, Khandayat, Teli, Mali, and Keuta. In the sample of 34 households, 22 households (76%) belong to general caste category, 6 households (18%) belong to OBC and 2 households (6%) scheduled caste (SC) category. From the total 34 sample households, 21 households (62%) belong to BPL category and rest 13 households (38%) APL category. Only 5 households (15%) from the sample are landless and 13 households (38%) have agricultural land of size 1 acre or less, 10 households (29%) have one to two acre of land and only 6 households have more than 2 acres of land. A large proportion of the lands is irrigated. The main crop grown by the landholders is paddy. Due to availability of irrigation facility farmers are able to harvest two crops a year. Electricity is connected to the village. However, 20 households (59%) from the sample have not got electricity connection and only 14 households (41%) have taken electricity connection. For cooking, 30 households (88%) use firewood and only 4 households (12%) use LPG. A majority of the households (24 or 71%) use tube well water for drinking purpose and 9 households (26%) use water from own/public well and only one (3%) household use water (unpurified) from the stream flowing from the nearest dam through their village. A large proportion of the households (25 or 74%) don't have toilet and only 9 households (26%) have toilet of their own.

4.4.3 Bhagabatipur

Bhagabatipur village comes under Kantabada Panchayat of Bhubaneswar block in Khordha district of Orissa State. It comes under Jhumuka beat of Chandaka range in Chandaka Wildlife division. There are around 400 households clustered together in this village. However, the village comes under two wards- Kantabada and Bhagabatipur. For the study purpose the section of the households in Bhagabatipur ward is selected. The characteristics of the households in the entire village all most same. There are around 250 households in Bhagabatipur (selected) village and all are tribal. In their locality they are called as Sabar. Out of these 250 households a sample size of 73 households is selected. A majority of the households are below poverty line. 63 households (86%) from our sample belong to BPL category, and

only 10 households (14.7%) belong to APL category. 54 households (74%) are landless and only 18 households (25%) have agricultural land of size 1 acre or less. Only 1 household has land of 2 acres. There is no electricity in the village. Therefore, all the households use kerosene for lighting. For cooking 72 households (99%) use firewood for cooking and only one household use LPG, which is considered as a major outlier in all terms from the rest of the households. For drinking water 70 (97%) households depend upon one public well and only one household has its' own well. Other 2 households (3%) use tube well water for drinking. All most all the households (97%), except 2, don't have toilet.

CHAPTER 5

DATA ANALYSIS AND MAJOR FINDINGS

5.1 Forest Dependency: Nature and Degree

People depend upon forest for firewood, fodder, timber and other varieties of non-timber products for household consumption and also income. Therefore, while documenting the nature of dependency a whole range of forest products can be taken into account. But here the main stress has been given on those components of forest products, which has a severe bearing on the health of forests. Our sample households are dependent on forests for collection of firewood for domestic consumption as well as selling in the market for income and securing fodder for domestic animals. Out of 140 sample households, 96% of them use firewood for cooking and they collect it from the nearest forest. Similarly 40% of the households own domestic animals - bullock, cow, and goats- and all of them graze their animals on the forestland.

However, village wise analyses reveal households' dependency on forest of diverse nature and degree. While, both Majana and Angarapada villages are protecting a patch of forest each, both of them don't depend upon the forest assigned to them for firewood and fodder. Like Bhagabatipur village, which does not protect any forest, Angarapada village uses the de facto open access forest for firewood as well as fodder (see figure-5.1). On the other hand for firewood households of Majana village depend upon the forest protected by them and for grazing their animals they use both -their forest as well as the de facto open access forests. Such difference between Angarapada and Majana arises not due to the different size or nature of forests, rather, their dependency on forest for income. Since, Angarapada village people collect firewood from the open access forest for selling purposes, they don't find any difference to collect the same for domestic consumption also. It puts different levels of pressure on forest. The village people of Majana collect only dried branches, twigs or trees from their village forest. Hence they don't cause any harm to the forest. On the other hand, people of Angarapada and Bhagabatipur cut trees and set fire in the forest, to prepare charcoal in the forest, since it is difficult to get dried branches or trees regularly for selling as well as for domestic use, from the open access forests. Hence they play an important role in forest

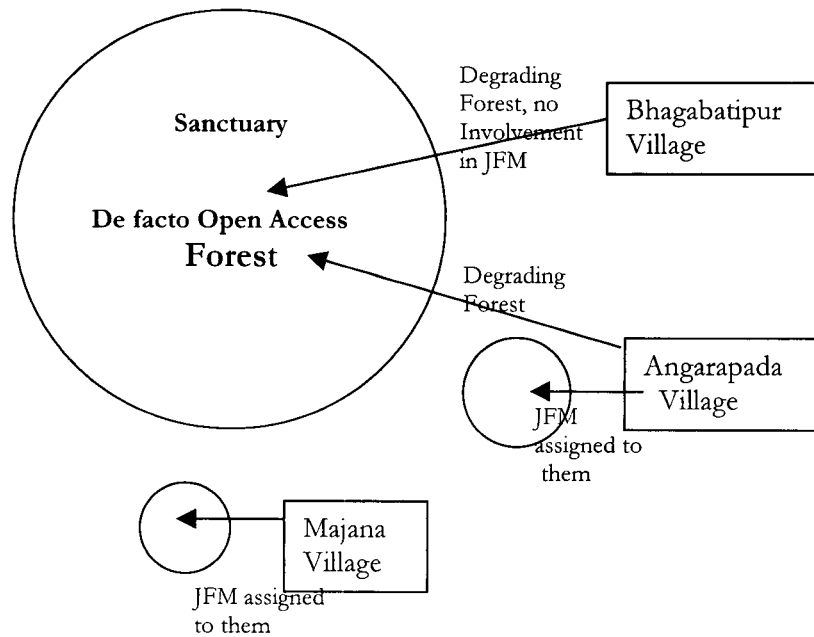
degradation as well as deforestation. However, all the three villages graze their domestic animals in the open access forests and degrade the forests.

There are no major non-timber forest products in these forests, which has either some economic value or are used for domestic consumption.

5.2 Participation in Forest Conservation

Having discussed the nature of dependency of the rural households on forest we'll analyse the nature of community participation in forest conservation. Then we'll analyse the poverty and deforestation nexus in Joint Forest Management regime and explicate the factors that influence the individual's participation in forest degrading activities.

Figure-5.1 Village Participation in Forest Conservation and Degradation



5.2.1 Forest Protection in Majana

Of our three villages studied, two villages-Angarapada and Majana- are involved in forest protection. Majana village is considered as the torchbearer in the locality in initiating forest protection. During late 1950's a group of young people formed a club in the village and started protecting around 200 acres of completely degraded Sal (*Shorea Robusta*) forest. The main motivations behind such an initiative was the concern about complete degradation of the Sal forest adjacent to their village and circumvent possible scarcity of firewood and timber in future. Subsequently, the entire village participated in forest protection. Although initially a few households in the village did not show their interest to participate in the forest protection, latter on when they saw the gradual regeneration of precious forest, they showed enthusiasm to join in the same. But they were not allowed to join the same. However, they were included in forest protection committee, which protects another small (20 acres) patch of forest having eucalyptus trees. For forest protection everyday a group of three to four members from 3 to 4 households from the village do patrolling in the forest on a rotation basis, which is known as *thengapalli* in local language. Latter on, as per the demand of their neighbour village, the villagers offered a patch of forestland to them. During 1970's under social forestry program forest department planted eucalyptus trees in a small patch of forestland and latter when the trees became matured they cut it and shared the sales proceedings among village households and forest department. After that, they did not replant or sell any other forest. As per official record now they are protecting 46 hectares of forestland. Their success of forest protection is well gauged from the regenerated Sal forest standing just adjacent to their village.

Only very recently, Forest Department has taken interest to register the forest protection committee under JFM program. As per the official record it has been registered only in 2004 although the process was initiated much earlier. In all this process the role of forest department has been negligible. Although, legal as well as other helps-like developmental works in the village, providing loans to villagers for creating self-employment opportunities-have been assured to the villagers, nothing has been materialized yet. Rather, sometimes FD has played negative role.

5.2.2 Forest Protection in Angarapada

Angarapada village has been protecting a forest of 40 hectares area since last 30 years. The main motivation behind such an initiative was basically to meet the future firewood and timber requirement of the villagers. Demonstration effect from the neighbour villages had also a prominent role behind such an initiative. There are different varieties of trees e.g. Kochila (*Strychnos nuxvomica*), Mahula (*Madhuca Longifolia*) and Amla (*Phyllanthus emblica*) available in this forest¹⁵. Initially, for its' protection everyday a group of three to four people from 3 to 4 households used to do patrolling in the forest on rotation basis. During 1995-95, due to eruption of some conflict in the village a few households from their village started cutting trees from their village forest. Then the women of the village got united and decided not to allow their family members to cut trees from their village forest. Since then, the village forest is well protected and these days there is no need of any formal patrolling to protect it. Villagers just keep vigil on the forest and no outsiders do attempt to cut trees from their forest. Very recently, in 2005, their forest protection committee has been registered under JFM program. Even though FD has given a number of promises to the villagers nothing has been materialized yet. FD's role in the organization of VSS and the villagers endeavour to protect the forest has been minimal.

5.3 Role of Women in Forest Protection

With the popularity of participatory management system for protecting forests, many studies have been carried out to examine the nature of participation of different sections (like social, economic, and gender) of society. The role of women in environmental conservation has been much emphasized in the literature. But unfortunately, many times either these institutions (e.g. JFM) are not paying much attention to this fact while implementing such programs or it does not get materialized due to the existing social norms and perceptions (Agarawal, 2001). Our study also reveals such exclusion on the basis of gender.

In Majana village, role of women in forest protection or decision-making is zero. To meet the official requirements, names of 2 women are included in the executive committee. But never

¹⁵ Although there are a few Mahula and Amla plants in this forest yet there number is very less to provide a sizeable return.

do they attend the meeting nor their opinion is ever sought in this regard. Similarly, no woman is engaged in forest protection (paroling). As per their custom no woman in the village go for out-door works except furnishing domestic works.

In Angarapada village the case is not much different. It is true that the decision taken by the women in the Angarapada village for not allowing their family members to cut trees from the village forest has been successful to halt the degradation of village forest and helped regeneration. Nevertheless, not a single woman attends any executive committee meeting convened for taking any decision. However, just to meet the official requirements, the names of a few female members have been included in the membership list of forest protection committee.

5.4 Forest Department as a Stakeholder in JFM

In the ongoing co-management (JFM in India) drive, the levels of co-production (Ostrom, 1996)- in the form of level of common action achieved- is contingent upon the nature of participation by the two stakeholders-community and the government agency (FD). In many cases such collaborative efforts bring in sub-optimal outcome because of the unequal power play (Vira, 2005).

The role of FD to conserve the forests is vital. Starting from the time period of complete monopoly of Government on forests (1947 to 1990) to the present form of management (since 1990 onwards), where FD is a stakeholder with the local community to protect the forest, the sole authority to conserve forests has been vested with Forest Department. Nonetheless, the performance of FD in this regard has not been satisfactory. A couple of factors could be pointed out that influence the efficiency of the Forest Department to protect forests. The major factors responsible to bring in sub-optimal outcome are lack of manpower in the department, dearth of interest of government officials and paucity of fund.

Our field study also confirms such reasons. First and foremost reason is lack of sufficient manpower. It handicaps the FD to achieve the desired outcome. Due to the popularity of JFM programme the top-level officials of FD set targets for the officials at bottom level to form more and more forest protection committees. It brings out devastating outcomes. Sometimes, forest protection committees are set up only in paper.

The second reason for the failure of FD to achieve desired outcome is dearth of enthusiasm among the officials. In most of the cases where JFM has shown satisfactory performance, a large part of credit goes to the involved government officials and their level of participation. Sometimes a few charismatic officials are able to efficiently motivate the community people to wholeheartedly participate in forest conservation, but in majority of cases they fail to do so. The success of community management, as also pointed out by Ghate (2003) and Hussain and Bhattacharya (2004), depends upon the level of awareness of the community on consequences of environmental degradation. Besides the cases where community members are well aware of this, the role of forest department is very much important to create such awareness. However, due to lack of manpower and time constraint the forest officials at the lower hierarchy are not able to do so. A corollary of the second reason is the unequal power relation between the community members and forest department officials which has a huge bearing on the success of co-management programme (Vira, 2005). The non-cooperation of the FD with the community reduces the effective result of such a joint effort¹⁶. Due to improper consultation with the community by the FD before and after the implementation of JFM programme, such initiatives end up in a fiasco. In many cases, community members don't feel as an equal partner in this programme. It does not provide them any incentive to work in tandem with the FD to achieve the common goal; rather very often it brings negative consequences.

Last but not the least reason is the paucity of fund. It restricts the FD to undertake a series of complementary programs along with JFM to achieve satisfactory outcome. For instance, in our study area although FD had made promises for providing the villagers loans for animal husbandry, poultry, and undertaking different developmental works in the village, nothing has been materialized yet.

5.5 Factors Influencing Individual's Involvement in Forest Degradation

On the basis of our theoretical analysis a couple of factors could be analysed, which influence the individual's involvement in forest degradation. First of all, a general analysis of all three

¹⁶ For instance, our respondents reveal that even FD does not provide legal assistance when they seek permission to cut a few trees or catch people illegally cutting trees from their village forest. To add up the villagers' discontentment, FD also never provides adequate compensation in time for their crop loss or damage done by elephants even after their frequent complain.

villages is carried out to find out the commonalties and explain the reasons why individual participate in low yielding forest cutting activities. It helps us to understand how poverty and deforestation nexus works in a broader framework. Then, special analysis for two villages is made to understand the poverty and deforestation nexus in JFM regime. It helps us to comprehend how to make JFM a complete success in halting deforestation at aggregate level.

In our study area, households in Angarapda and Bhagabatipur revealed that they are involved in forest cutting activities. Since the forest adjacent to their village does not bear any such major saleable non-timber forest products, people rely on the sale of firewood and charcoal in the local market to earn their livelihood. The local market for firewood and charcoal is of oligopsonistic in nature. Hence it fetches a very low return to the sellers of these forest products¹⁷. Similarly, the enforcement by the forest department is very weak. As a result the expected cost of penalty is very low in all these three villages. Individuals could further lower the expected cost of penalty by having a good deal of information on the movement of forest department officials. Therefore, the expected cost of penalty would vary due to the variability of chances of being caught by the FD officials and the level of penalty imposed by the forest officials on the accused. Although the expected cost of penalty varies from person to person, depending upon their access to information, it is not of high magnitude. Moreover, all the sellers of forest products face a same price level. Therefore, the major determinant for individual's participation in such forest degrading activities are the individual's own opportunity cost, which is determined by a couple of factors (e.g. asset possession, educational attainment, availability of unskilled off-farm job in the locality, social network and availability of credit) as mentioned earlier in section III.

Further, the common factors, which determine the individual's opportunity cost, are availability of credit (assuming that credit reaches all once it is made available) and the off-farm unskilled job in the locality. In our study area, both credit market and the labour market for off-farm

¹⁷ The respondents reveal that the sale of firewood in the locality fetches a minimum of Rs. 20 and a maximum of Rs. 40 depending upon their ability to bring firewood from the forest. Both supply and demand factors are responsible for generating a low return. In supply side, the villagers everyday walk around 10 to 15 kilometres to collect a standard quality of head load of firewood. Due to their poor economic condition they are also unable to invest in a cart, which would have helped to bring a larger quantity of firewood. Therefore, it is difficult in their part to increase the supply of firewood as per the market demand. In demand side, the demand for firewood is inelastic in nature. Therefore, they cannot sale a larger quantity in the market by lowering the price.

unskilled job are missing. Low level of household income in the locality also does not allow for the formation of rural informal sector, which would have also created off-farm job opportunities. Therefore, the major determinants of individual's opportunity cost in our study area are household's asset holding and level of educational attainment.

5.5.1 Land Holding and Forest Dependency

Land is an important determinant of opportunity cost for the people in rural areas and hence it largely influences individual participation in forest conservation or depletion. From our study of 140 households, majority of households, who depend upon forest for income, are either landless or marginal farmers¹⁸. The relationship between landlessness and forest degradation is established from the chi-square test showing significant result (see Table-5.1). During the interview of households many of the marginal land holders responded that many times they don't get any yield from their land since most of lands are dry and do not have irrigation facility. Moreover, elephants damage their crop most of the years. Hence a few households also leave their land as fallow. Out of total 140 households, 96 households depend upon forest for income (see Table-5.1) and of them 74 households (77%) are landless, 22 households (23%) have land 1 acre or less. Of course, there are a few households who are either landless or are marginal landholders but don't depend upon forest for income. It could be due to other facilities available for them to meet their livelihood needs. The households having land 2 acres or more are not at all dependent on forest for income. So far as sharecropping is concerned, only a few households get land to do this. Even though they get it, hardly is it adequate to meet the household needs.

¹⁸ There is wide difference among economists and different organisations to classify the farmers into different categories. Some time times classification is made on the basis of land size and some times on the basis of yield. For a broad analysis, see Patnaik, Utsa (1999) 'Ascertaining the Economic Characteristics of Peasant Classes-in-Themselves in Rural India: A Methodological and Empirical Exercise'.

Table-5.1: Land Holding and Forest Dependency

Land Holding	Household having at least one individual depending upon forest for income		
	No	Yes	Total
No Land	10 (22.7)	74 (77.1)	84 (60)
1 acre or less	16 (36.4)	22 (22.9)	38 (27.1)
2 acre or less	12 (27.3)	0 (0)	12 (8.6)
5 acre or less	3 (6.8)	0 (0)	3 (2.1)
More than 5 acre	3 (6.8)	0 (0)	3 (2.1)
Total	44 (100)	96 (100)	140 (100)

Data Source: Computed from data collected from HH survey

Note- Values in the parentheses are column percentage

Chi-Square value 56.14 significant at one- percent level.

5.5.2 Educational Attainment and Forest Dependency

Another determinant of individuals' opportunity cost is his/her educational attainment. Low or zero educational attainment keeps the opportunity cost low if they don't possess any special inherited skill. Moreover, low educational attainment squeezes the individual's access to market information and mobility, which determines the individual entry into any job market. Therefore, as per the theoretical analysis discussed in earlier section, it is presumed that more and more illiterate people will be involved in illegal forest felling. For the present analysis, average years of schooling for the members of household above age 5 are taken. From our sample, out of 96 forest-dependent households, in 5 households all the members are illiterate; 67 households have attained 1 to 5 years of schooling. Table-5.2 demonstrates that with the attainment of higher level of education, household's dependency upon forest for income decreases, which is reflected from the diminishing number of households depending upon forest (for income) with the increase in educational attainment. Out of total 96 forest dependent households, 67 households have attained only 1 to 5 years of schooling, and only a few households depend upon forest for income when they have attained higher level of education. Out of 26 households who have attained an average 7 to 10 years of schooling 21 (81%) households don't depend upon forest for income and only 5 (20%) households depend

upon forest for income. The relationship between level of educational attainment and involvement in forest degradation is strengthened from the chi-square test showing significant result.

Table-5.2: Average Years of Schooling of the Household Members Above Age 5 and Forest Dependency

Average Years of Schooling	Household having at least one individual depending upon forest for income		
	No	Yes	Total
0	0 (0)	5 (100)	5 (100)
1-5	7 (9.5)	67 (90.5)	74 (100)
5.1-7	14 (42.2)	19 (57.6)	33 (100)
7.1-10	21 (80.8)	5 (19.2)	26 (100)
10.1-12	2 (100)	0 (0)	2 (100)
Total	44 (31.4)	96 (68.6)	140 (100)

Note- Values in the parentheses are row percentage
Chi Square value (54.5) significant at 1% level

Source: Computed from the data collected from HH survey

Further, Table-5.3 shows the level of educational attainment by an individual (between age 15 to 65 years) and his/her main occupation. 54% (86 out of 159) of the total illiterate people are engaged in forest cutting activities. With the increasing level of educational attainment the number of individual going for forest cutting gradually diminishes. Particularly after attaining high school level of education hardly any individual likes to go for forest cutting. Our table of course shows that there are 8 people even after attaining high school level of education are still engaged in forest cutting and selling in the market. But here it needs to be mentioned that due to categorization of educational attainment a few people who have merely attended 8th or 9th class are also taken into account this category. Therefore, we could guess that those people might be involved in low yielding forest cutting activities. Our table also reveals that after attainment of high school education many (27) people rather prefer to remain unemployed than going for forest cutting. We also observe that a large number (43) of individuals after attending high school education are engaged in household work. This is explained with the

social norm of the Majana village where no woman goes for out door work. Therefore, we can draw the conclusion that education has a considerable influence on the individual to determine his/her participation in forest cutting.

During focus group discussion (FGD) with the village people in Bhagabatipur and Angarapada they describe the pathetic situation of the schooling system in their village. Low attendance of schoolteacher in the school and inadequate care to the students result in poor performance of the students. Further, the poor economic conditions and ignorance of the parents do not enable them to provide quality education to their children In Angarapada village there is not a single child who has passed 10th class. And in Bhagabatipur village only 3 students have completed their intermediate. This way the vicious circle perpetuates and a large number of people are forced to go for forest cutting to earn their livelihood.

Main Occupation of the individual	Educational attainment (count)						Total
	Illiterate	UP school	ME School	High School	10+2	University	
No work	14	7	2	0	0	0	23
Service in govt. sector	0	4	2	13	4	1	24
Job in private sector	0	0	1	3	1	1	6
Business	1	3	2	6	2	1	15
Farming in own land	2	11	4	17	2	1	37
Share cropping	1	6	2	2	0	0	11
Wage labour	7	8	6	11	0	1	33
Collects and sale firewood for income	86	39	12	8	0	0	145
Unemployed	8	6	5	27	4	1	51
Household works	38	34	15	43	2	0	132
Animal rearing	1	0	0	0	0	0	1
Student	0	0	0	16	8	0	24
Helping the main worker	1	8	3	9	1	1	23
Total	159	126	54	155	24	7	525

Source: Computed from the data collected from HH survey

5.5.3 Multivariate Analysis for Forest Dependency and the Factors that Influence It

After confirming the association between landlessness of the household and low educational attainment of the individual with his/her forest dependency with bivariate analysis, we move on to validate this relationship by using multivariate analysis. Our conceptual model for this purpose is as follows:

$$\text{Forest dependency} = f(\text{landholding, human capital, awareness, income})$$

Forest dependency of the household for income¹⁹ is expected to have positive relationship with landlessness, lack of human capital, lack of awareness on consequences of forest degradation and low income.

Method

The analysis is carried out with the data collected from the field survey. The variables used in the empirical analysis are described in Table-5.4.

TABLE-5.4: VARIABLES	
Variable	Variable Description
HHDF	Household has at least one individual depending upon forest for income. Yes = 1, No = 0.
LAND	Does the household possess land? Yes = 1, No = 0
HUCAP	Have the members of household (above age 15 and below 65) attained, on an average, high school level of education? Yes = 1, No = 0
AWARE	Awareness of the respondent on the impacts of forest degradation No = 0, Yes = 1, Very Well = 2
INCOM	What is the per month aggregate income of the household, from various sources,

The dependent variable, which measures the forest dependency, is HHDF. HHDF is equal to 1 if the household has at least one individual, who is involved in forest cutting for earning and 0 otherwise. For our analysis logistic regression model is used to identify the factors in terms of their inducing the household forest dependency for income.

¹⁹ Household's dependency on forest could be for various purposes, e.g. fuel wood for domestic uses, fodder for domestic animals and other varieties of forest products, which are solely meant for domestic uses. But for our analysis we have taken into account those households who cut forest for selling firewood in the market to earn income and it is their primary source of income.

The descriptive statistics are presented in Table-5.5

	N	Minimum	Maximum	Mean	Std. Deviation
LAND	140	0	1	.40	.492
HUCAP	140	0	1	.20	.401
AWARE	140	0	2	1.11	.481
INCOM	140	0	12,000	2281.45	2006.676
HHDF	140	0	1	.69	.466
Valid L (list wise)	140				

Results

Logistic regression results are presented in Table-5.6 and 5.7. In the two models presented here, the dependent variable in each is whether the household has at least one individual depending upon forest for income (Yes=1 if there is at least on individual in the household who derives income from forest, 0 otherwise). Two models include different blocks of independent variables.

Variables	Model-1		Model-2	
	Coefficient	t-stat	Coefficient	t-stat
Constant	-1.075#	2.623	-3.824*	11.428
LAND	1.876*	14.183	1.702*	8.629
HUCAP	2.450*	15.206	2.380*	10.853
INCOM	.000*	6.886	.000*	5.941
AWARE(1)			3.7.9*	8.141
AWARE(2)			3.444*	14.531
Model Chi-Square [df]	68.091[3]		90.002[5]	
Block chi-square[df]			21.91[2]	
% Correct Predictions	82.1		87.9	
R ² (Model Chi-Square/Original -2LL)	.39		.516	

Note: The Wald statistics are distributed are distributed chi-square with 1 degree of freedom
 * Indicates that the coefficient is statistically significant at .01 (99% confidence interval) level.
 # Indicates that the coefficient is statistically insignificant at .10(90% confidence interval) level

TABLE-5.7: ODDS RATIOS		
Independent Variable	Odds Ratios	
	Model-1	Model-2
LAND		
Have land	Referent	Referent
No Land	6.528	5.485
HUCAP		
Have attained High School	Referent	Referent
Have not attained High School	11.584	10.800
INCOM	1.00	1.00
AWARE		
Very Well		Referent
Yes		42.051
No		31.312

Model-1

The first model includes three independent variables-LAND, HUCAP and INCOM. The results from Model-1 indicate that the participation of household in deforestation is influenced by the factors mentioned in our conceptual model. . Members of landless households, lacking in human capital, and having low aggregate household income, are more likely to go for forest cutting for income purpose. The coefficients of LAND, HUCAP, and INCOM have Wald statistics equal to 14.183, 15.106 and 6.886 respectively, which are significant at the .01 (99% confidence interval) level. The overall model is also significant at the .01 level according to the Chi-square statistics. The model predicts 86.1% of the observations correctly. The R² is .39.

Model-2

Model-2 incorporates one additional independent variable: AWARE. As per our block chi-square statistics, model-2 is superior to Model-1 in terms of over all fit. The block chi-square statistics is significant at the .01 level (critical value = 21.91 [df-2]), the percentage of correct predictions increases by 5.8 % and the R² is .516. The co-efficients on the LAND, HUCAP, and AWARE variables have Wald statistics equal to 8.629, 10.853 and 15.004 (AWARE [1] 8.141, and AWARE [2] 14.531) and are statistically significant at the .01 level and the coefficient INCOM has Wald statistics 5.941 and is statistically significant at .05 level.

Out of these two models, Model-2 is superior one in term of over all fit. Moreover, the constant value of the model becomes significant in Model-2. The “odds ratio” for the LAND

coefficient is 5.485 with a 99% confidence interval of [1.762, 17.074]. This suggests that who are landless are almost 5 times more likely to depend upon forest for income when compared with land owning households. Similarly, the “odds ratio” for the HUCAP coefficient is 10.80 with a 99% confidence interval of [2.622, 44.491]. This suggests that the members (above age 15) of households with an average educational level below high school are almost 12 times more likely to depend upon forest for income as compared to the households with an average educational attainment above high school level. The ‘odds-ratio’ for the AWARE (1) and AWARE (2) are 42.051 and 31.312 with 99% confidence interval of [3.224, 548.553 and 5.329, 183.966]. This implies that the members of households with merely awareness²⁰ on the impact of forest degradation are 42 times more likely to be involved in forest cutting and the households with no such awareness are 31 times more likely to be involved in forest cutting than the households who are very well aware of the impact of forest degradation²¹. This odds ratios implies that mere environmental awareness does not induce individual’s to refrain from forest degrading activities. The influence of AWARE on HHDF has also been verified with a bivariate regression model. For detailed results of the analysis see Appendix C.

Discussion

From both bi-variate and multivariate analysis we find that landlessness, lack of human capital and low or mere environmental awareness have considerable bearing on the rural households in determining whether to participate in low yielding forest cutting activities or not. In our analysis the purpose of taking attainment of high school education as the referent category is due to the fact that merely being literate (with the attainment of primary or M E school education) hardly makes any difference to an individual in terms of skill gain and increasing access to information and mobility. In rural areas the households who possess land get income and employment from this. It keeps the opportunity cost of individual members high and prohibits them to be indulged in low-yielding forest cutting activities. On the other hand education plays a vital role to increase the access to information from external world resulting

²⁰ We have categorized the environmental awareness into three categories. 1st is No awareness, 2nd is merely aware (yes) and thirdly very well.

²¹ In spite of the fact that our bivariate and multivariate analyses confirm our theoretical analysis, due to the small sample size we acknowledge that this finding should be taken as indicative rather than conclusive

in increasing mobility, and possibilities of skilled employment. It increases their opportunity cost and discourages them to be involved in forest degrading activities. Further, awareness on the impact of forest degradation dissuades the members of households to be indulged in forest cutting. Nonetheless, mere awareness on the negative consequences of deforestation does not induce individuals to get away from forest degrading activities. Only a high level of awareness induces individual's to refrain from such activities. (In section 5.5.5 we have discussed it further how merely environmental awareness fails to stop individuals to go for forest cutting).

5.5.4 Unskilled Job Opportunities in the Locality and Participation in Deforestation

Along with land holding and educational attainment of the household and individual members respectively, availability of other job opportunities influences the individual decision to participate in forest cutting or not. Availability of job in the locality and a good remuneration for that will discourage individual to go for forest cutting. However, during the interview and focus group discussion with the people in Bhagabatipur and Angarapada villages, they narrate the grim picture of employment opportunities. The only option available is working as wage labour during the crop sowing or harvesting season. That too is not available regularly. But due to available of unlimited supply of labour in the locality wage rate remains very low. Even though government announces minimum wage rate every year, hardly do they get it. Moreover, since they are unskilled they also don't have a chance to be employed in any other places. Therefore, the ultimate option left for them is cutting forest and selling firewood in the neighbour villages.

5.5.5 Environmental Awareness It's Internalisation and Individual Participation in Forest Conservation

For conservation of any natural resource by the community members, their environmental awareness is very much important. Hussain and Bhattacharya (2004) have stressed the necessity of environmental awareness among the community members before the implementation of JFM programme. Nonetheless, our study reveals that mere environmental awareness does not necessarily get internalised by the community members and urge them to act upon forest conservation. Baland and Platteau (1996) also point out that unless the impact of resource degradation affects the life of community members so severely, hardly do the community members come forward for its' protection. Our sample households demonstrate

different degrees of environmental awareness and their involvement in forest degradation (see Table-5.8).

Awareness of the respondent on the impact of forest degradation	Household having at least one individual depending upon forest for income		
	No	Yes	Total
No	1	7	8
Yes	19	87	106
Very well	24	2	26
Total	44	96	140

Source: Computed from the data collected from HH survey

Out of total 140 respondents, 8 of them show their ignorance of the negative outcome of forest degradation and of them in 7 households there is at least one individual depending upon forest for income. 106 respondents show moderate awareness but in 87 households there is at least one member involved in forest degradation. Similarly, out of 26 households who show very good awareness of impact of forest degradation no one from 24 households is engaged in any type of forest degradation activities. The respondents who show their awareness on the impact of forest degradation moderately (here, replying yes) reply that they often listen from radio about this. But unfortunately their awareness does not get internalised. Therefore, many of them are engaged in forest degradation activities. In this locality, environmental problems have also been not so acute to force the local people to stop forest degradation. Village wise analysis on environmental awareness (see Table-5.9) reflects that most of the people in Angapada village and Bhagabatipur village show moderate awareness but in Majana village a majority show very good awareness. It could simply be owed to higher level of education attained by the people in Majana village.

Village	Awareness on the impact of forest degradation			
	No	Yes	Very well	
Angarapada	3 (9.1)	27 (81.8)	3 (9.1)	33 (100)
Majana	1 (3)	12 (35.3)	21 (61.8)	34 (100)
Bhagabatipur	4 (5)	67 (91.8)	2 (2.8)	73 (100)
Total	8 (6)	106 (76)	26 (18)	140 100

Note: Values in the parentheses are row percentage

Source: Computed from the data collected from HH survey

The failure of Angarapada and Bhagabatipur villagers to internalise their moderate environmental awareness could be due to their landlessness. Most households in these two villages don't possess land. Therefore, the drop of water table or irregular rain caused by massive deforestation does not affect to them. So far as the direct impact of forest degradation is concerned, since the villagers opportunity cost is much lower they don't hesitate to walk a long distance to collect firewood. All the respondents in Bhagabatipur village explain the increasing distance of forest from their village over the years and degradation in the quality of forest. A few decades ago forest was just adjacent to their village, from where they used to collect firewood as well as timber, but now they have to walk down around 12 kilometres for collecting firewood.

5.6 Role of Women in Forest Degradation

Out of three villages, in one village-Majana- no individual is involved in forest cutting to earn income. However, in Angarapada and Bhagabatipur villages most households are engaged in forest cutting. Out of 349 people in the working age group of these two villages (between 15 and 60) 182 are male and 167 are female. 46.7% of the women's main occupation is collection of firewood for income (See Table-5.10). Similarly, 34.6% of men are engaged in same activity. In these two villages it is generally preferred that the female member go to forest for collecting firewood whether for sale or domestic use. The reason behind this is, as villagers explain, the penalty for a woman if caught by the forest guard is lesser than that of men. If the forest guard

catches women they simply have to surrender their sickle or axe along with seizure of the bundle of firewood. But in case of men, the penalty could be in terms of money or sometimes jail. Further, men work as wage labour in the neighbour villages or do farming in their own land or sharecropping. Another reason for women going to forest could be the non-availability of enough work in the locality.

TABLE-5.10 Main Occupation of the Individuals in Angarapada and Bhagabatipur Villages (In percentage)			
Main Occupation of the individual	Male	Female	Total
No work	0.5	2.4	1.4
Service in govt. sector	7.1	0.6	4.0
Job in private sector	0.5	-	0.3
Business	2.2		1.1
Farming in own land	7.1	0.6	4.0
Share cropping	4.9	-	2.6
Wage labour	11.5	3.0	7.4
Collects and sale forest products for income	34.6	46.7	40.4
Unemployed	19.8	1.8	11.2
Household works	0.5	40.1	19.5
Animal rearing	-	0.6	0.3
Student	6.6	1.2	4.0
Helping the main worker	4.4	3.0	3.7
Total	100.0	100.0	100.0

Source: Computed from the data collected from HH survey

5.7 Do Tribals Degrade Forest?

There is a debate whether tribals are involved in deforestation or not. In the literature it is widely described and also there is a general notion that tribals don't degrade forest since they depend on it for their livelihood. The Tribal Bill 2005 is also an attempt to provide land tenure right to the forestland with a presumption that tribals are the best conservators of forest.

Nevertheless, from the findings of our study it seems that the romanticized notion that tribals are the conservators of forest cannot be generalized and should be taken with caution while going for policy recommendations. Table-5.11 shows the caste category and forest dependency for income. From the sample of 140 households only the tribal households are engaged in forest cutting. It is observed that tribals are mostly engaged in illegal forest cutting to meet

their basic livelihood needs. A broad analysis of their economic conditions will help us to find the reason behind their involvement in deforestation.

Table-5.11: Caste Category and Forest Dependency

Caste Category	Household having at least one individual depending upon forest for income		
	No	Yes	Total
General	26	0	26
OBC	6	0	6
SC	2	0	2
ST	10	96	106
Total	44	96	140

Source: Computed from the data collected from HH survey

From our study of 140 households, 84 households are landless and of them 79 households are tribal. Not a single tribal household has land of more than 2 acres (see Table-5.12). Out of 106 tribal households 79 are landless, 25 households have land of 1 acre or less, and only 2 have land between one to two acres. As mentioned earlier, the marginal farmers hardly do get any yield from their land since most of them is dry and there is no provision for irrigation. And also due to high frequency of crop damage by elephants, many households leave their small amount of land fallow. During the interview of households, they unequivocally reply that they don't get any compensation for their crop damage, even after complaining at the forest office, and if they get, the amount is very low and that too even after many years.

Thus agriculture has zero or negligible contribution to these tribal households to provide food and employment. At the same time, people in the working age group are either illiterate or merely literate without having any job skills. They also lack information regarding other employment opportunities. Even though sometimes they go out in search of work, they are cheated by labour contractors²². Further, their socio-cultural factors work against their mobility²³. There is hardly any job opportunity available in their locality. Therefore, the

²² Replying to the question why don't they go out in search of work these tribal households reply that they are scared of the labour contractors. They also narrated the story. A few years back some people went out to work as labourers with a local labour contractor. Many of them did not get full amount of their payment and one of them could not come back and is missing till date (time of our interview).

²³ Most of the tribal households have nuclear family system. Hence they feel it difficult to go out leaving their wife and children alone.

ultimate alternative left for them is to cut forest, which is easily accessible to them, and sell firewood in the local market to meet their subsistence requirements.

Table-5.12: Caste Category and Agricultural landholding

Size of Agricultural Land holding	Caste Category				Total
	General	OBC	SC	ST	
No Land	4 (4.8)	0 (0)	1 (1.2)	79 (94)	84 (100)
1 acre or less	8 (21.1)	5 (13.2)	0 (0)	25 (65.8)	38 (100)
2 acre or less	9 (75)	0 (0)	1 (8.3)	2 (16.7)	12 (100)
5 acre or less	2 (66.7)	1 (33.3)	0 (0)	0 (0)	3 (100)
More than 5 acres	3 (100)	0 (0)	0 (0)	0 (0)	3 (100)
Total	26 (18.6)	6 (4.3)	2 (1.4)	106 (75.7)	140 (100)

Source: Computed from the data collected from HH survey

Note- Values in the parentheses are row percentages
Chi square value (79.86) significant at 1% level

5.8 Timber Smuggling and Tribals

During our household interview in Bhagabatipur village, not a single household revealed their indulgence timber smuggling. However, without taking anybody's name many respondents replied that many households are also engaged in such business. However, they are not able to derive all the profits from such business. They work as the agent of the timber Mafias. On the order of timber mafias tribals cut timber from the forest and transfer it to them. Therefore, they get a very small share of the actual price of the timber. Similarly, no households did reveal about their involvement in charcoal selling. However, without mentioning any name they confess that a couple of households are engaged in charcoal selling²⁴.

²⁴ Selling of charcoal causes more harms than cutting trees. People cut a patch of forest put all the woods in a pit and then set fire on it. It fetches more money than sale of firewood. Respondents reply that sale of charcoal would fetch them around 100 rupees per day whereas that of firewood would fetch a maximum of 40 rupees per day.

5.9 Poverty and Deforestation in JFM Regime

In this section we undertake a village specific analysis to take stock of the poverty and deforestation nexus in JFM regime.

Although, both Angarapada and Majana villages have been protecting a patch of forest each since last 30 and 40 years respectively and quite recently (in 2004) they have been brought under Joint Forest Management, it has not brought in uniform result to stop their involvement in forest degrading activities. Not a single household from Majana village cuts forest from open access forest. To meet their domestic firewood requirement households of Majana village rely upon their village forest. Conversely, like Bhagabatipur village, almost all the households from Angarapada village are engaged in cutting trees from open access forest. Along with meeting their domestic requirement for firewood, and fodder they derive their livelihood from the open access forest by selling firewood in the market. It demonstrates that the poverty and deforestation nexus also prevails in Joint Forest Management regime. Where rural folk are completely dependent on forest for their basic livelihood requirements and the forest does not bear any immediate benefits in the form of valuable usufructs, then the community members go for unsustainable forest cutting activities. Like the households in our study area, people would go for cutting forests for selling firewood and charcoal to derive their means of livelihood. The implementation of JFM might enable the community to protect a certain patch of forest, but until their opportunity cost remains zero or much lower they will be involved in low yielding forest degrading activities from the open access forests. Without addressing the dependency of rural households on forest for their basic requirements, the implementation of JFM merely shifts the dependency or degradation of forest from one patch to another. Thus, at aggregate the level there will be forest loss. Therefore, in order to halt the degradation of forest by local people redressal of their poverty is very crucial.

CHAPTER 6

CONCLUSION AND POLICY IMPLICATIONS

Based on our analysis, this chapter draws several conclusions and offers important policy implications. The study ends by highlighting some issues, which need further research.

6.1 Conclusion

The relationship between poverty and deforestation operates in a very complex manner. An array of social, economic and demographic factors play crucial role to reinforce the circular relationship and perpetuate it over time. Apart from individual resource endowments (physical as well as intellectual), the nature of market – factor as well as output, efficiency of institutions for enforcing the rules, individual's access to information, availability and the nature of common pool natural resources, existence of social and economic infrastructure, and the existing social norms and cultural practices determine the individual participation in forest cutting activities. Due to oligopsony nature of forest-product market and inelastic nature of demand for such products, it generates a very low return to sellers. Therefore, the people involved in this profession earn a low income and are unable to invest further in more productive sectors. Thus they fail to move out of the low-level equilibrium trap. Similarly, due to weak enforcement by the Forest Department, the expected cost of penalty remains low. It acts as a pull factor and low opportunity cost acts as a push factor for the poor rural households to go for forest cutting. Opportunity cost of individual is determined by two sets of factors. One set of factors – the existence of credit market and its nature, presence of social and economic infrastructure, and availability of off-farm unskilled activities – influence the opportunity cost of all individuals in one locality uniformly, or at least provides equal opportunity for this. Another set of factors – educational attainment, household asset possession and the access to information through social network – influence the individual opportunity cost differentially. In case of lack of first set of factors, it is well expected that the opportunity cost of all individuals will remain low. But the second set of factors varies from one household to another. Therefore, the second set of factors has more bearing on the individual opportunity cost and plays decisive role to determine the individual participation in low yielding forest cutting activities.

As mentioned earlier, in rural areas, land being an important asset of the household, it plays a prominent role in providing employment as well as income to its' members. Landless households or marginal farmers are deprived of such self-employment opportunities and depend upon other sources for income and employment. For them, common pool resources (here forest) provide the best alternative. However, opportunity cost of the members of the households who own land remains high and it prevents them from indulging in forest cutting. Similarly, education has a significant bearing on individuals to determine his/her participation in forest cutting. Illiteracy or merely being literate keeps individual's opportunity cost lower and in absence of other alternatives (s)he is forced to go for forest cutting. Conversely, attainment of higher education keeps individual's opportunity cost at higher level. It increases individual's mobility by increasing employability and access to information on other job opportunities. Besides, it increases the environmental awareness and demand for a (environmentally) better quality of life. High opportunity cost restricts individual to go for forest cutting and environmental awareness encourages conserving natural resources. In an inter-linking process, low asset possession or the low income of one household deprives them from higher level of education. As a result the opportunity cost of the individuals of the households remain lower. This way poverty forces the individual to degrade forests when a whole range of factors, mentioned above, keeps the individual opportunity cost depressed.

Co-management system is seen as the most efficient mechanism to conserve forests (Kolavali, 1995). Social fencing by the community members reduces the enforcement cost of forest protection and enables to halt the reckless tree felling by the community itself and other communities. It will also halt the timber smuggling by outsiders. In India, as a result, JFM has gained much popularity and huge areas of forest have been brought under this management system by forming a large number of Village Forest Protection Committees. There is no doubt that deforestation has come down or stopped in those areas where JFM has been successful. Nonetheless, degradation of forest has not completely stopped. In many places JFM has not been successful to halt forest degradation. Our study reveals that due to the prevalence of abject poverty, implementation of JFM merely shifts the burden of deforestation from one patch to another. Even though community members successfully participate in conserving the assigned forest patch, they cut trees in other patches of forests. While the community members are successful in conserving forests at unit level, they fail at the aggregate level. Hence, the

present study conveys that the success of JFM to halt forest degradation at aggregate level is contingent upon the degree of dependence of the community members on the forest. Some communities depend upon forest just for fuel wood or (and) fodder. Some others depend upon forest to meet their subsistence livelihood requirements. Before the implementation of JFM programme a thorough study of the local problems is very much essential. While implementing JFM every attempt should be made to address basic problems of livelihood by diverting the community's dependence upon forest to some other means. In this regard one-size-fits-all policy will definitely not help. Local solution for local problems will be the best approach. Where communities are dependent upon forest merely for fuel wood, allocation of an adequate size of forest, which provides enough fuel wood without causing any harm to the forest, or any other sources of fuel, will serve the purpose. However, where people are dependent upon forest for income, due to their low opportunity cost, provision should be made for other employment and income opportunities.

Our theoretical analysis conveys that a higher penalty cost works as a deterrent for individual's participation in illegal forest felling. But mere hike in penalty would not be fruitful to stop illegal forest felling by people. Therefore, along with the implementation of JFM by addressing the basic problems of the community and enabling them to effectively participate in forest management, enforcement mechanism by the Forest Department needs to be tightened. Penalty cost should be kept much higher. Since Village Forest Protection Committees could monitor the forest effectively it should be given more incentive to act upon it. And also empowering these Committees with more legal aid will result in a better enforcement of property right.

A few studies (Hussain and Bhattacharya, 2004; and Ghate, 2003) have emphasised upon the importance of environmental awareness for the success of Joint Forest Management programme. Nonetheless, our empirical findings show that awareness per se on the impact of forest degradation does not necessarily get internalised to urge individuals to refrain from such action. Unless the degradation of forest affects the community directly, seldom do they come forward for its conservation. A higher level of environmental awareness and landholding enables the individuals to internalise it and conserve the forest.

In contrast to the general notion that tribals are the best conservators of forest, our study shows that tribals are engaged in massive forest degradation activities. Therefore, this romanticised notion on tribals cannot always be generalised and while going for any policy recommendations it should be taken with caution. Similarly, our finding comes in contrast to the notion on women as the best conservators of environment. Although women's decision to stop forest cutting from their village forest in Angarapada village has brought positive result, at least one female in majority of the households is engaged in forest cutting from the open access forest. Therefore, it also cannot be generalised that women show more concern to conserve natural resources and environment.

Most of the ongoing JFM projects are funded by external agencies. However, it is well known that the flow of fund will not continue in future. Studies have also found that with the withdrawal of funding the interest of community members wither away (Vira, 2005). Therefore, while implementing JFM schemes, all attempts should be made to provide a long run income-generating source to the community members. It should be made not by perpetuating the flow of funds, rather, by making these communities independent.

6.2 Policy Implications

Poverty among rural poor and their low opportunity cost, due to a slew of reasons, force them to indulge in deforestation. Therefore, to halt deforestation by these communities, different departments and agencies should work together by adopting a multi-pronged strategy. First step in this direction should be to generate employment opportunities in rural areas. The next priority should be formation of human capital and infrastructure development in rural areas. Education increases the employability and mobility of labour. It will enable them to work in other places or be self-employed. Role of government is very much important in this direction to break the vicious circle. Thirdly, provision should be made for channelling more credit to rural educated youths for making them self-employed. Fourthly, and more importantly an alternative source of fuel should be made available to reduce the high dependency upon firewood. Rise in income of the households will lead to substitution of fuel from firewood to other sources. Therefore, long term planning should aim at averting the future energy crisis. Providing local solutions for local problems will be the best way to strengthen the co-management institutions for conserving forest.

6.3 Issues for Further Research

From our study we have only implied that for completely halting the degradation of forest by the community, before implementing JFM, one needs to examine the nature of dependence of the local folk on forest and make provisions accordingly. However, it is also imperative to see the nature of forests and the nature of forest dependence. Forests provide different environmental services and economic returns. For instance, forests bearing more non-timber products will give incentive to the community members to conserve the forests since they would be receiving immediate benefits from it. Similarly, a forest either full of medicinal plants, on which local community depends or a forest, which generates money from eco-tourism, would discourage the community to degrade it. Rather the community would show greater interest to conserve such forests. Of course the government policy on the non-timber forest products and other services will have a strong bearing on the motivation of community members to conserve the forests. Therefore, following questions need further examination. (1) How does the nature of forest affect the economic condition of local people? (2) How does the nature of forest influence the nature of community participation in forest conservation? (3) How does government policy on forest products (goods and services) influence the economic conditions as well as the nature of community participation?

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APPENDIX A

DEFORESTATION Vs. FOREST DEGRADATION

Deforestation: FAO defines deforestation as the conversion of forest to another land use or the long-term reduction of the tree canopy cover below the minimum 10 percent threshold.

It implies the long term or permanent loss of forest cover and implies transformation into another land use. Such a loss can only be caused and maintained by a continued human-induced or natural perturbation.

It includes areas where, for example, the impact of disturbance, over utilization or changing environmental conditions affects the forest to an extent that it cannot sustain a tree cover above the 10 percent threshold.

It also includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas.

The term however excludes areas where the trees have been removed as a result of harvesting or logging and where the forest is expected to regenerate naturally or with the aid of silvicultural measures.

Forest Degradation is defined as changes within the forest, which negatively affect the structure or function of the stand or site, and thereby lower the capacity to supply products and/or services (FAO).

Since forest is a renewable resource the stock of resource can be kept intact even harvesting the resource. However, the rate of harvest should not exceed the rate of regeneration. Further, criticism may arise that from a strong environmental perspective that any intervention into the resource stock is not desirable since it could result in unsolicited and unnoticed losses e.g., biodiversity loss. Nonetheless, it is difficult to achieve such a degree of conservation of forest and at the best we can go for a weak order conservation of forest. Following this principle we can define forest degradation as changes in forest from its' original status leading to a lower capacity to yield the forest products and services than its' natural rate.

Therefore, merely increase in the area of forest or tree cover is not enough to maintain ecological order. Maintenance of good quality of forest is very much important. World Bank has also showed serious concern that degradation, not deforestation, currently is the major problem in the forest sector in India (Kumar et al. 1999. XI cited in Sunder, N (2001).

APPENDIX B

PROBLEMS IN FOREST STATISTICS

There are a number of problems coupled with the data on forest cover in India and in its various States. The problems arise due to various reasons; viz. definition problems of forest cover and tree cover, recorded forest and actual forest, measurement problems and change in scale for analyzing the data collected from the satellite picture, and discrepancy between different data sources. Therefore, the data over time period are not amenable for comparison. In this section we illustrate all those problems.

Forest Cover and Tree Cover

FAO defines **Tree** as a woody perennial with a single main stem, or in the case of coppice with several stems, having a more or less definite crown. It includes bamboo, palms and other woody plants meeting the above criteria. However, the normal perception is that forest includes areas covered by the canopy of naturally occurring forests, while man made tree crops and plantations would constitute tree cover. While interpreting satellite imagery for a small area followed by intensive ground verification, it may be possible to distinguish natural forests from plantation. However, within time and resource constraint FSI has not done such an intensive analysis. All tree canopies that could be delineated and assessed from satellite data (Sensor LISS III of IRS satellite 1C/1D) is termed as forest cover. It includes canopy of all forest and tree crops, larger than 1 ha in extent, irrespective of land ownership, land use and type of tree species. It is unable to classify forest cover into natural forests, orchards, coffee/tea plantations, public parks, agro-forestry plantations, etc. Therefore, as per SFR (2003)'s definition, tree cover means the area covered by crown of trees that is too small to be delineated by digital interoperation of remote sensing data at 1:50, 000 scale used for forest cover assessment

Trees Outside Forests and Tree Cover

There is difference between these two concepts. FAO defines Trees outside forest (TOF) as trees outside forests include all trees found outside forests and outside other wooded lands:

- Stands smaller than 0.5 ha;
- Tree cover in agricultural land, e.g. agro-forestry systems, home gardens, orchards;

- Trees in urban environments;
- Along roads and scattered in the landscape

SFR (2003) defines TOF mean all tree crops and woodlots outside forest area. However, the tree crops and woodlots outside forest area that are larger than 1 ha in extent is captured by satellite data used for forest cover assessment and such tree canopies deemed to have been included in the forest cover assessment. The crown cover of residual trees outside forest cover constitutes tree cover. Thus, trees included in tree cover constitute only a part of TOF.

The data on forest cover and tree cover have importance from two perspectives. From environmental perspective the total tree cover-whether inside or outside the forests- is very important. But from ecological and biodiversity concern the area under forest cover is very much important. Data relating to coverage of natural forest, secondary forest, plantation forest and number of species is even more important for assessing the biodiversity loss and ecological balance. Unfortunately the data collected from the satellite picture do not provide such information. Therefore, the data collected from satellite picture can provide better information on total tree cover and its' class and for other detailed information on the nature of forest and species within that, reports published by State Forest Departments will be the better source in the existing scenario.

Measurement Problems

In India, since 1987, the forest cover of the country is being assessed biennially by the Forest Survey of India (FSI) using remote sensing technology. In addition, FSI also prepares thematic maps using aerial photographs, and carries out inventory of natural forests as well as Trees Outside Forest (TOF).

However, the use of remote sensing method has many limitations to provide data.

1. The period of satellite data is of utmost importance. The reflectance from the forest is dependent on growth of the crown and its chlorophyll content. A deciduous forest would, therefore, not give proper reflectance in leafless period.
2. Considerable details on ground may be obscured in areas having clouds and shadows. It is difficult to interpret such areas without the help of collateral data.

3. Satellite sensors do not record the reflectance of young plantations with small crown and low chlorophyll content.
4. In visual interpretation, the minimum size in the imagery that can be mapped is $2\text{mm} \times 2\text{mm}$ which corresponds to 25 ha on the ground on 1:250,000 scale and 1 ha on 1:50,000 scale. Since the resolution of sensors LISS-II and LISS-III are 36.25m and 23.5m respectively, the plantations along road, canal and rail of a width less than resolution are not recovered.
5. Gregarious occurrence of bushy vegetation like lantana, tea and coffee poses problems in delineation of forests, as their reflectance is similar to that of forest.
6. The processing of satellite data and its generation in the form of paper prints may also cause tonal variation in hue affecting interpretation.

New Scale for Data Analysis

Upto the seventh State of Forest Report (SFR, 1999) the forest cover assessment was made using visual interpretation technique and scale of interpretation was 1:1 million (SFR, 1987) to 1:250,000. For the first time SFR 2001 was prepared on the basis of figures of forest cover arrived at using digital image processing (DIP) technique at the scale of interpretation of 1:50,000.

The change of scale for interpretation imposes a limitation (called cartographic limit) on mapping of any geographic feature and makes the times series data incompatible for comparison. For example, at 1:250,000 scale, the smallest area of forest cover that could be delineated was 25 hectare (ha) while at 1:50,000 scale his limit comes down to 1 ha. An advantage of the forest cover mapping on larger scale is that the details are highlighted on 1:50,000 scale, which is not discernible on 1: 250, 000 scale. In case of fragmented forest, the area of forest cover decreases as the openings were not clearly discernible on the smaller scale are picked up on the larger scale. Conversely, the scattered small patches of forests/plantations, not discernible at smaller scale, are included in the assessment on larger scale thus adding to forest cover. The implication of cartographic limit was that during the eighth assessment (2001), smaller patches of forest and tree canopies (1 to 25 ha in extent) could also be detected and mapped. At the same time, small blanks and gaps inside forested areas could also be identified and delineated to the extent possible.

Therefore, looking at the forest statistics it is also difficult to reach at any conclusion whether forest cover in India has increased or decreased over time. For example the data given by FSI (see Table-1.2) demonstrates a sudden rise in forest cover, in India as whole, from 637,293 square k.m.s (19.39% of total geographical area) in 1999 to 675,538 square kms (20.55% of total geographical area) in 2001 and 678333 square k.m.s (20.64% of total geographical area) in 2003. And the year 2001 coincides with the change in measurement scale from 1:250,000 to 1:50,000. Therefore, it will be misleading to infer that forest cover has really increased in India.

Estimation of Plantations

As earlier stated due to so many technological limitations and difficulties, with remote sensing analysis, FSI has been unable to report the scattered forests, which have a cover less than 1 hectare (before 1999 it was 25 hectares). Therefore, the total forest cover- natural plus planted forest- has been underreported. Government also spends enormous money for the plantations in denuded areas and in some places it has also been successful to regenerate forest cover. Therefore, in the total forest cover statistics it needs to be included. State forest departments provide data for this. However, these data have serious problems to take into account for estimating forest cover in any State and country as a whole.

The data given by forest department on cumulative area forest plantation is erroneous due to several reasons. First reason is the estimation of plantation area on the basis of number seedlings distributed is not credible at all. Since 1980, the target of all kinds of afforestations was fixed by number of seedlings. Under this provision a notional number, 2,000 seedlings equivalent to 1 hectare, converted the number of seedlings into area. The practice continued within 1990. Area and seedlings fix the target since then separately. The same notional number later on converts seedlings distributed to the private individuals and institutions into area. The planted area reported by the National Afforestation and Eco-development Board (NAEB) under the Union Ministry of Environment and Forests, therefore, has two components; area of block plantations and area estimated by converting distributed seedlings. About 35% to 40% areas of the total annual plantations are achieved by converting seedlings into area.

Secondly, there is problem of double counting. During plantation all lands don't survive. Moreover, the fast growing species are felled after their maturation period and the area is

replanted. In cumulative area of plantations, replanted, replanted areas are counted doubly and areas of failed plantations are also included.

For the first time India, using satellite picture FSI reported the tree cover in the year 2001. The tree cover comprising small patches of trees (<1.0 ha) in plantations and woodlots, or scattered trees on farms, homesteads and urban areas, or trees along linear features, such as roads, canals, ponds, etc. was estimated by using field inventory methods. However, in SFR 2003 high-resolution satellite data (PAN together with LISS III) has been used to estimate tree cover. Therefore, in comparison to earlier estimate Tree covers have been classified as block, linear and scattered, based on their geometric formation

Discrepancy between Data produced by of FAO and FSI

The FAO estimates forest cover for different countries with the information collected by different countries since it does not have a separate mechanism for assessment. In cases where countries are not able to provide data, the data are compiled by referring to other reliable sources. For India, the FSI acts as a nodal agency for providing the information on forest resource of the country. However, FAO has a distinct criterion to define and classify forests. This leads to a discrepancy between the data given by FAO and FSI. As per FAO's classification, forest areas affected by shifting cultivation even once in the past are recorded under the category of 'forest fallow' even if such areas presently support forest vegetation (close or open), whereas, in the FSI's classification, the present status of the forest cover is taken into account. For this reason, the estimates for forest cover given by FAO and FSI vary widely.

Discrepancy between Data provided by Directorate of Economics and Statistics in Agricultural Statistics

Directorate of Economics and Statistics (DES) also provide data on forest cover in its' Report Agricultural Statistics in the table on land use. However, there is a huge difference between the data given by DES and FSI. This is showed in **Table-A.1** below.

**Table-A.1 Source Wise Variation in Data on
Forest Cover In India**
in million hectares

Year	Forests*	Forest @	Difference
1987-88	66.9	64.1	2.9
1988-89	66.9		
1989-90	67.4	63.9	3.5
1990-91	67.8		
1991-92	67.9	63.9	3.9
1992-93	68.0		
1993-94	68.3	63.9	4.4
1994-95	68.6		
1995-96	68.8	63.9	4.9
1996-97			
1997-98		63.3	

*Source: Indian Agricultural Statistics vol. & II -All-India State-wise and District wise & Indian Agriculture in Brief (Jan 2000)
Agricultural Statistics Division,
Directorate of Economics & Statistics

@Source: State of Forest Report 2003

While the forest cover data given by DES shows a steady rise in forest cover, the data given by FSI shows almost a stagnant picture. It results in a divergence between these two data sources.

The data provided by FSI do not provide information on the coverage of reserved forests and protected forests and on the ownership of forests-whether government ownership or private ownership. Hence from FSI data it is difficult to assess the change in forest status on these criteria. FSI in its' forest cover data includes the tree cover outside the forests and agro forestry which has a cover more than 1 hectare. Therefore, it is again a mess to know the source of change in forest area- whether it is due to change in tree cover or due to natural forest cover.

State Forest Departments in their reports publish the data on forest cover on the basis of statutory classifications- like reserved forests, unclassed forests, demarcated protected forests, un-demarcated protected forests, other forests under the control of revenue department, total government forests, forests in private ownerships and the area which were earlier forests but stands degraded denuded or cleared. Sometimes they also publish the name of species available in different patches of forests. Nonetheless, these data don't provide any information on the class of forests as mentioned in FSI report- very dense forests, moderately dense forests, open forests, mangroves, and scrubs.

APPENDIX C

**Bivariate (Logistic) Regression Model for Environmental Awareness and Involvement
in Deforestation**

Table-C.1: Biivariate Logistic Regression Results (Dependent Variable = HHDF)		
Variables	Model-1	
	Coefficient	t-stat
Constant	.087*	10.976
AWARE(1)	3.695	11.509
AWARE(2)	3.964	25.859
Model Chi-Square [df]	51.131 [2]	
% Correct Predictions	83.6	
R ² (Model Chi-Square/Original -2LL)	.293	

Note: The Wald statistics are distributed are distributed chi-square with 1 degree of freedom

*Indicates that the coefficient is statistically significant at .01 (99% confidence interval) level.

TABLE-C.2: ODDS RATIOS FOR AWARE	
Independent Variable	Odds Ratios
	Model-1
AWARE	
Very Well	Referent
Yes	40.250
No	52.658



APPENDIX-D

Schedule No.:

*CONFIDENTIAL
FOR RESEARCH PURPOSE ONLY*

MPHIL PROGRAMME: 2004-06
JAWAHARLAL NEHRU UNIVERSITY
CENTRE FOR DEVELOPMENT STUDIES, PRASANTH NAGAR, ULLOOR,
THIRUVANANTHAPURAM – 695 011, KERALA, INDIA

Interview Schedule

Factors that Influence Individuals' Participation in Forest Conservation or Depletion.

A Study of the Households in Chandaka Wildlife Division, Orissa, India.

Name of the Investigator: Amarendra Das	Date _____
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A. IDENTIFICATION

District	: _____
Forest Division	: _____
Forest Range	: _____
Forest Beat	: _____
Block	: _____
Panchayat	: _____
Ward	: _____
Village	: _____
Household Number	: _____
Name of the Household Head	: _____
Name of the respondent	: _____

Use code	Write the name	Use code
Religion	Caste:	Category
Code:Hindu-1, Muslim-2, Christian-3, Other		BPL/APL Category code: General-1, OBC-2, SC-3, ST-4

B. HOUSEHOLD DETAILS

	01	02	03	04	05	06
	Members of the household	Relationship to head of the Household	Sex	Marital Status	Age	Education
Sl. No	Please give me the names of the persons who usually live in your household starting with the head of the household?	What is the relationship of (Name) to the head of the household?	Is (Name) male or female?	What is the current marital status of (Name)?	What is the age of (Name)?	What is the level of education (Name) has received?
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						

Codes for Q. 02

- 01=Head
- 02=Wife or Husband
- 03=Son or daughter
- 04=Son-in-law or daughter in law
- 05= Grandchild
- 06=Parent
- 07=Parent-in-law
- 08=Brother or sister
- 09=Brother-in-law or sister-in-law
- 10=Neice or Nephew
- 11= Other relative

Codes for Q. 03

- Male = 1
- Female = 2

Codes for Q. 04

- 01=Currently married
- 02=Never married
- 03=Divorced
- 04=Widowed

Codes for Q. 06

- 01=Illiterate
- 02= UP School or less
- 03= ME School
- 04= High school
- 05= College
- 06= University

C. ECONOMIC STATUS OF THE HOUSEHOLD

C.1 Household Assets

Do you have your Own House		Agricultural Land?		Domestic Animals?				
If yes, conditions		If No	If yes, how much?	No	If yes			No
					Name	Nos.	Where do you graze them?	
Roof*		Use code	Use code				Use codes	
Wall**			Codes for agricultural land				Codes for Grazing Field	
Floor***			01= No land				01=Forest	
*Codes for roof 01=Thatched 02=Asbestos/tile 03=Concrete 04=Other ** Codes for Wall 01=Mud 02=Wood 03=Brick/stone *** Codes for Floor 01=Mud 02=Concrete 03=Mosaic/Tile		01= Hire 02=Other	02= 1 acre or less				02=Village Pasture	
			03= 2acres or less				03=Own Pasture	
			04= 5 acres or less				04=Feed at home	
			05= More than 5 acres					
			How much irrigated land do you have?					
			Total crop produce in a year?					

C.2 Housing Facilities

Lighting Facility	Cooking Facility	If the household uses firewood, how much do they use in a day? (approx. in Kgs)	Drinking Water	Toilet Facility	
Use Code	Use Code		Use Code	Use Code	
Codes for Lighting 01= Kerosene 02=Electricity 03=Other	Codes for Cooking 01=Firewood 02=Kerosene stove 03=Bio-gas 04=Electric Heater 05= Solar Chula		Codes for Drinking water 01= Well 02=Tube well 03=Supply water 04= Other	01=No 02=Yes	

C.3 Source of Income of the Household

Sl No.	Occupation		If any member of the household depends upon forest for income				Secondary occupation of the (Name)?
	Write as per the serial no of table on HH details	What kind of work does (Name) do most of the times?	Monthly income in Rupees	During which time (Name) goes to forest?	How many days in a month (Name) goes to forest	What does (Name) collect from forest?	
01							
02							
03							
04							
05							
06							
07							
08							
09							
10							
Total							

Codes for occupation

01=Govt Service
 02=Job in private company
 03=Business
 04=Farming in own land
 05= Share cropping
 06=Wage labour
 07= Forest dependency

Code for time name goes to forest

01= Through out the year
 02=In leap season

Code for forest product collected

01=Firewood for sale
 02=Timber
 03=Wildlife
 04=Other products

D. PARTICIPATION OF THE HOUSEHOLD IN FOREST AND WILDLIFE PROTECTION

Is your family involved in forest protection?			
If Yes		No	
01	Since how many years back are you protecting forest?	Were your family member involved in forest protection and now not?	
02	Who motivated you to participate in forest protection?	If yes, what is the reason?	No
03	Why did you/village start protecting forest?		
04	What role do you play in forest protection?		
05	Do you participate in decision making?		
06	Role played by the Forest Department?		
07	What benefits do you get from forest protection		
08	Do you poach animals from forest?		
09	If yes, How frequently		
10	Do you have any provision in your village to protect wild life?		
11	If yes, do you cooperate with protection committee?		
12	If yes. What role do you play to protect wildlife?		
13	What is your view regarding the functioning of forest protection committee?		
14	What is the role of women in the protection committee?		

Codes for 02: 01 = Forest department, 02=NGO, 03=Village decided to protect. 04= Other

Codes for 03: 01 = Due to motivation by FD, 02=Due to motivation by NGO, 03= Being concerned about the forest degradation, 04 = For profit motive, 05= To meet the future firewood needs, 06= Other, specify-----

Codes for 04: 01 = Go for guarding as per our turn, 02= Protect forest getting wage, 03=Just keep vigil without formal guarding

Codes for 05: 01 = Activity being a member of executive committee, 02=Just attend the meeting, 03=No role

Codes for 06: 01 = Actively involved with people in all aspects, 02= Only legal help by arresting violators, 03 = Financial help to protect forest by paying wage, 04= Other, Specify-----, 05= No role

Codes for 07: 01 = Dry wood and leaves for firewood, 02=Timber for house as per urgent needs, 03= Money from the sales proceeds of timber, 04 = Other Non-timber forest products

Codes for 09: 01 = Frequently, 02=Occasionally.

Codes for 12: 01 = By not killing animals, 02=Just keep vigil that nobody kills animal

Codes for 13: 01 = Functioning very well giving all equal priority, 02= No role by weaker (economic as well as social) sections

Codes for 14: 01 = Participate in decision making, 02=Member in committee, but no voice, 03=No women member

E. ROLE OF THE FOREST DEPARTMENT AND PEOPLE'S PERCEPTION

01	Has the forest department (FD) motivated you to participate in forest conservation?	
02	Has FD undertaken some developmental work in your village?	
03	Have you received any help from FD or other govt. agency?	
04	What role is FD playing in your village?	
05	What is your perception regarding the role of FD to protect the forest and wildlife?	
06		

F. ROLE OF NGO TO PROTECT FOREST

01	Is any NGO working with your village people to protect forest and wildlife or conserve other natural resources?	Name: _____
02	What role is NGO playing in your village?	
03	What is your perception on the working of NGO to conserve natural resources?	

G. PEOPLE'S PERCEPTION ON THE STATUS OF FOREST

01	Has the distance of forest increased from your village over the years?	NO/Yes. If yes how many Kms. _____
02	Has the forest quality changed over the years?	Increased/Decreased/No change
03	If yes what are the reasons behind it?	
04	Has the number and variety of wildlife in the forest changed?	Increased/Decreased/ Significantly declined/ Significantly increased
05		
06		
07		

H. PEOPLE'S PERCEPTION ON FOREST AND AWARENESS ON ENVIRONMENTAL IMPACT OF FOREST DEGRADATION

01	How do you think about the forest?	Free for all States/FD's property Village property Other village's property
02	Do you know the impact of forest degradation on environment?	
03	If yes, then, why do you cut forest?	
04	Will you stop depending upon forest if you get alternative source of livelihood?	

