

**Bangor University**

## **DOCTOR OF PHILOSOPHY**

**An economic evaluation of agroforestry, forestry and agriculture projects in Orissa, India : with particular reference to financial profitability and basic needs fulfilment.**

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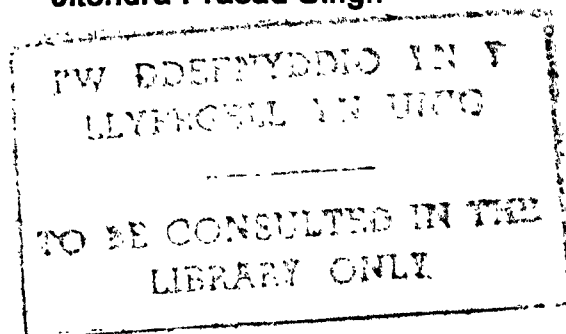
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**AN ECONOMIC EVALUATION OF AGROFORESTRY, FORESTRY  
AND AGRICULTURE PROJECTS IN ORISSA, INDIA; WITH  
PARTICULAR REFERENCE TO FINANCIAL PROFITABILITY  
AND BASIC NEEDS FULFILMENT**

A thesis submitted in the University of Wales for the degree of  
Philosophiae Doctor

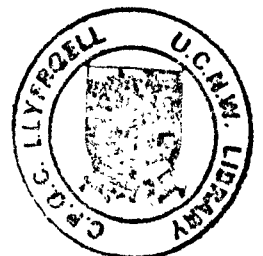
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## SUMMARY

The focus of this study is Orissa state of India. Socio-economically, Orissa is characterised by mass poverty and an inadequate level of development, particularly in rural areas where the overwhelming proportion of the population lives. Nearly half of the total land area is degraded and half of the total population are below the poverty line. With the objectives of tackling the problems of poverty (to meet basic needs) and land degradation, the government of India has taken a number of nation-wide initiatives, one of which is the Social Forestry Programme. An important plantation component of the Social Forestry Project in Orissa is Forest Farming for the Rural Poor (FFRP). FFRP is targeted at the landless rural poor towards meeting their basic needs by establishing agroforestry and forestry on degraded land.

This study aimed to undertake an *ex-post* financial evaluation, basic needs evaluation and evaluation of the factors determining the profitability in agroforestry and forestry projects of the FFRP and that of agriculture in the ERRP (a similar initiative focusing on agriculture on degraded land) based on field data. These data were gathered through a household survey of 210 participants amongst the three projects covered under three agro-ecological zones of the state.

Financial evaluation was carried out using FCBA. But for basic needs evaluation, CBA was found unsuitable mainly because it is based on the growth strategy or its variant "redistribution with growth" strategy, which differs drastically from the basic needs strategy. Thus the existing approaches developed for evaluation of projects within the basic needs strategy were reviewed. Nair's basic needs approach was found appropriate because it takes into account both the product and factor mix which are two essential components under the basic needs strategy. Nair's approach was then refined based on field data.

The evaluation results of the three projects indicate that agroforestry is the best project in terms of both financial and basic needs impacts followed by forestry and agriculture. However, on average, the basic needs fulfilment varied between 37% from agroforestry and 11% for agriculture. Slightly higher financial profitability and basic needs fulfilment in agroforestry in comparison to forestry is mainly due to additional income from agricultural crops, higher growth of trees and higher survival percentages of trees. Substantially lower profitability in agriculture in comparison to agroforestry and forestry is due to the absence of tree components and poor yield of agricultural crops due to the degraded land being particularly unfit for such crops. Amongst the agro-ecological zones, the Northern Zone ranks highest in terms of financial profitability and basic needs fulfilment followed by the Coastal Zone and the Central Zone. The zonal variation in profitability is due to the variation in agro-climatic as well as socio-economic factors.

Determinants of profitability apart from technical and agro-climatic factors appear to be such socio-economic factors as caste, literacy, occupation, income and awareness.

Although the CBA and basic needs analyses give similar results in this context, this will not necessarily always be the case. The basic needs analysis explained here is an appropriate method when basic needs fulfilment is a major objective. Initiatives on the part of the government or project agencies to enhance the performance of such projects are suggested. These are to focus the selection of beneficiaries more carefully, to enhance literacy and awareness amongst the project's participants and also to design a more appropriate technical model. Although the agroforestry project appeared to be the best of the three in terms of both financial profitability and basic needs fulfilment, technical improvement to the design and husbandry of the system may well be possible thus improving the efficiency of the policy instrument at the beneficiary level. In particular, more work is needed at a technical level in collecting bio-physical data describing both the tree and understorey productivity at a range of alternative spacings.



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## LIST OF ABBREVIATIONS AND SYMBOLS

AF	Agroforestry
AG	Agriculture
AWR	Accounting wage rate
BCR	Benefit-cost Ratio
BNA	Basic Needs Analysis
BNCF	Basic needs Conversion Factor
BNV	Basic Needs Value
CBA	Cost-benefit Analysis
ECBA	Economic Cost-benefit Analysis
ERRP	Economic Rehabilitation of the Rural poor
F	Forestry
FAO	Food and Agriculture Organisation
FCBA	Financial Cost-benefit Analysis
FFRP	Forest Farming for the Rural Poor
FSI	Forest Survey of India
FYP	Five Year Plan
GNP	Gross National Product
GOI	Government of India
GOO	Government of Orissa
ILO	International Labour Organisation
IRR	Internal Rate of Return
JMP	Joint Management Plan
MFP	Minor Forest Products
N	Total Number
NCA	National Commission on Agriculture
NCAER	National Council of Applied and Economic Research
NCERT	National Council of Educational Research and Training
NNP	Net National Product
NPV	Net Present Value
NREP	National Rural Employment Programme
NSSO	National Sample Survey Organisation
NWDB	National Wasteland Development Board
ODA	Overseas Development Agency
OFD	Orissa Forest Department
OFDC	Orissa Forest Development Corporation
ORG	Operational Research Group
Q	Quintal (equal to 100 kilograms)
RLEGP	Rural Landless Employment Guarantee Programme
Rs	Indian rupees
SCBA	Social Cost-benefit Analysis
SDP	State Domestic product
SIDA	Swedish International Development Agency
UNIDO	United Nations Industrial Development Organisation
VFC	Village Forest Committee

## GLOSSARY

<b>District :</b>	an administrative unit of a state.
<b>Division:</b>	an administrative unit of forest department at the district level.
<b>Nistar :</b>	nistar demand is an old tradition in Orissa under which requirements for forest products for bonafide domestic needs of villagers are met by forest department on payment of a very nominal royalty (called nistar cess).
<b>Package of practices:</b>	information describing typical agricultural system and cropping pattern in Orissa. Requirements of various inputs and their estimated costs in the production of various agricultural crops are described in the package of practices.
<b>Panchayat:</b>	village council is an elected body at village level at which various socio-economic problems of the village are discussed.
<b>Plantation register:</b>	a document maintained by the forest department in which details of an individual plantation such as period of various operations, inputs and their costs incurred and details of the growth and yields are decorded.
<b>Poverty line:</b>	corresponds to the per capita daily calorie requirements of 2400 in rural area and 2100 in urban area . A person consuming less than this prescription is called the "below poverty line".
<b>Range:</b>	an administrative unit of a forest division.
<b>Range officer:</b>	a field officer in charge of a forest range.
<b>Tahsil:</b>	an administrative unit of the revenue department below the district level.
<b>Tahsidar:</b>	an administrative officer in the revenue department who is in charge of a tahsil and is responsible for collection of government revenue.
<b>Tree patta:</b>	a legal document which entitles the FFRP beneficiaries to use the usufructory rights from the agroforestry and forestry plantations including agricultural produce. It is issued by the revenue department.



## **Introduction and Background to the Problem**

### **Introduction**

Nearly one third (210 million) of the total rural population (629 million) in India, officially classified as " people below the poverty line" (GOI, 1993), largely derive their basic requirements from local natural resources. Over the last few decades, the natural resources of the country, particularly the land, have been subject to continuous degradation. As a result of this, nearly half of the total land area (328.8 million ha) in the country is now classified as wasteland (NCA, 1976). Consequently, the above disadvantaged group of the population find it difficult to meet their basic needs particularly in terms of fuelwood for cooking, fodder for livestock and small timber for house construction and agricultural implements (Verma, 1991). Orissa, one of the most economically backward states of India is no exception to this general scenario of the country. It is estimated that nearly 41% of the total land area in Orissa is wasteland (NWDB, 1989).

Several steps have been taken in India to rehabilitate the degraded and waste land in order to increase the production of food, fuelwood, fodder and small timber. Massive afforestation through social forestry is one of the important steps which was envisaged since the mid seventies. The main purposes of social forestry are the creation of sustainable forest resources for households to meet their basic consumption needs of fuelwood, fodder and small timber and the provision of employment and income generation to the rural unemployed to improve their quality of life as well as environmental rehabilitation. Social forestry programmes are being implemented in almost all states with investment funds from both national and international organisations. The Social Forestry Project in Orissa was started in the early eighties with investment funds provided partly by the Government of Orissa and partly by the Swedish International Development Agency (SIDA).

Forest Farming for the Rural Poor (FFRP) is an important plantation component of the Social Forestry Project of Orissa. FFRP is a subsistence-oriented and individual-based programme biased towards the rural and tribal poor. Agroforestry and density plantation are the two activities under the FFRP component. The major objectives of these two activities; apart from environmental rehabilitation, are firstly, to satisfy the

poors' basic needs for staple food, fuelwood, fodder and small timber and secondly to raise their income to maintain a minimum standard of living (OFD, 1987a). These objectives are being addressed by allowing landless rural households to practise agroforestry and forestry on government wastelands in and around their villages.

Parallel to the FFRP, there is another land use development programme known as Economic Rehabilitation of the Rural Poor (ERRP) which is governed by a joint co-operation of the Agriculture and the Rural Development Departments of Orissa. The ERRP aims to encourage the growth of agricultural or horticultural crops preferably, but not exclusively, on degraded land. Both FFRP and ERRP are similar in their objectives.

FFRP and ERRP have been in existence in Orissa for over 9 years. However, the existing literature suggests that no systematic study based on actual field data has hitherto been made to assess the impacts of these two land use initiatives in terms of financial profitability and basic needs fulfilment.

In view of the above mentioned facts, it was decided to undertake an *ex-post* economic evaluation of the two sub-projects of FFRP with particular reference to their impact on financial profitability and fulfilment of basic needs of the landless rural poor in Orissa based on field data. As a means of comparing economic performance with that of a project employing only agriculture in Orissa's degraded lands, ERRP would also need to be studied.

### **The background of the problem**

During the period 1985 to 1991 I was entrusted with the responsibility of management of forest and wasteland as a forest officer in the state of Orissa. During that period I observed that mere higher production through silvicultural and other technical management are not sufficient to address the basic needs requirements of the rural poor. What are required in addition are significant redirection and redistribution of investment in the production of more basic goods and services to satisfy the essential requirements of the targeted population (ILO, 1977). This experience provided me with the background for the present study.

The economy of Orissa is predominantly agrarian. Agriculture provides employment for 79% of its population and accounts for 69% of the state domestic product (OFD, 1987a). About 88% of its population resides in more than 50000 villages and nearly 39%

of the population belongs to the socio-economically deprived castes known as the scheduled castes and the scheduled tribes. Tribal people constitute nearly 23% of the total population and depend mainly on the forest for their livelihood. About 48% of the population have incomes below the poverty line (GOO, 1993).

The state domestic product is highly vulnerable to the vagaries of the weather because of the erratic distribution of rainfall which often results in severe flooding at one extreme and drought at the other. Cyclones are frequent in coastal areas, disrupting production and jeopardising the way of life. Although the proportion of forestry in the state is well above the national average (GOI, 1987), a recent estimate based on satellite imagery (FSI, 1991) indicates a disturbing trend in its degradation, apparently due mainly to heavy population pressure.

Fuelwood is the main source much of domestic energy both in the rural and urban areas and this has led to denudation of the forest into barren bushy land. As a result, village forests and pasture on which poor villagers depend have been severely depleted. Forest depletion has also adversely affected the soil fertility and hence agricultural production. The vicious circle of agricultural and forest land degradation has led to a large area of land becoming degraded. This process is expected to continue with the growth of population.

It would appear that the agricultural and environmental problems facing villages include declining fertility, reduced vegetative cover, significant risk of crop failure and substantial reliance on firewood as a principal source of energy for domestic use. One possible solution to these problems is to develop an innovative land use system such as FFRP for these vast areas of degraded land which guarantees household food and fuelwood security while rehabilitating and then maintaining the future productive capacity of the natural resource base. Within the background of the above features the present study was carried out with the following objectives.

### **The objectives**

1. To evaluate the financial profitability of the agroforestry and forestry sub-projects of FFRP and the agriculture sub-project of ERRP.
2. To evaluate the impacts of these sub-projects with regard to the basic needs fulfilment of the rural poor.

3. To identify the factors influencing the profitability of the agroforestry and forestry sub-projects of FFRP in order to enable planners to improve future project performance.

### **The thesis**

To illustrate the various aspects of this study, the thesis has been structured into three parts. Part 1 discusses the background of the problem and the area under study. This part has been divided into two chapters. Chapter 1 describes the physical and socio-economic background of India with particular reference to Orissa while Chapter 2 discusses the land use economy in India, again with particular reference to Orissa.

Part 2 begins with a reviewing of work hitherto carried out on project evaluation in similar situation and then proceeds to outline the methodology adopted for collection and analysis of data required to address the desired objectives of the study. This part consists of three chapters. Chapter 3 reviews the available literature on economic evaluation of land use projects. The literature on basic needs evaluation is reviewed and amendments to the suggested methodology is outlined in Chapter 4. Chapter 5 describes the methodology adopted for sampling and data collection in this study.

Part 3 concerns the results of the application of the methodology outlined in Part 2 using the data collected from the study area. This part consists of five chapters. Chapter 6 presents the results of the questionnaire survey while Chapters 7 and 8 describe and discuss the results of the financial and basic needs evaluations respectively of the land use projects. The socio-economic factors determining variations in profitability in plantation forestry are evaluated in Chapter 9.

Finally, Chapter 10 discusses the overall results and findings with conclusions and suggestions for further improvement in the methodology of land use evaluation and decision making support.

**PART - I**  
**THE PROBLEM**  
**(CHAPTERS 1 AND 2)**

# Chapter 1

## Physical and Socio-economic Background of India with Particular Reference to Orissa

### 1.1 Physical environment

#### 1.1.1 Location

India is the seventh largest country in the world in terms of geographical area and the second largest country in the world in terms of human population. It is situated in south Asia, stretching from longitudes  $8^{\circ} 4' 28''$  to  $37^{\circ} 17' 53''$  north and from latitudes  $68^{\circ} 7' 53''$  to  $97^{\circ} 24' 47''$  east. Covering a geographical area of 3.28 million square kilometres, India accommodates 413 districts and nearly half a million villages which are distributed in 25 states and 7 Union Territories. It is surrounded by Nepal, Bhutan and China in the north, the Indian Ocean in the south, the Bay of Bengal and Burma in the north-east and the Arabian sea, Pakistan and Afghanistan in the west and Northwest respectively.

Orissa, one of the states of India, is located on the eastern coast of the country. It is surrounded by West Bengal and Bihar in the north, Andhra Pradesh on the west and the Bay of Bengal on the east. The state lies between longitudes  $17^{\circ} 31'$  to  $21^{\circ} 29'$  north and latitudes  $81^{\circ} 27'$  to  $87^{\circ} 30'$  east. It covers an area of 0.156 million square kilometre (4.8% of total area of India) which accommodates 13 districts, 57 sub-divisions, 147 Tahsils, 314 Blocks, 4386 Panchayats and about 50000 villages. Map 1.1 below exhibits the location of Orissa within India.

#### 1.1.2 Constitutional and administrative framework

India became an independent country on 15th August 1947 and adopted a written constitution on 26th January 1950. The constitution of India proclaims India a sovereign, socialist, secular, democratic republic with a parliamentary form of government. The constitution of India is headed by the President and executive power of union rests with the Prime Minister. The Prime Minister heads the Council of Ministers who are answerable to the Lok Sabha (House of Parliament). Each state also has a governmental machinery which closely resembles that of the union.

Map 1.1 Location of Orissa in India.



Note: The highlighted (dark black) portion shows the location of Orissa within India.

The Chief Minister in the state acts as executive head and Governor appointed (by the union) as head of the constitution. Members of parliament and state assembly are changed through a general election every five years.

The state of Orissa has been divided into 3 revenue divisions under the control of a Revenue Divisional Commissioner. The revenue divisions are further divided into 13 districts each under a District Collector. Map 1.2 below shows the location of the 13 districts in Orissa. Each district is further divided into sub-divisions administratively supervised by a Sub-Divisional Officer. For administrative convenience each sub-division is divided into Tahsils under a Tahsildar. Villages have been grouped into Community Development (CD) Blocks as development units. Community Development blocks are headed by a Block Development Officer.

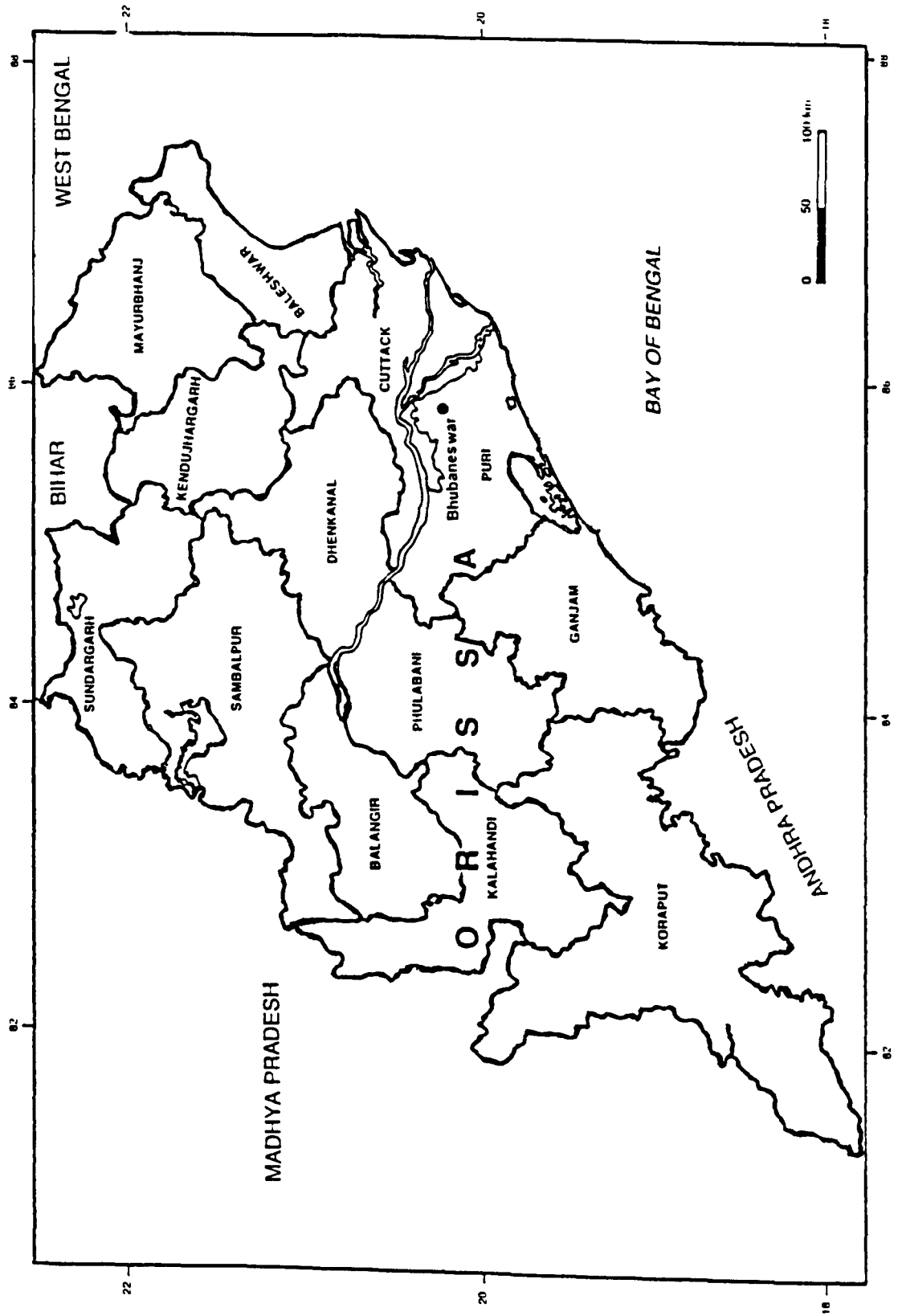
### **1.1.3 Agro-climatic zones**

India has been divided into 15 agro-climatic zones. The distribution of these zones presented below in Map 1.3 shows that Orissa falls within the Eastern Zone (Zone VII) along with the states of West Bengal and Bihar. According to a survey made by the Government of India (GOI, 1991b), the Eastern Zone has good rainfall and is predominantly rural based with more than 80% of the populations living in villages. In terms of human labour, which mostly consists of unskilled and illiterates, this zone is abundantly rich. Nevertheless, any strategy concerning optimum land use for agricultural and / or forestry production in the Eastern Zone is often confronted with a variety of constraints. Sizeable areas suffer from either some inherent soil deficiencies, unfavourable land features or other environmental stress, as a result of which it is difficult to put these to normal production.

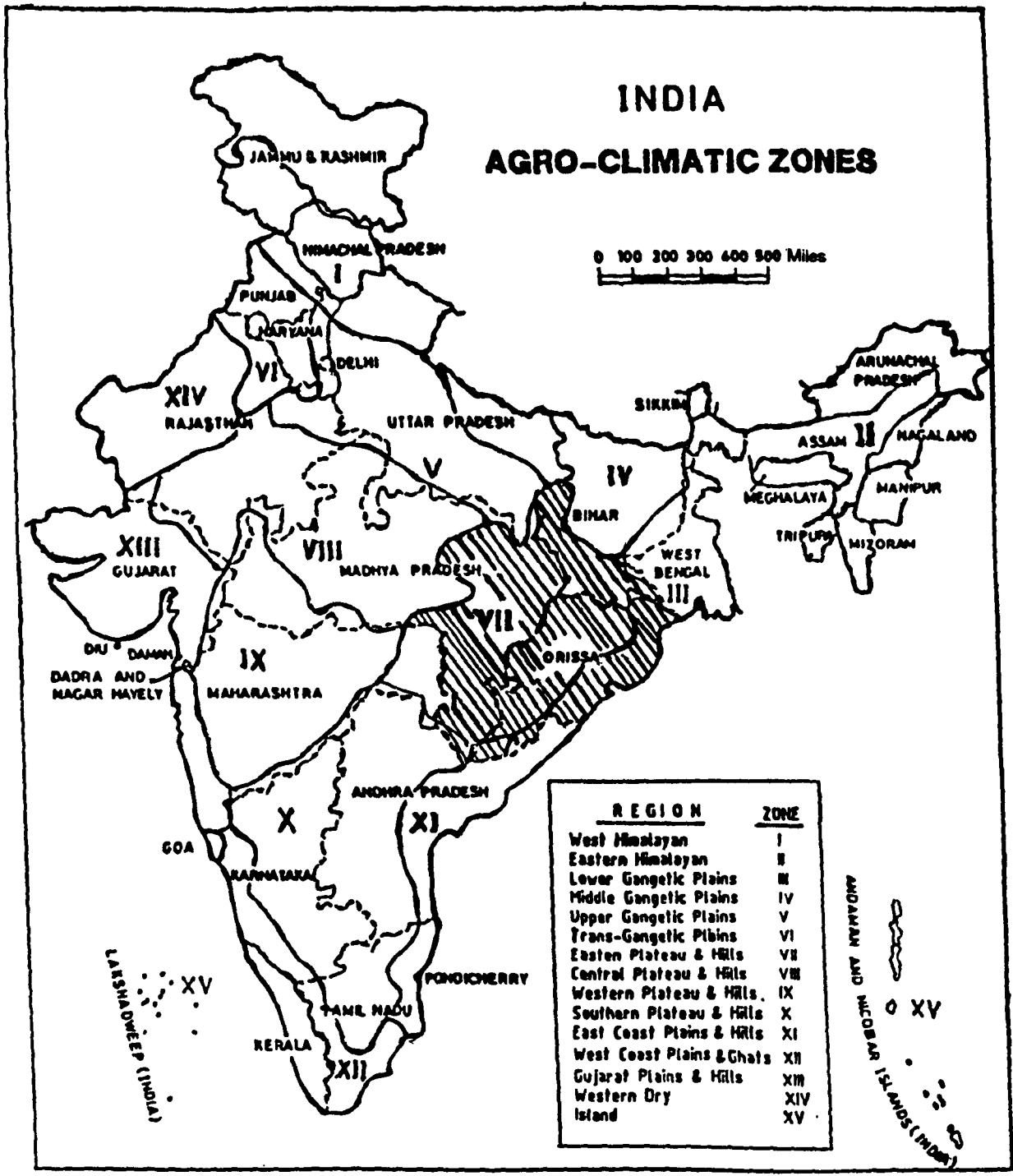
According to the physical features and agro-climatic conditions, the state of Orissa has been further divided into 4 distinct agro-ecological zones. These are Northern Plateau Zone, Central Table Land Zone, Coastal Plain Zone and Eastern Ghat Zone. Table 1.1 below presents the distribution of districts, areas and salient physio-climatic features of the agro-ecological zones. These four agro-ecological zones are from now onwards referred to as Northern Zone, Central Zone, Coastal Zone and Eastern Zone respectively for the sake of convenience. The salient features of these agro-ecological zones given in Table 1.1 indicate that the Northern Zone, which occupies 23% of the total area, consists of hilly ranges full of forest interspersed with cultivated valleys. Forest and low productive agricultural land cover nearly 45% and 36% of the total area in this zone



Map 1.2 Location of districts in Orissa.



Map 1.3 Location of Orissa within the agro-climatic zones in India.



Note: Highlighted portion shows the location of Orissa in agro-climatic zone number VII of India.

**Table 1.1 Distribution of districts, area and physio-climatic features of the agro-ecological zones of Orissa.**

<b>Agro-ecological zone</b>	<b>District</b>	<b>% of area</b>	<b>Physio-climatic features</b>
1. Northern Zone	i. Dhenkanal ii. Keonjhar iii. Sundargarh iv. Mayurbhanj	23	Hill ranges rising to elevation of 600 to 900 m above sea level.
2. Central Zone	v. Sambalpur vi. Bolangir	23	Flat with slightly undulating topography rising to elevation of 300 m.
3. Coastal Zone	vii. Cuttack viii. Balasore ix. Puri x. Ganjam	18	Flat coast containing a number of deltas.
4. Eastern Zone	xi. Koraput xii. Kalhandi xiii. Phulbani	36	Hill ranges with some plains and valleys lying between them with elevation 300 to 600m.
<b>4 zones</b>	<b>13 districts</b>	<b>100</b>	

Source: Sharma (1990).

respectively. This zone has the highest rainfall throughout the state. The Eastern Zone has the lowest productivity throughout the state and is the largest amongst the four zones. The Central Zone has undulating topography and is almost equal in area (23%) to the Northern Zone. Nearly 18% of the area is covered by the Coastal Zone occupying the deltas formed by two rivers, namely the Brahmani and the Mahanadi. The Coastal Zone is considered to be the best zone with regard to agricultural productivity.

#### 1.1.4 Climate

India is a tropical country characterised by a monsoon-type climate with contrasting rainfall and temperature. It has a wide range of climate from sub-freezing winters in the Himalaya to scorching 50<sup>0</sup>c temperatures in the Indo-gangetic plain. The highest rainfall (1096 cm) occurs in the Cherrapunji district in Meghalaya which contrasts with the

rainlessness in the Thar desert of Rajasthan. Nearly 90% of the rainfall throughout the country occurs as a result of the summer monsoon (south-west monsoon). The winter monsoon causes the remaining 10% of the precipitation which occurs mainly in November and December.

Floods and droughts are common features, especially in the northern parts of the country. By and large, four distinct seasons are common to all the regions of India. These are the (i) cold weather season, (ii) hot weather season, (iii) rainy monsoon season and (iv) season of retreating monsoon. The actual duration of season varies from one region to another.

The state of Orissa has a tropical monsoon climate. Table 1.2 below gives the distribution of average annual rainfall in different agro-ecological zones of Orissa which indicates that the Northern Zone has the highest rainfall with lowest in the Central Zone. The entire annual rainfall (average of 12 months) of around 1500mm is received in 73 days with nearly 85% falling between June to September (kharif season) (OFD, 1987a). During this period, most of the agricultural and forestry operations are completed. However, the rainfall shows a high variation both in amount and intensity within this period and rainfall is variable both between years and within years, which limits the forestry and agricultural activities (GOO, 1988). Such variations adversely affect the employment of agricultural labour whose livelihood depends on wage earning from seasonal employment.

### **1.1.5 Relief**

The land of India is characterised by a great diversity in its physical features. Physiographically India may be divided into three defined units.

- i. The Himalyan Mountain Chains.
- ii. The Northern Indian Plains.
- iii. The Peninsular Plateau.

**Table 1.2 Distribution of average annual rainfall in agro-ecological zones of Orissa.**  
(figures in mm)

<b>Agro-ecological zone</b>	<b>Districts</b>	<b>Average annual rainfall</b>	<b>Zonal average</b>
<b>1. Northern Zone</b>	1. Dhenkanal	1421	1588
	2. Keonjhar	1534	
	3. Sundargarh	1648	
	4. Mayurbhanj	1748	
<b>2. Central Zone</b>	5. Sambalpur	1526	1438
	6. Bolangir	1464	
<b>3. Coastal Zone</b>	7. Cuttack	1349	1495
	8. Puri	1440	
	9. Balasore	1568	
	10. Ganjam	1396	
<b>4. Eastern Zone</b>	11. Koraput	1422	1469
	12. Kalahandi	1378	
	13. Phulbani	1607	
<b>Orissa (average)</b>	<b>13 districts</b>	<b>1495</b>	<b>1495</b>

Source: GOO (1988).

The Himalaya consist of a series of parallel mountain ranges with bold relief and characterised by a complex topography. They were formed by the movement of the earth in the last phase of geological history. Because of this, Himalayan ranges are described as youthful. The Peninsular Plateau, on the other hand is an old mass of the earth's crust worn down by continual erosion. As a consequence, the plateau has acquired the looks of old age. It has a characteristically senile topography, dominated by erosion surfaces and broken by striking ridges and trough valleys. The plateau has been divided into two ghats known as Eastern and Western Ghats (NCERT, 1975). The plateau is flanked by a coastal plain of varied width extending from Gujarat to Orissa. These two coasts are popularly known as the western coast and the eastern coast. In between the two main physiographic units lies the Northern Plain which marks an initial basin filled by deposits brought down by the rivers over a long period. The filling has been done so uniformly that the plain gives an impression of a flat surface.

Orissa contains the features of both the plain and plateau units. A major portion of the plateau (Eastern Ghat) in Orissa is flanked by the eastern coast. Floods and cyclones are very common in coastal areas.

### **1.1.6 Geology**

The Himalayan region consists of sedimentary as well as metamorphic rocks with a large intrusion of granite, while the rocks of the Northern Indian Plain are the result of alluvial river deposits. The Western Ghat and the Eastern Ghat have formed mainly from gneisses and charnokites from various archean and Purana formations. Pre-cambrian and archean rocks have resulted in the formation of the Peninsular plateau (Sharma, 1990).

Most parts of Orissa contain the Archean rocks. These are mainly classified into two groups namely (a) sedimentary and metamorphic rocks and (b) intrusion of granite and charnokite.

### **1.1.7 Soils**

The state of Orissa comprises seven different groups of soils. The occurrence of different soils in the state is closely related to the broad physiographic divisions. Table 1.3 below illustrates the distribution and salient characteristics of the soil types of Orissa.

This shows that the soils of Orissa are generally poor in fertility except for those in the Central and the Coastal Zone which have alluvial and laterite soils and, to a lesser extent those parts of the Eastern Zone, which have brown forest soils.

## **1.2 Social background**

### **1.2.1 Demographic features**

India is the second most populous country of the world, ranking next to China, whereas Orissa is the eleventh most populous state of India and supports nearly 4% of Indians (GOO, 1993). It has been estimated that by the end this century India's population will exceed one billion (World Bank, 1992) and that of Orissa 40 million (ORG, 1993).

**Table 1.3 Distribution and salient characteristics of soils types of Orissa.**

<b>Soil types</b>	<b>Distribution</b>	<b>Salient characteristics</b>
1.Red Soil (Alfisol)	Northern Zone and part of Eastern Zone	i. Red in colour due to diffusion of iron ii. High base status <b>iii. Low in fertility.</b>
2.Laterite Soil (Ultisols)	Part of Coastal and Central Zone	i. Excessively drained and porous ii. High in organic matter and nitrogen iii. Low in potash and lime <b>iv. High fertility</b>
3.Black Soil (Vertisols)	Part of Eastern and Coastal Zone	i. Deficient in organic matter and nitrogen ii. Rich in potash and lime <b>iii. Low fertility</b>
4.Alluvial Soil (Entisols)	Part of Coastal and Central Zone	i. Sandy loam to clay in texture ii. Red yellow to dark brown colour iii. Rich in organic matter and nitrogen. <b>iv. Very high fertility</b>
5.Brown Forest Soil	Part of Eastern and Coastal Zone	i. Found in association with forest ii. Red yellow to dark brown in colour iii. Rich in organic matter and nitrogen <b>iv. Moderate fertility</b>
6.Red and Yellow Soil	Parts of Northern and Central Zone	<b>Poor fertility</b>
7.Red and Black Soil	Parts of Central and Northern Zone	<b>Poor fertility</b>

Source: Compiled from ORG (1993).

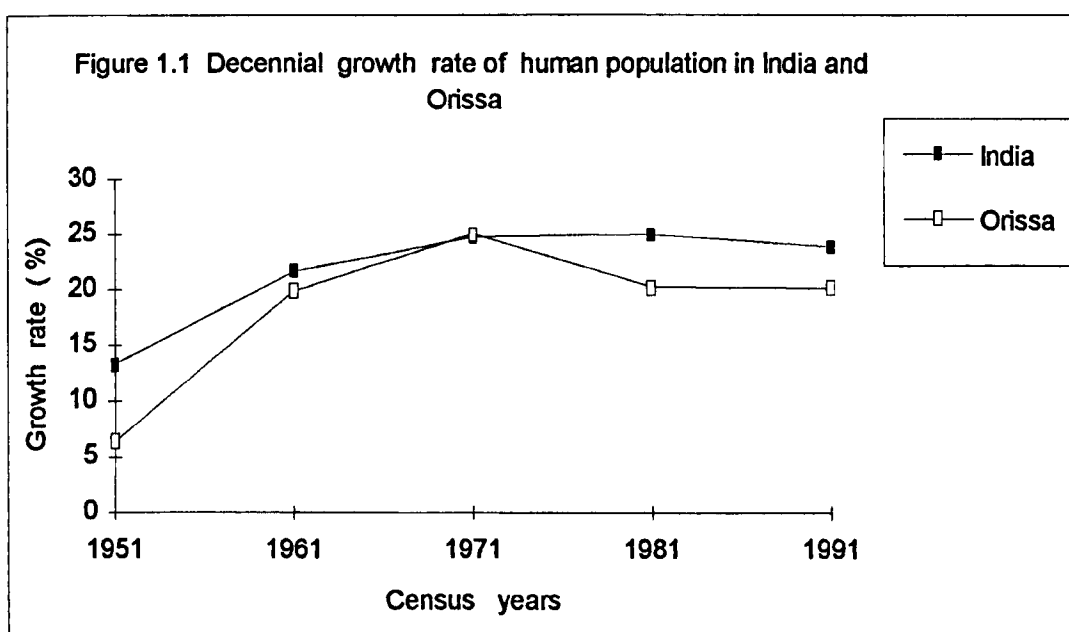
Table 1.4 and Figure 1.1 below illustrate the comparative picture for India and Orissa with regard to the total population and decennial growth of population between the census years 1951 and 1991.

It is obvious from Table 1.4 and Figure 1.1 that the total population both in the case of India as a whole and Orissa in particular has become more than doubled during the period of 40 years to about 846 and 32 million respectively. However, the decennial growth rate rose in the early part of the period and declined in the eighties in India as a whole and in the seventies in Orissa in particular.

**Table 1.4 Population details of India and Orissa.**

Census year	Total population (million)		Decennial growth (%)	
	India	Orissa	India	Orissa
1951	361.1	14.6	13.3	6.4
1961	439.2	17.5	21.6	19.8
1971	548.2	21.9	24.8	25.1
1981	685.2	26.4	25.0	20.2
1991	846.3	31.6	23.8	20.1

Source: Compiled from Govt. of India census reports, (GOO, 1993).



Obviously such a high population put a severe pressure on resources and with continued population growth this pressure is likely to increase. The important socio-economic indicators (based on the 1991 census) including density of population, percentage of the rural population, percentage of disadvantaged groups, percentage of people below the poverty line<sup>1</sup> and percentage of literacy, presented below in Table 1.5, illustrate the above argument.



**Table 1.5 Socio-economic indicators of India and Orissa.**

(based on 1991 census)

Indicators	India	Orissa
1. Density of population (per sq.km.)	257	202
2. Rural population (% of total population)	74	87
3. Scheduled castes and Scheduled tribes population (% of total population)	25	39
4. People below poverty line (% of total population)	33	48
5. Literacy (% of total population)	52	49

Source: Compiled from the Economic Survey of Orissa (GOO, 1993).

This indicates that nearly 87% of the state's population reside in villages with an average density of 202 persons per square kilometre. The population of traditionally disadvantaged groups such as scheduled castes and scheduled tribes together account for nearly 40% of the population which is also higher than the national average of 25%. Health and educational standards are also below the Indian average. Although Orissa has shown good performance in literacy (49% in 1991 in comparison to 34% in 1981), it is still below the national average of 52% (ORG,1993). Male and female literacy levels in Orissa were 62% and 34% respectively in 1991. The proportion of literate people is higher in the urban areas (62%) as compared to the rural areas (39%) (GOO, 1993). Nearly half of the total population (48%) of Orissa is below the poverty line; a proportion well above the national average of 33%. These indicators suggest that the overwhelming proportion of Orissa's population is struggling for its basic needs and is dependent on rural resources.

### 1.2.2 Livestock resources

Livestock is an important sector for the agricultural economy in Orissa. Nearly 80 % of the rural population in Orissa are engaged in agricultural activities (GOO, 1992) and livestock are maintained by the majority of the rural poor as a subsidiary occupation. They are important because the cattle, which constitute 70% of total livestock, are used for two purposes; firstly as animal power to be used in agricultural activities and secondly for milching (ORG, 1993). Both of these uses generate production and income which are utilised in meeting the basic consumption needs. The following brief description of the livestock status of India and Orissa illustrates the above argument.

Table 1.6 and Figure 1.2 below present the comparative picture of the livestock population in India and Orissa during the period 1972 to 1992. This shows that the livestock population has risen over the 20 year period by 27% in India and by 50% in Orissa to a total of 450 million and 23 million respectively in 1992. However, over the past ten years, the growth has slowed to less than 1% per annum in both the cases.

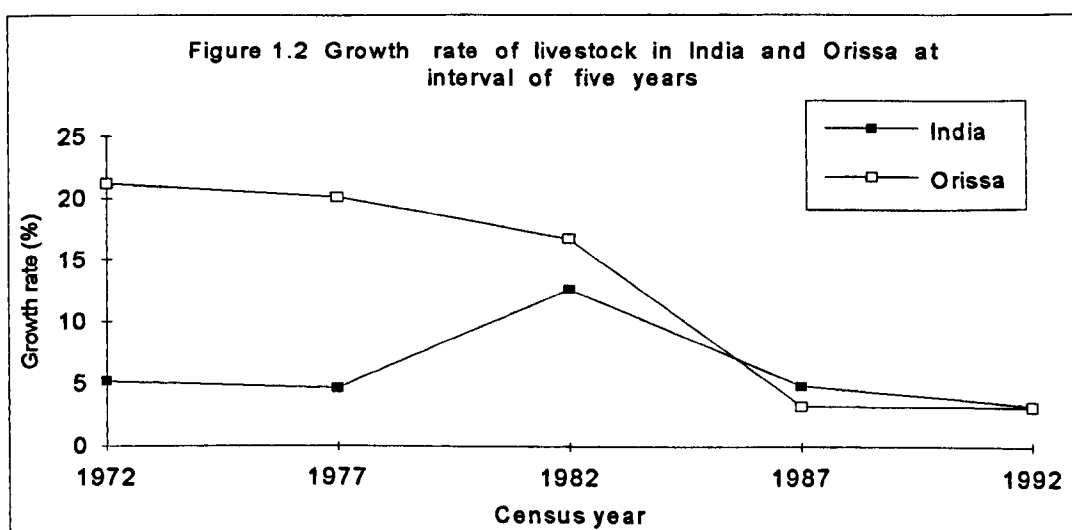
According to a survey made by the Operations Research Group (ORG, 1993), out of the total livestock population of the state (23 million) in 1992, cattle constituted 13.6 million (about 70%) with working cattle numbering about 4.6 million and milch cattle about 4.2 million. It is also estimated that the state's livestock population will exceed 25 million by end of this century (GOO, 1992).

**Table 1.6 Livestock details of India and Orissa**

(figures in million)

Census year	Total Livestock population (million)		Five yearly growth rate (%)	
	India	Orissa	India	Orissa
1. 1972	353.3	15.4	4.6	20.1
2. 1977	369.5	18.5	12.6	16.7
3. 1982	415.9	21.6	4.8	3.2
4. 1987	436.0 <sup>+</sup>	22.3	3.2	3.1
5. 1992	450.0 <sup>+</sup>	23.0		

Note: + estimated figure. Source: Livestock census report , GOI (1993).



### **1.2.3 Socio-cultural attributes**

A sequence of invaders and rulers has influenced the Indian culture. The people of India in the pre-historic, ancient and medieval periods have left deep imprints on our ethnic characteristics. Their socio-economic culture based mainly on religion, caste and occupation are still prevalent in India (Raja and Ahmad, 1990). In fact, the basic consumption requirements are greatly influenced by the caste, religion and territory to which the person belongs. A brief review of some of the socio-cultural factors existing in Orissa illustrate this argument.

Orissa has its own culture and history which are different from other parts of the country. It has its own language called Oriya. There are well defined cultural zones with defined ethnic, linguistic and religious groups. The socially and economically deprived caste of Orissa known as the scheduled tribes, depend largely on forestry and agriculture for their livelihood whereas the elite castes such as brahmins, rajputra and kayastha have a diversity of occupations from agriculture to business and government jobs. The food habits, dress and activities of tribes differ greatly from those of the non-tribal communities. Tribes of Orissa still wear traditional dress and practice skilled crafts particularly in forestry, fishing, carpentry, hunting and similar activities. Similarly the general standard of living including medical care, diet, education, sanitation and general hygiene are of a low standard amongst tribals compared to non-tribals.

### **1.2.4 Rural settlement**

A study of settlement<sup>2</sup> has great relevance to human geography as the shape and pattern in any particular region reflects man's relationship with the environment. Settlements have gradually grown up and evolved over a long period of time and by studying the site, pattern and arrangement of settlement we can know something of the history of man's utilisation of the surrounding land. Moreover, the settlement reflects the socio-economic and cultural status of a society (NCERT, 1975). Settlements are generally classified into rural and urban categories. The basic difference between the rural and the urban settlement is that in urban settlement the chief occupations of the population are industry, trade, commerce and administration while in rural settlements the people are engaged in agricultural work. This means their settlement largely depends on agriculture.

It is argued that the type of rural settlement in India is determined by a number of factors such as relief, altitude and caste (Raja and Ahmad, 1990). Since the present study focuses on the basic needs problem of the rural poor, it is therefore important to know the type of rural settlement which reflects their socio-economic status. A brief description of the rural settlement of Orissa illustrate the above argument.

In Orissa, rural settlement varies from one region to other. From undulating hilly and forested tracts to the extensive alluvial plains and deltas one observes a distinct variation in their shapes, sizes and layout plans. The rural houses in Orissa are generally made of soil, mud, thatch, bamboo, stones, wood or unburnt bricks. Most of these materials are locally available from natural resources. Because the majority cannot afford costly building material, only a few have either a concrete or tiled roof.

### **1.2.5 Tribal scenario**

The tribal population of Orissa accounts for about 23% of its total population and this is considerably higher than the national average of 8% (GOO, 1993). Tribals generally live in areas which are, by and large, backward in terms of social and economic development, yet these territories are rich in natural resources, particularly mineral and forest wealth.

Policies of socio-economic development in Orissa have given consideration to the problems of the tribal areas. Most of the land use development programmes are biased towards the rural and the tribal communities (GOO, 1992). The Forest Farming for the Rural Poor (FFRP) programme of the Social Forestry Project of Orissa is one of such example (OFD, 1987a). It is argued that tribals have some unique social and economic characteristics and their occupation and way of life are intrinsically linked with the environmental setting of the area. It is also believed that the social structure of tribals helps in conserving the forest, on the assumption that a symbiotic relationship exists between tribals and forests.

Nearly 90% of the tribal population in Orissa is concentrated in 6 districts, namely Keonjhar, Mayurbhanj, Sundargarh, Koraput, Kalahandi, and Phulbani. Socio-economic indicators of the 13 districts of Orissa are presented below in Table 1.7, with these 6 districts highlighted and underlined.

These figures indicate that the proportion of the area under forest in tribal dominated districts is relatively higher than the rest of the districts. A higher percentage of tribals

reside in rural areas and they tend to exhibit low literacy and low income. This information adds weight to the perception that scheduled tribes of Orissa are socially and economically backward.

**Table 1.7 Socio-economic indicators of 13 districts of Orissa.**

(based on 1991 census)

Districts	% of rural to total population	% of tribal to total population	% of literacy	% of people below poverty line *	% of forest area to total area
1. Dhenkanal	90	12	45	45	49
<u>2. Keonjhar</u>	<u>87</u>	<u>45</u>	<u>36</u>	<u>53</u>	<u>30</u>
<u>3. Sundargarh</u>	<u>67</u>	<u>51</u>	<u>44</u>	<u>50</u>	<u>41</u>
<u>4. Mayurbhani</u>	<u>94</u>	<u>58</u>	<u>31</u>	<u>56</u>	<u>52</u>
5. Sambalpur	83	27	42	48	35
6. Bolangir	90	19	33	46	16
7. Cuttack	88	3	53	44	16
8. Balasore	91	7	49	48	4
9. Puri	80	3	54	50	32
10. Ganjam	85	9	37	49	56
<u>11. Koraput</u>	<u>89</u>	<u>55</u>	<u>19</u>	<u>50</u>	<u>33</u>
<u>12. Kalahandi</u>	<u>93</u>	<u>31</u>	<u>25</u>	<u>55</u>	<u>44</u>
13 Phulbani	94	38	32	50	51
<b>Orissa(average)</b>	<b>87</b>	<b>23</b>	<b>41</b>	<b>48</b>	<b>38</b>

Note : Underlined figures refer to tribal dominated districts; \* estimated figures.

Source: Compiled from GOO (1993).

The lifestyle and livelihood of tribals of Orissa are traditionally associated with forest and hence the vast majority of them are forest dwellers. Appendix 1.1 gives a list of the different tribes existing in different districts of Orissa and shows that more than 60 tribals groups are found in Orissa (ORG, 1993). Their livelihoods depend on the forest through shifting cultivation and the collection of firewood, fodder and other minor forest products.

A fraction of their income (nearly 25%, Das, 1991) is also generated through seasonal employment in various forestry operations such as nursery raising, plantation and harvesting of trees. They are relatively little exposed to the outside world. Tribals of Orissa have a community based social structure which helps in conserving the forest by imposing restrictions on use of forests. A common example is totem and ancestral worship, which protects certain trees, treating them as sacred and imposing restrictions on the exploitation of these trees in certain seasons. These socio-economic characteristics have certain implications for the adoption of a particular land use practice and hence need proper consideration.

### **1.3 Economic background**

#### **1.3.1 A general economic profile**

The Indian economy is predominantly agrarian. Agriculture is the largest but declining contributor to GNP (GOO, 1993). India is low by global standards in terms of per capita GNP (\$350) with Ethiopia having the lowest (\$340) and Japan the highest (\$25430) (World Bank, 1992). The per capita GNP of Orissa is less than one third (\$116) of that of India.

The economy of Orissa is characterised by mass poverty, particularly in rural areas. In spite of being endowed with rich natural resources such as forestry, minerals (iron, chromite, magnese, coal and limestone), rivers with the potential of providing hydroelectric power, irrigation and fisheries and a vast coast-line offering the opportunity for ports and fishing, the state of Orissa is relatively underdeveloped. Despite some recent progress the state still lacks the infrastructure to develop its natural resources. The economy which is backward and predominantly agrarian, has not benefited from these resources to the desired extent. Agriculture provides employment for nearly 80% of its work force. The net state domestic product (SDP) is influenced significantly by income generation from the agricultural sector which contributes around 50% (GOO, 1992). Variation in the output of this sector greatly influences the growth rate of the state economy. As only 31% of the net sown area is irrigated, agricultural production is mostly rainfed and crop yield fluctuates according to the aberrations in weather conditions. The contribution of industry has been low with 12% of SDP and 7% of employment, although the potential for further growth is high in view of the state's rich natural resources. The real per capita income of the state is estimated to have increased to Rs. 4068 in 1991-92 from Rs. 3596 for the year 1990-91 due to a sharp increase in agricultural production.

### 1.3.2 Occupational pattern

The labour force constitutes the most important resource for any land use programme in Orissa. Nearly two thirds of the total expenditure in many land use activities such as agroforestry, forestry and agriculture is spent on payment of wages to labourers. These payments are mostly utilised for basic consumption requirements. The successful completion of these land use activities largely depends on the availability of labour in certain periods of the year. Thus the availability of seasonal workers becomes crucial both for agriculture and forestry practices.

Table 1.8 below gives the occupational classification of workers in Orissa with regard to the percent of the main<sup>3</sup> and the marginal<sup>4</sup> workers to the total population and the working population.

**Table 1.8 Occupational classification of workers in Orissa.**

<b>Category</b>	<b>% of total population</b>	<b>% of working population</b>
<b>(A) Main Workers</b>		
i. Cultivators	14.5	38.5
ii. Agricultural labours	9.4	25.1
iii. Non-agricultural labours	9.8	23.5
<b>Sub-total</b>	<b>32.7</b>	<b>87.1</b>
<b>(B) Marginal workers</b>	<b>4.8</b>	<b>12.9</b>
<b>Total (A+B)</b>	<b>37.5</b>	<b>100.0</b>

Source: ORG (1993).

Total workers constitute nearly 38% of the total population and out of this, main and the marginal workers constitute about 87% and 13% respectively. Amongst the main workers, cultivators, agricultural labour and non-agricultural labour constitute nearly 44%, 29% and 27% respectively. Non-agricultural workers include those engaged either as self employed or wage earners in household industries, trades, professions and forestry.

From the participation of main workers in different activities it can be concluded that nearly 64% of the main workers are involved in agricultural activities. This proportion is as high as 80% in rural areas.

### **1.3.3 Unemployment**

With an increasing human population, the economy of Orissa is confronted with the problem of unemployment. Unemployment, particularly in rural areas, exists in two forms. Firstly, the people who are full-time unemployed and secondly those who are part time employed as seasonal agricultural labourers, called under-employed. Seasonal unemployment in Orissa is very high because of the dependence on agriculture. Seasonal labour employed either in agricultural activities or in forestry receives very poor wages (Rs. 25 per working day). This implies that seasonal labourers hardly fulfil their basic requirements through such earnings. In other words, the generation of additional employment opportunities for seasonal unemployed has a direct impact on the fulfilment of basic consumption needs. Land use activities such as forestry and agroforestry provide such opportunities to these rural poor. The Social Forestry Project in Orissa, for example, generated a total employment<sup>5</sup> of 37.15 million man days during the year 1983-84 to 1992-93 (OFD, 1993).

### **1.3.4 Income distribution and poverty**

Even after 46 years of independence, there is a wide gap between rich and poor in India (GOI, 1993). The major cause of income inequality is probably a combination of high population growth, excessive unemployment and limited access to capital and land resources (Sharma, 1990). It has been emphasised over time that growth is an important condition for alleviation of poverty on the assumption that the economic growth has a tendency automatically to "trickle down" to the poor (Hicks and Streeten, 1979).

However, the growth oriented strategy (discussed in more detail in chapter 3) failed to tackle the problem of mass poverty in India and hence there is a need to re-orientate the pattern of growth through reallocation of productive resources towards poverty groups. In other words, the strategy should be oriented towards the creation of self employment for all those who do not have means of production. The following section examines these aspects in the course of describing the five year development plans in India and Orissa.



### 1.3.5 Development planning

In its attempt to solve the economic problems of the country, the government of India started the Five Year Plan (now onwards FYP) in 1951. Accordingly, the Planning Commission was set up and was given responsibility to take decisions about the objectives of the FYP with regard to the investment and allocation among the various sectors of the country. Table 1.9 below presents the pattern of allocation amongst various sectors of the country during the seven FYP's.

The first FYP (1951-56) was started with the prime objective being to increase the food production (GOI, 1951). A comparatively large amount of investment (15% of total outlay) was therefore made in agriculture.

**Table 1.9 Pattern of outlay in FYP's.**

(figures in % of total outlay)

FYP's	Agriculture*	Irrigation	Industry
i. (1951/52 - 1955/56)	14.9	19.7	7.9
ii. (1956/57 - 1960/61)	11.3	9.7	21.1
iii. (1961/62 - 1965/66)	14.2	8.7	23.8
iv. (1969/70 - 1973/74)	17.2	6.8	22.8
v. (1974/75 - 1978/79)	12.1	8.7	25.9
vi. (1980/81 - 1984/85)	12.9	12.5	15.4
vii. (1985/86 - 1989/90)	12.7	9.4	12.5
viii. (1992/93 - 1996/97)	12.2	7.2	12.0

\* includes allied sector such as forestry and fishing.

Source: Compiled from GOI (1994).

The second FYP (1956-61) placed emphasis on rapid growth through industrialisation. Consequently, a large share of outlay was allotted to the heavy industries (21%) compared to agriculture (11%). The strategy of rapid industrialisation was extended in the third FYP (1961-66).

Rapid industrialisation during the second and third FYP's attracted two criticisms, firstly for the urban biased planning and secondly the neglect of agriculture. Consequently the fourth FYP (1969-74) restated the importance of agriculture with the main object to become self sufficient in food production. Accordingly agriculture was allotted an increased share (17.2%) of total outlay. The Green Revolution, with an object to attain self sufficiency in food production, gained ground during this period. This was based on the high technology package of inputs approach using fertilisers, irrigation and high yielding seed varieties.

In the first four FYP's the development strategy of the nation was based on capital formation, industrial development and attaining self sufficiency in food production. However, the distributional aspect of the income so generated was not considered adequately.

According to the Gandhian philosophy (Gandhi, 1966) it is argued that alleviation of poverty is possible with an equal distribution of work and opportunities. In other words the distribution should be provided at the production level and not at the consumption end. This means the distribution must be simultaneously associated with growth and not considered later after growth has first been achieved. According to Sharma (1990) the strategy should have been based on technological improvements which are labour intensive and land and capital saving to ensure the distribution of works and opportunities among the growing population.

The growing concern with distributional aspects in economic growth was evident in the fifth FYP (1974-79). This was addressed by including specific measures aimed at poverty alleviation. The beneficiary oriented approach of planning was adopted with an object to raise the consumption level of the poorest group by making provision for employment creation and production of basic consumption goods.

Subsequently, the sixth FYP (1980-85) initiated the Integrated Rural Development Programmes (IRDP) such as the National Rural Employment Programme (NREP) and the Rural Landless Employment Guarantee Programme (RLEGP). These programmes aimed to generate employment for landless rural poor and to improve productivity by creating rural assets. Plantation through the Social Forestry Project was another labour intensive programme initiated during this period.

The seventh FYP (1985-90) was drawn with the aims to satisfy basic needs, provision of full employment and eradication of poverty as a long term strategy. During this plan, added emphasis on afforestation was instigated to rehabilitate the degraded land of the country.

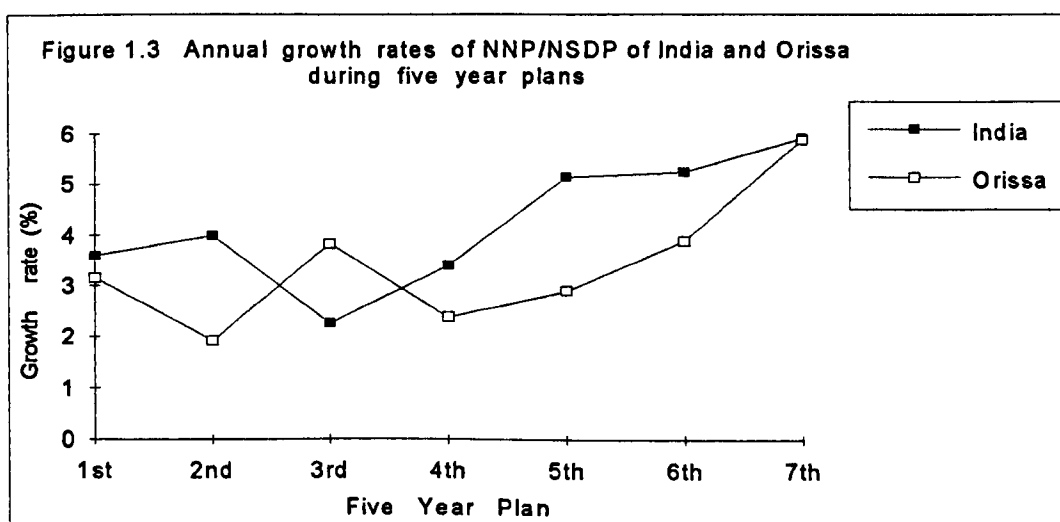
Although the objectives earmarked at national level during the various FYP's were kept intact for Orissa, a lower growth rate of state domestic product was achieved in the state in comparison to the nation. Table 1.10 and Figure 1.3 below give the comparative picture of economic growth rates achieved at the state and national level during the various FYP's.

**Table 1.10 Comparative picture of growth rate of India and Orissa during FYP's.**

FYP's	Annual growth rate of N.S.D.P/ N.N.P <sup>+</sup> (%)	
	India	Orissa
i. (1951/52 - 1955/56)	3.6	3.2
ii. (1956/57-1960/61)	4.0	1.9
iii. (1961/62-1965/66)	2.3	3.8
iv. (1969/70-1973/74)	3.4	2.4
v. (1974/75-1978/79)	5.2	2.9
vi. (1980/81-1984/85)	5.3	3.9
vii. (1985/86-1989/90)	5.9	5.9

+ NSDP refers to the net state domestic product and NNP is the net national product.

Source: GOO (1993).



It is obvious from Table 1.10 and Figure 1.3 that during the second FYP, when the emphasis was shifted towards industrial development, the growth rate of SDP of Orissa declined sharply from 3.2% to 1.9%. The growth rate was also lower than the national rate of 4% achieved during the second FYP. This was mainly due to the natural hazards such as floods and cyclones which adversely affected agricultural production along with poor industrial development due mainly to the poor infrastructure of the state.

However, in the third FYP the growth rate of Orissa was sharply increased to 3.8%; greater than the national growth rate of 2.3%. The reason behind such a rise was the bumper harvest of crops owing to favourable monsoons.

During the fourth and fifth FYP's the growth rate of Orissa again declined and fell below the national growth rate. This was because of the lack of impact of the Green Revolution which had limited success in Orissa due to the unavailability of high yielding varieties of rice compared to wheat. This is why the wheat cultivating states of India (western and north-western India) benefited through the Green Revolution compared to the rice cultivating states like Orissa (GOO, 1993).

In the seventh FYP the growth rate again increased to almost equal the national rate of nearly 6%. This was again due to a favourable monsoons and less natural hazards.

The above fluctuating growth rates of Orissa indicate that the state domestic product is highly vulnerable to the vagaries of nature which often disrupts the agricultural production through its erratic distribution of rainfall, drought, floods and cyclones in coastal areas.

## **Summary**

The physical, social and economic background of India as a whole and Orissa in particular are discussed in this chapter. Physiographically Orissa state is characterised by poor soil and frequent attack of natural hazards such as floods and cyclones due to being located in the coastal region of India. Socio-economically the state is characterised by mass poverty and an inadequate level of development particularly in rural areas where the overwhelming proportion of the population live. Such a problem has existed over a long period of time due mainly to population growth. In an attempt to solve the economic problems of the country, the Government of India and Orissa started the first FYP in 1951. The earlier FYP's (from 1951-1970) adopted a growth oriented strategy which

failed to tackle the issues such as an alleviation of poverty, unemployment and equitable income distribution. Later decades of planning (1970 onwards) however, saw the gradual shift from a growth oriented approach to beneficiary-based approach to economic development. Social development was integrated with economic development to tackle directly the problems of poverty, unemployment and disparities in income distribution. However, the recent statistics indicate that nearly one third of the people in India as a whole and half of those in Orissa are still below the poverty line (GOO, 1993).

Although the population growth has started to level out since 1981, there is a continuing need for project interventions designed to meet the essential goods such as food, shelter, fuel and fodder and to create employment to raise incomes. The next chapter initially looks at the land use pattern and economies in India in general and Orissa in particular and then goes on to discuss the initiatives which have been undertaken in this field by the central and state governments.

#### **Notes :**

- 1 The task force on minimum needs and effective consumption demands constituted by the Planning Commission, Government of India (GOI, 1979) defined the poverty line as the per capita monthly expenditure of Rs. 49.09 in rural areas and Rs. 56.64 in urban areas at 1973-74 prices. This corresponds to the per capita daily calorie requirements of 2400 in rural areas and 2100 in urban areas.
- 2 Settlement refers to a group of houses or huts with a certain layout plan and includes the buildings meant for residential and other purposes.
- 3 A main worker is one who works more than 3.5 days in a reference week (see Sharma, 1990).
- 4 A marginal worker is one who works either for 3.5 days or less or did not work at all in a reference week (see Sharma, 1990).
- 5 Table 2.2 of Chapter 2 provides the details of employment generated through the Social Forestry Project in Orissa.

## Chapter 2

### Land Use Economy in India with Particular Reference to Orissa

This Chapter presents the overall picture of the land use pattern, land use economy and the government's initiatives to rehabilitate the degraded lands through afforestation activities in India with particular emphasis on Orissa. Section 1 describes the land use pattern as well as the nature and causes of land degradation. The agriculture and the forest economy with particular reference to the satisfaction of rural needs are discussed in sections 2 and 3 respectively. Afforestation activity with special emphasis on the Social Forestry Project in India and Orissa is described in section 4. The salient features of the FFRP (agroforestry and forestry practices) component of the Social Forestry Project and the ERRP (agriculture practice) of the Rural Development Project of Orissa are outlined in section 5.

#### 2.1 Land use pattern

Land as a resource is of particular importance in India given the density of population and the prominent position of agriculture in the economy. This is also applicable in Orissa where more than three quarters of the rural population is dependent on agriculture for its livelihood. Table 2.1 below presents the comparative land use pattern in India and Orissa.

This indicates that cropped land occupies the largest share both in India and Orissa, although the proportion is rather lower in Orissa. The proportion of land under forest in Orissa, is however much higher than the national average. In fact if the permanent tree crops and groves are included, trees cover a bigger area of Orissa than agricultural crops. Pasture and grazing land accounting for 4.6% of the land area in the state is also slightly higher than that of India as a whole. The land under permanent crops and groves includes land under shrubs and trees for fruits and other products but excludes land under trees grown for wood or timber. Other lands include unused but potentially productive land such as culturable waste, barren, fallow and area under parks, gardens and roads; the proportion in Orissa is nearly half of the national average.

**Table 2.1 Land use pattern in India and Orissa.**

Type of land use	India*		Orissa**	
	Area (million ha)	% of geographical area	Area (million ha)	% of Geographi cal area
1. Agriculture (net sown area)	154.7	47.0	6.3	40.6
2. Forest	75.1	22.8	5.7	36.8
3. Pasture and grazing land	12.2	3.7	0.7	4.7
4. Permanent tree crops and groves	3.9	1.3	0.9	5.5
5. Other lands (non-agricultural land, culturable wasteland, barren land fallow land and urban land)	83.3	25.2	1.9	12.4
<b>Total</b>	<b>328.8</b>	<b>100.0</b>	<b>15.5</b>	<b>100.0</b>

Note: \* Compiled from GOI (1993) , \*\* Compiled from GOO(1993).

The area under agriculture in India has increased by nearly 33% over a period of some 30 years, from 132 million hectares in 1951 to 175 million hectares in 1979 (GOI, 1992). A similar trend has also been observed in Orissa where exploitation of land for agriculture is greatest in the coastal belt of Balasore, Cuttack, Puri and Ganjam on account of their high fertility (ORG, 1993). Forests, mainly concentrated in upland, are generally distributed amongst the tribal-intensive districts such as Keonjhar, Mayurbhanj, Koraput, Sambalpur, Phulbani and Kolahandi.

Thus, agriculture and forestry are the two major land use practices which together account for more than two thirds and three fourths of the total area of India and Orissa respectively.

### 2.1.1 Dependence on land resources

As pointed out earlier, nearly one third of the population of India and half of the population of Orissa have little or no land of their own. They derive their subsistence needs from labouring and local resources. These local resources include mainly the forest and unused wasteland owned by the government. Thus the proportion of the

population gaining their subsistence requirements from the land, both landholders and landless is extremely high. Due to the increasing human population, per capita availability of land in Orissa has declined from 1.2 hectare in 1951 to 0.49 ha in 1991. It is estimated that by 2000 AD the per capita land availability will further decline to about 0.39 ha (ORG, 1993) implying increasing pressure on the limited land resources.

### 2.1.2 Land degradation

With increasing human and animal pressure on land, the production of vegetation for food and other resources has extended to more marginal areas under great ecological stress. In such areas faulty and unscientific land use practices and natural hazards have extensively depleted the protective soil cover and exposed surface soil to the processes of degradation which have resulted in partial to complete loss in productivity. The land which has lost its productivity through these processes has been termed wasteland (NWDB, 1987). The National Wasteland Development Board (NWDB) has defined wasteland as "those lands which for one reason or other do not fulfil their life sustaining potential." In other words, where the production of bio-mass is less than its optimum productivity. A brief account of the classification and description of wasteland existing in India is given in Appendix 2.1.

### 2.1.3 Extent of land degradation

The National Commission on Agriculture (NCA, 1976) has estimated the extent of wasteland in the country to be 175 million hectares. This is more than half of the total geographical area and nearly two thirds of the productive area. The broad sub-divisions of the degraded land resources presented below in Table 2.2 shows that both forest and agriculture lands are degraded to a similar degree.

**Table 2.2 Extent of land degradation in India.**

(based on NCA, 1976 estimate)

Land uses	Total area (million ha)	Degraded area (million ha)	Percentage degradation
1. Forestry	75.0	40.0	53
2. Agriculture land	143.0	80.0	56
Total land area	328.8	175.0	53



Pasture and grazing lands and other public lands are most degraded because these have been the most neglected areas. However, there is no scientific data on which this estimate is based. The NWDB set up a task force which carried out a classification of various kinds of wasteland in India.

A comparison of degraded forest and non-forest area in India and Orissa is given below in Table 2.3. It indicates that the proportions of degraded areas both under forest and non-forest in Orissa substantially exceeded the national average. As a whole nearly 39% of the total area in India and 41% of the total area in Orissa are estimated as wasteland.

**Table 2.3 Degraded area under forest and non-forest in India and Orissa.**

(based on NWDB estimate)

<b>Land category</b>	<b>India</b>	<b>Orissa</b>
<b>1. Forest degraded area</b> (% of total forest area)	<b>46.6</b>	<b>53.8</b>
<b>2. Non-forest degraded area</b> (% of total non-forest area)	<b>37.2</b>	<b>46.2</b>
<b>Total degraded area</b> (% of total geographical area)	<b>39.4</b>	<b>41.2</b>

Source: Compiled from NWDB (1989).

#### **2.1.4 Causes of degradation**

There are many complex reasons for land degradation. Important amongst these are; the development of industry, railways and urbanisation, construction of dams, reservoirs, canals and roads in fragile areas and unsustainable agricultural practices. Natural hazards such as cyclones, floods and droughts have also contributed to a certain extent towards the degradation of land resources in India. The above practices cause land degradation mainly through erosion by water and wind, salinisation and alkalinisation and nutrient depletion.

## 2.2 The agricultural economy

### 2.2.1 The land area and its distribution

As pointed out earlier, agriculture occupying the largest share of land resources forms the backbone of the Indian economy. The situation is similar in Orissa where more than two thirds of the population is directly or indirectly engaged in agricultural activities. Cultivation in Orissa is mostly dependent on monsoon rainfall as less than 30% of the cropped area gets irrigation coverage. The agricultural production thus varies with fluctuations in the monsoon, particularly with regard to its periodicity, quantum and pattern of precipitation.

Since rice is the staple food for the people of Orissa, paddy dominates the cropping scenario, particularly during "kharif" (June-October). At present some 77% of the cropped area is under food grains with paddy accounting for nearly 62% of this, followed by pulses (22%) and millet (16%) (GOO, 1993). Average yields of cereal crops such as paddy, maize and wheat are usually low, ranging from 1.0 ton/ha for rainfed "kharif" to 2.1 tons/ha for irrigated "rabi" (November-February). A large number of human factors have combined to contribute to the low productivity in Orissa. The tools and implement used on farms are mostly primitive, the methods of farming are outdated and the seeds used are generally poor in quality. A high percentage of illiteracy, poor infrastructure such as non-availability of input, inadequate credit and marketing facilities and insecurity against failure of crop are also responsible for the low productivity in the state (Sharma, 1990; ORG, 1993; GOO, 1993).

The zamindari land tenure system was in existence in Orissa until the mid fifties. Under this system the lands were controlled by a small number of landlords called the zamindar. The tenants were growing crops and paying huge taxes to these landlords. The practice was abolished after the merger of the princely states in the early sixties and then the ownership of land was passed on to the tiller from the absentee landlords. A maximum limit (ceiling) on the size of holding which a farmer could own was fixed in order to ensure the equitable distribution of land.

The pressure of increasing population over the limited sown area has resulted in reduced holding size. Table 2.4 below gives the percentage distribution of holdings, area operated and average size of holding amongst the marginal, small, semi-medium, medium and large farmers. This shows that small and marginal farmers (owning less

than 2 hectares) hold about 78% of total holdings but operate only 42% of the cultivable area. By contrast, the farmers with 2 hectares or more account for only 23% of holdings but control over 58% of the area under cultivation. The average size of holding is 1.47 ha, although the figure is less than 1 hectare for small and marginal farmers.

**Table 2.4 Distribution of holding and area operated in Orissa.**

Land holding category	Area (ha)	% of holding	% of Area operated	Average size of holding
1. Marginal	< 1.00	52.1	17.5	0.5
2. Small	1 to 2	25.4	24.2	1.4
3. Semi-medium	2 to 4	16.3	29.8	2.5
4. Medium	4 to 10	5.7	22.2	5.7
5. Large	10 and above	0.6	6.3	16.2
<b>Total</b>		<b>100.0</b>	<b>100.0</b>	<b>1.5</b>

Source: Compiled from ORG (1993).

### 2.2.2 Agricultural growth

The economy of the state of Orissa centres on agriculture. The annual contribution to GDP by different sectors given below in Table 2.5, shows that the primary sector has consistently contributed about 50% of the total GDP since 1985. Fluctuations in the GDP share during the period 85-86 to 1991-92 have mainly been due to the fluctuations in the monsoon (GOO, 1993).

The Green Revolution, gaining ground in India during the sixth five year plan (1974/75-78/79), had very little impact in Orissa due to the substantial area under paddy. It has had limited success in rice production due to the lack of high yielding paddy varieties, unlike wheat. Similarly, due to a variation in land resources, there is a large variation in agricultural productivity within various agro-ecological zones in Orissa.

**Table 2.5 Annual contribution to state domestic product by sector.**

(figures in % of total SDP)

<b>Year/sector</b>	<b>Primary sector</b> (agriculture and allied)	<b>Secondary sector</b> (industries and allied)	<b>Tertiary sector</b> (transport etc.)	<b>Service sector</b> (banking, insurance)	<b>All sectors</b>
1985-86	55.9	14.1	14.7	15.3	100
1986-87	52.5	15.7	14.8	17.0	100
1987-88	48.6	17.9	14.6	18.9	100
1988-89	51.9	16.5	14.6	17.0	100
1989-90	55.3	20.0	8.8	15.9	100
1990-91(p)	51.3	15.7	18.0	15.0	100
1991-92 (q)	52.9	14.1	17.7	15.3	100

Note: p and q indicate provisional and quick estimates respectively.

Source: Compiled from the Economic Survey of Orissa, GOO (1993).

### **2.2.3 Strategy for agricultural development**

As mentioned earlier, agriculture, although making a major contribution to SDP in Orissa, has not reached the level of the more developed states such as Punjab and Harayana (GOO, 1992). Until the late sixties, (i.e. the first three five year plans) the main strategy for agricultural development was to increase investment and the area under production. But it was judged inadequate during the seventies when the emphasis was shifted towards technological modernisation through the provision of credit facilities to farmers, use of high yielding varieties and use of higher doses of inputs such as fertilisers and pesticides. Therefore, crop planning based on agro-climatic conditions and adoption of specific technology with increased use of fertilisers, high yielding varieties and better management of irrigation were the strategies fixed by the state government during current eighth FYP (1992-97). The current planning however, is biased towards the rural poor particularly in meeting their basic needs (GOO, 1993).

### **2.3 The forest economy**

The forest represents the largest, most complex and most self perpetuating of all eco-systems and is one of the most valuable natural resources in India. It plays a key

role in the socio-economic and ecological development of the country. Although forestry is considered as an ancillary activity to agriculture in Orissa, it occupies an important position in the economy and confers both direct and indirect benefits (OFD, 1993). However, the forest base in India is dwindling at an alarming rate and has been a grave concern for the government both for India as a whole and Orissa in particular (GOI, 1987).

India has been one of the few countries in the world which enunciated a forest policy in the nineteenth century. The first forest policy in India was announced in 1894 which was subsequently revised in 1952 and 1988 (Sagrieya, 1982). The first forest policy, influenced by Voelcker's (Voelcker, 1893) report on Indian agriculture, focused on meeting the needs of the agricultural sector. This policy was based on the assumption that forestry's claim for land could be justified only on the basis of its direct and indirect contribution towards sustaining agriculture. The second forest policy, which was formulated in 1952, aimed to maintain at least one third of the country's geographical area under forest without giving any explanation as to how this proportion was arrived at. The dimension of subsequent forest policy (i.e. the existing 1988 policy) was changed by recognising the need of forestry for a balanced and complementary land use. Achievement of these latter policies was to be mainly through checking the denudation of mountainous regions, erosion along rivers, invasion of seas and coastal tracts and shifting sand dunes. The increasing supply of fuelwood, fodder, timber and other forest products through a massive afforestation and social forestry programme was also outlined as an important task in the existing forest policy of 1988. An obvious change in existing policy from earlier policies is the recognition of local and environmental interests rather than only the national and economic interest.

### **2.3.1 Area and distribution**

Information describing the recorded forest area, actual forest cover, and per capita availability of forest in India and Orissa is given below in Table 2.6. This indicates that the officially recorded forest area in Orissa (about 37% of total area) is higher than the national average of 23%. However, the recent estimates based on visual interpretation of landsat imagery (FSI, 1991) give figures for the actual forest cover as 19.4% of the total land area for India and 30.3% for Orissa. In Orissa, out of this, 30.3% has actual forest cover, 17.5 % has dense cover (density over 40%), 12.7 % has open cover (density 10 - 40%) and the remainder is occupied by mangrove forest. Again the forest area covered by dense and open forest in Orissa is higher than the national average by

around 50% and the per capita availability of forest in Orissa (0.19 ha) is almost double the national average. Thus compared with the country as a whole, Orissa is relatively well endowed with forest.

**Table 2.6 Details of forest area in India and Orissa.**

Types of forest	Forest area	
	India	Orissa
1. Recorded forest area (% of total land area)	22.8	36.8
2. Actual forest cover (% of total land area) (based on landsat imagery data, FSI (1991))	19.4	30.3
a. Close cover (crown density over 40%)	11.7	17.5
b. Open cover (crown density 10-40%)	7.6	12.7
c. Mangrove forest	0.1	0.1
3. Per capita forest (ha)	0.09	0.19

Source: FSI (1991).

Forests in India are distributed from the Tropical Rain Forest in the south and east to the Alpine Forest in the Himalayas in the north. The coniferous and the broad-leaved forests constitute 6.4% and 93.6% respectively of total forest. In between the two extremes, forests are unevenly distributed throughout the country. The spatial distribution of forests in various states of the country shows that the higher proportions of forest are found in the states which are comparatively less developed and thinly populated such as Assam, Meghalaya, Madhya Pradesh and Orissa, and vice versa (FSI, 1987).

Table 2.7 below gives the distribution of forest amongst the agro-ecological zones of Orissa which indicates that the forest cover within Orissa is unevenly distributed. The Eastern and Northern Zone which have almost equal proportions of forest (about 43% of total area), have a much higher proportion of forest area than the Coastal and Central Zones which have about 26% of their area under forest. The per capita forest follows almost the same pattern, being highest in the Eastern Zone and lowest in the Coastal Zone.

**Table 2.7 Distribution of forest within Orissa.**

<b>Agro-ecological zone</b>	<b>Forest area (% of geographical area)</b>	<b>Per capita forest (ha)</b>
1. Northern Zone	42.7	0.25
2. Central Zone	27.1	0.15
3. Coastal Zone	25.7	0.08
4. Eastern Zone	43.9	0.33
<b>Orissa (average)</b>	<b>36.8</b>	<b>0.19</b>

Source: GOO (1993).

### 2.3.2 Forest types

Fulfilment of basic needs of fuelwood, fodder and small timber depends on the type of species available in the locality. Usually the short duration species with multiple canopies cater for the multiple requirements of the poor people (Das, 1991). This helps in providing fuel, leaf litter, fodder, timber and minor forest products (MFP) on a regular basis in contrast to those which have long rotations with clear ground flora. Forest types of India are divided into 16 groups on the basis of climatic data and vegetation (Champion and Seth, 1968). Table 2.8 below presents the proportionate distribution of types of forest in India and Orissa.

Tropical Dry Deciduous and Tropical Moist Deciduous types together constitute two thirds of the total forest area of the country. This proportion in Orissa is as high as 80% of total forest area of the state with a relatively higher proportion of Tropical Dry Deciduous Forest. The Littoral and Tidal Swamp Forest together account for the remaining 20 % of the forest area of Orissa. Forests in Orissa are dominated by the species locally known as sal (*Shorea robusta*). Sal is a very good coppicer and yields a very useful timber, strong and durable. Small poles and branch wood are used by villagers for house building and repairs. Leaves are used for making local plates used mostly in rural areas. The collection of sal seeds employs a large number of people in backward areas between February and June which are the lean months for agricultural labourers.

Other important forest species of the state include teak (*Tectona grandis*), piasal (*Pterocarpus marsupium*), rosewood (*Dalbergia latifolia*), gamhar (*Gmelina arborea*) and kurum or haldu (*Adina cardifolia*). Most of these are coppice crops.

**Table 2.8 Forest area under different forest types in India and Orissa.**

Forest type	Percentage of total forest area	
	India	Orissa
<b>1. Tropical Forest</b>		
i. Tropical wet evergreen forest	8.0	0.0
ii. Tropical semi-evergreen forest	4.1	0.0
iii. Tropical moist deciduous forest	37.0	30.0
iv. Littoral and swamp forest	0.6	20.0
v. Tropical dry deciduous forest	28.6	50.0
vi. Tropical thorn forest	2.6	0.0
vii. Tropical dry evergreen forest	0.2	0.0
<b>2. Montane Sub-tropical Forest</b>		
viii. Sub-tropical broad-leaved forest	0.4	0.0
ix. Sub-tropical pine forest	6.6	0.0
x. Sub-tropical dry evergreen forest	2.5	0.0
<b>3. Montane Temperate Forest</b>		
xi. Montane wet temperate	3.6	0.0
xii. Himalayan moist temperate	3.4	0.0
xiii. Himalayan dry temperate	negligible	0.0
<b>4. Alpine Forest</b>		
xiv. Sub-alpine forest		0.0
xv. Moist alpine forest	2.4	0.0
xvi. Dry alpine forest		0.0
<b>All types</b>	<b>100</b>	<b>100</b>

Source: FSI (1987).

### 2.3.3 The status of forestry

The total forest area of the country has legally been divided into three groups namely Reserved Forest, Protected Forest and Unclassed Forest. The Reserved Forests are



exclusively administered by the government while the Protected Forests facilitate rights and concessions to local people for the collection of daily used forest products. The Unclassed Forests have multiple forms of access for local people.

In Orissa, Reserved Forest has been divided into two categories namely class 'A' and class 'B'. Rights and concessions in 'A' class Reserve Forest are very restricted. Minor privileges such as grazing, collection of MFP particularly edible fruits, flowers, tubers and dry fuels are permitted in some 'A' class reserves. The 'B' class reserves are, however, meant for the exercise of rights and privileges by the local communities subject to certain restrictions such as removal of forest products according to the approved plans or schemes, payment of royalty, etc. Rights and concessions are more liberal in the Protected Forest. The local communities are allowed a number of privileges in these forests except those which are explicitly prohibited (Das, 1991). Unclassed Forests in Orissa comprise a very negligible quantum of area (less than 1%). Unfortunately the areas of Protected Forest in the state have drastically reduced with the increase in population (GOO, 1993 ; ORG, 1993). Therefore, there is heavy pressure on "B" class Reserved Forest.

The areas covered under these three types of forests in India and Orissa are presented below in Table 2.9. This shows that the area under Reserved Forest in Orissa is less than the national average while that of Protected Forest is almost double. This implies that the rights and concessions with regard to forest are more liberal in Orissa compared to those of India as a whole.

Another classification based on the ownership of forests suggests that the forests owned by state government, corporate bodies and private people comprises in the proportions of 95%, 2.5% and 2.5% respectively (GOI, 1987). According to an estimate made by GOI (1991a), nearly 33% of the total forest area is managed as protection forest for maintenance of ecological balance, 21% for production of timber for industrial uses, 33% as social forestry and the remaining 13% for maintaining national parks and sanctuaries. This implies that one third of the area which is earmarked for social forestry plantations is aimed mainly to supplying the basic requirement of fuelwood, fodder and small timber for the local rural poor as well as to generate employment to raise the income of the rural poor.

### 2.3.4 Forest products

Timber and fire-wood are the major forest products of Orissa. Bamboos, kendu leaves (*Diospyrus melanoxylon*, leaves used for smoking) and sal seeds are the most important minor forest products of the state. These provide considerable employment for the poorer sections of the society (Das, 1991). The other important items under MFP

**Table 2.9 Legal classification of forest in India and Orissa.**

Status of forest	India		Orissa	
	Area (million ha)	% of total forest area	Area (million ha)	% of total forest area
1. Reserved Forest	41.0	55.0	2.7	47.0
a. 'A' class	na	na	2.4	41.7
b. 'B' class	na	na	0.3	5.3
2. Protected Forest	21.0	28.0	3.0	53.0
a. Demarcated	na	na	1.6	28.2
b. Undemarcated	na	na	1.4	24.8
3. Unclassed Forest	13.0	17.0	negligible	0.03
<b>Total</b>	<b>75.0</b>	<b>100</b>	<b>5.7</b>	<b>100.0</b>

Note : na refers to not available

Source: FSI (1991) and Das (1991).

of the state are sal and siali (*Bauhinia vahili*) leaves. These are used for making plates and cups for use as crockery in rural and sometimes urban areas. Oilseeds such as mahua (*Madhuca latifolia*), kusum (*Schlechera oleosa*), neem (*Azadirachta indica*), karanj (*Pongamia pinnata*) and grasses such as sabai grass (*Eulaliopsis binnata*), khus khus (*Vetiveria zizinooides*) and aromatic grasses yield essential oils used for various edible and medicinal purposes. All these products provide substantial employment to the rural poor in the process of their collection from the forests.

### 2.3.5 Demand and supply from the forest area

Nearly 80% of the population in developing countries depend on fuelwood for their domestic fuel energy (Khan, 1993). The demand for forest products in India is increasing as rapidly as anywhere in the world due to the absolute increase in the human and

livestock population. In Orissa, being predominantly a rural state, nearly 95% of the population uses fuelwood as a source of domestic energy. The increasing cattle population in the state has left the pasture and grazing land almost devoid of vegetation (ORG,1993).

Table 2.10 below indicates that there is a wide gap between demand and supply of timber, firewood and fodder both at national and state level and this shortfall is expected to increase. It is estimated that the country's forests are meeting only 17% of the demand for fuelwood and 43% of the demand for industrial wood while the remaining quantities are met through illegal extraction (Khan, 1993). The wide scarcity of fuelwood has also resulted in maximum amounts of valuable cow dung being burnt for fuel each year which could have been utilised for agricultural production (Sagrieya, 1962). The government of India has estimated that the number of animals grazed in the forest has increased from 35 million in 1958 to 90 million in 1987(GOI, 1987).

**Table 2.10 Demand and supply from forest in India and Orissa.**

Products	1987 <sup>**</sup>				2000			
	India		Orissa		India <sup>*</sup>		Orissa <sup>+</sup>	
	Demand	supply	Demand	Supply	Demand	supply	Demand	Supply
1. Timber (million m <sup>3</sup> )	27.0	13.5	1.2	0.2	60.0	25.0	2.0	0.5
2.Firewood (million m <sup>3</sup> )	235.0	40.0	8.0	0.5	330.0	60.0	12.0	3.0
3.Fodder <sup>++</sup> (million tonnes)	850.0	450.0	40.0	24.0	2000.0	1000.0	50.0	30.0

Note : \*\* compiled from GOI (1987) , \* projected by FSI (1987) , + projected by OFD (1987a).

Source: GOO (1987).

The situation with regard to the demand for and supply of forest products in Orissa differs somewhat from the national picture. The situation for fodder is similar, that for firewood is more favourable, while the excess demand for timber is relatively greater. Demand in the form of the 'nistar' is very prevalent. The nistar demand is the requirement for forest products for bonafide domestic needs of villagers who pay a very nominal royalty (nistar cess). This is an old tradition under which certain rights and

concessions are given to local villagers, but under the present depleting forest situation the practice does not seem feasible to continue because it may cause increasing damage to the forest.

### **2.3.6 Tribal dependence on forestry**

About 90% of the total tribal population in the country live in and around forests and depend directly or indirectly on the forest for their livelihood. Not only are their economies closely linked to the forest but they are socially and culturally associated with the forest too. It is estimated that nearly one third of their livelihood is earned from the employment generated through various activities in the forest and collection and sale of the MFP (GOI, 1987).

The relationship between the forest and tribals in Orissa is still strong due mainly to the higher percentage of tribal population as well as forest area. The vast majority of tribals are forest dwellers and their whole economy revolves round the forest. Any deforestation will have a direct and adverse effect on these relatively poor forest dwellers who are socially and economically backward in comparison to the rest of the population (ORG, 1993).

### **2.3.7 Revenue from forest product**

Besides industrial and firewood production, MFP, such as bamboo, canes, kendu leaves (*Diospyrus melanoxylon*), lac, gum, resin and sal seeds are a good source of revenue. In Orissa, kendu leaves fetch a large amount of annual revenue. Information on the annual generation of revenue from various forest products is presented below in Table 2.11. This illustrates that the value of forest products together has increased from Rs. 651 million in 1987-88 to Rs. 1090 million in 1990-91 registering an annual growth of 22.5%, compared to an average annual inflation rate of 8.7% (World Bank, 1995). Kendu leaves have generally fetched the highest revenue accounting for between 23% and 70% of total revenue between 1987 and 1990. Although the percentage contribution of forestry to the total revenue of the state is only 2%, a major portion of revenue is utilised for development activities in rural areas (GOO, 1993), particularly in contributing to essential services by way of the construction of schools, health centres and facilities for safe drinking water.

### 2.3.8 Forest productivity

According to an estimate made by the Forest Survey of India (FSI, 1987), the growing stock of wood in the country in 1986 was 4196 million m<sup>3</sup>. The net annual increment was 52 million m<sup>3</sup> or 1.2% of the growing stock. Average annual production of wood per hectare is estimated as 0.7 m<sup>3</sup> per ha which is far below the world average of 2.1 m<sup>3</sup> (GOI, 1987).

**Table 2.11 Average annual revenue generated from forest in Orissa.**

Forest product	Yearly revenue (Rs. in million)			
	1987	1988	1989	1990
1. Timber	249	202	208	166
2. Bamboo	27	57	57	63
3. Minor forest product	36	24	35	19
4. Kendu leaves	278	136	588	768
5. Others	63	72	73	73
<b>Total</b>	<b>651</b>	<b>592</b>	<b>962</b>	<b>1090</b>

Source: Compiled from the Economic Survey of Orissa (GOO, 1993).

In Orissa, productivity of forests is still worse. Most of the forests are in a degraded condition except the few reserved forests. The mean annual increment of Orissa's forest is estimated as only 0.5 m<sup>3</sup> per ha.

### 2.3.9 Loss of the forest cover

The discussion in the previous sections confirms that the forests of India in general and Orissa in particular are under heavy biotic pressure. The widening gap between the demand and supply of forest products has accelerated the process of deforestation. It is estimated that India is losing forest cover of nearly 1.4 million hectares each year (GOI, 1987).

Large areas of forests, containing valuable stands were deforested during rehabilitation to provide the agricultural lands for the landless tribal. To add to this,

diversion of land for other non-forestry uses such as submergence in river valley projects, development of industries, townships, transmission lines and roads and settlement of persons by these projects have also caused a substantial loss of forest cover. Table 2.12 below presents the diversion of forest land for non-forestry uses in India and Orissa under different activities for the period 1951 to 1980.

This shows that the greatest diverted forest area has gone for expansion of agriculture both in India as a whole and in Orissa. In Orissa the proportion of forest area deforested during the 30 year period has been more than double that of India. The average annual rate of deforestation in India and Orissa has been 1.4 million and 0.03 million hectares respectively over the period.

**Table 2.12 Diversion of forest land for non-forestry purposes under different activities in India (1951 to 1980).**

Purpose of diversion	Diversion of forest land for non-forestry uses			
	India		Orissa	
	Area (million ha)	% of forest area	Area (million ha)	% of forest area
1. Agriculture	2.62	3.5	0.60	10.5
2. River valley projects	0.50	0.7	0.10	1.8
3. Industries and townships	0.13	0.2	0.04	0.7
4. Transmission lines and roads	0.06	0.1	0.02	0.3
5. Miscellaneous	1.01	1.3	0.04	0.7
<b>Total</b>	<b>4.30</b>	<b>5.8</b>	<b>0.80</b>	<b>14.0</b>

Source: GOI (1989).

Encroachment and shifting cultivation on forest lands are also a common feature in India. Shifting cultivation (slash and burn or *podu* in local language) is the most primitive form of agriculture generally practised by tribals in Orissa. Although the exact number of households practising shifting cultivation in the state is not available, there are conflicting estimates of the area affected by this practice.

Table 2.13 below presents the forest area under encroachment and shifting cultivation in India and Orissa. This indicates that the extent of forest area affected by both encroachment and particularly shifting cultivation is much higher than the national average, although in total it is less than 5% of the total forest area. According to a study made by the Operations Research Group (ORG, 1993), the practice of shifting cultivation by tribals of Orissa is the highest amongst all the states of India.

**Table 2.13 Area under forest encroachment and shifting cultivation in India and Orissa.**

Types of degradation	India <sup>+</sup>		Orissa <sup>++</sup>	
	Total affected area (million ha)	% of forest area	Total affected area	% of forest area
1. Area under forest encroachment	0.70	0.95	0.08	1.43
2. Area under shifting cultivation	0.31	0.41	0.18	3.23

Note: + estimate made by GOI (1989) for 1983,

++ denotes the estimate made by the Soil Conservation Department, Government of Orissa (ORG, 1993).

Another cause of forest degradation is through excessive grazing. According to an estimate made by the government of India (GOI, 1989), about 90 million domestic animals annually graze in the forest. This is more than three times of the estimated carrying capacity of animals. Because of this uncontrolled grazing, the productivity of forest lands is continuously reducing and forests are gradually depleting.

Subsequent to the realisation of the diversion of vast area for non-forestry purposes, the government of India promulgated the Forest Conservation Act<sup>1</sup> during 1980. This act, which aimed primarily to check the indiscriminate deforestation/diversion of forest land for non-forestry purposes was amended in 1988 to make it more stringent by prescribing punishment for violations. The rate of diversion came down considerably after the introduction of the act (GOO, 1993). Because of the deterioration of forests in the state, the Orissa government have banned the felling of trees in Reserved and Protected

Forest in five out of the 13 districts. This has affected the rural poor who were fully dependent on the forest for their livelihood.

### **2.3.10 Strategy to control the land degradation**

It is obvious from the earlier discussion that in the last few decades, the lands (both under agriculture as well as forestry) in India have been subject to major degradation. It is also clear that the main reasons for such degradation are the biotic demands for subsistence needs of food, fuel, fodder and small timber. This situation was realised at national level and attention was focused to halt the pace of degradation. Subsequently, a number of action plans were launched, all having two main objectives: firstly to meet the consumption needs of the growing population by increasing productivity of integrated land resources and secondly to restore the productivity from further degradation, by an appropriate package of practices<sup>2</sup>. A brief description of the historical context of these plans is given below:

During the late seventies the National Commission on Agriculture of India (NCA, 1976) submitted a report with issues relating to forestry recommending that proper investment should be made in social forestry to meet the fuelwood and small timber needs of rural communities and to create employment opportunities for them.

Not much concern was shown for afforestation until 1979 in spite of vast deforestation. In 1980 however, the government of India announced the revised programme in which afforestation and tree planting were incorporated as key activities (GOI, 1983). This resulted in focusing of the attention of state governments and hence a high priority for afforestation.

Subsequently, there was substantial progress in the allocation of funds during the sixth FYP (1980/81-1984/85). This resulted in a significant increase in the total area afforested during this period, to 4.65 million hectares with an average of 0.93 million hectares annually. It was in this period that the emphasis was first placed on social forestry. Consequently, social forestry projects were initiated in 14 states in India with the funds available from the state forest department, central government as well as from external agencies. Most prominent among the latter were the World Bank, the Canadian International Development Agency (CIDA), the Overseas Development Administration (ODA), the Swedish International Development Agency (SIDA) and the United States Agency for International Development (USAID).



In May 1985, the National Wasteland Development Board (NWDB, 1987) was set up by the national government to supervise and monitor the progress of social forestry and other afforestation activities throughout the country. It was established with the primary objective of undertaking wasteland development through the annual afforestation of 5 million hectares of fuelwood and fodder species with an active involvement of non-governmental agencies and voluntary organisations.

During the seventh FYP (1985-90), people involvement was given added emphasis. A number of people-oriented schemes were initiated to increase the level of people participation in afforestation. As a result the afforestation reached 8.88 million hectares during the period of this FYP (NWDB, 1990) .

Towards the end of the seventh FYP, the NWDB programme was reviewed and it was found that the programme did not adequately address the issues related to fuel and fodder production. Also, the problem of land degradation and deforestation had not, in the opinion of the reviewers, been adequately addressed. People's participation had also remained limited. Accordingly, the National Mission on Wasteland Development was launched with the goal of checking land degradation and helping to restore the ecological balance, on the one hand, and putting wasteland to sustainable use, especially with a view to increasing bio-mass availability particularly in the form of fuel and fodder on the other. The composition and role and function of the Board was modified suitably to enable it to achieve the stated goal.

As to the future, the major efforts of the NWDB during the current FYP (1992-97) will be to ensure the necessary dovetailing of all wasteland related schemes at village level and to ensure community participation in a real sense. It also co-ordinates, on behalf of the government of India and external organisations, social forestry projects in 14 states of the country. The schemes and projects include important elements such as tree planting, silvi-pasture development, soil and water conservation, agroforestry and farm forestry and natural regeneration of degraded forest.

A brief description of the implementation of the Social Forestry Programme in India as a whole with particular emphasis on its FFRP component in Orissa is given in the following section .

## **2.4 Social forestry in India**

The term 'social forestry' was used in India by Jack Westoby (Westoby, 1968) during the ninth Commonwealth Forestry Conference. Subsequently, the concept of tree growing was activated throughout India.

The World Bank (1990) has defined social forestry as

"...a programme designed to create the necessary conditions for tree planting outside the traditional domain of the forest lands...includes tree planting in farmer's field; in village common land; along roads, railways and canals; and in degraded wastelands..are multidimensional and complex...involve much more than just planting trees."

### **2.4.1 The origin of the social forestry**

Although the concept of social forestry existed earlier, it got official recognition only after submission of a report on the wider scope of farm forestry by the National Commission on Agriculture (NCA, 1976) in 1976. The gist of the important forestry recommendations of the NCA is given in Appendix 2.2. Subsequently, social forestry was nationally recognised and included under economic development programmes. As stated above, during the sixth FYP, the government of India launched a massive afforestation programme under social forestry in 14 states including Orissa. The NWDB and the Departments of Agriculture and Rural Development of various states mobilised vast amounts of funds for this purpose. At that time social forestry was recognised internationally and foreign funding agencies (as mentioned above) started funding the programme. With the help of these funds some of the states, for example Gujarat, Orissa, Uttar Pradesh and Tamil Nadu, have now completed the tenth year of their implementation. Some 30 billion rupees had already been spent on the Social Forestry Project in India (GOI, 1993) by 1993.

### **2.4.2 Objectives of the Social Forestry Project**

According to the NCA, the Social Forestry Project broadly aims to fulfil the basic and economic needs of the community. The following objectives of the Social Forestry Project have been defined at a national level.

- a. To meet the requirements of fuelwood, fodder and small timber in rural areas.
- b. To provide employment for the rural poor.
- c. To meet the raw material requirements of cottage and small scale industries.
- d. To bring one third of the area under forest.
- e. Ecological restoration and protection of the degraded agriculture and forest land.

### **2.4.3 Management of the Social Forestry Project**

Since the Social Forestry Project basically aims towards the benefits of society, its management is based on the mutual interest of both villagers and implementing agencies. This means the management is based on the assumption that social forestry would create sustainable resources for the interests of the society (OFD, 1989b). The Social Forestry Project in Orissa is managed on the principle of a joint management system through village level committees consisting of representatives from villages as well as the Forest Department.

### **2.4.4 The Social Forestry Project in Orissa**

The initiation of the Social Forestry Project with the support of the Swedish International Development Agency (SIDA) in all thirteen districts over a period of 10 years is an important land mark in the forestry development of Orissa. The project with its integrated and multi-component approach reflects the rural development nature of social forestry. The project is characterised by a number of innovations to make it a more public oriented programme.

#### **2.4.4.1 Objectives**

Depending on the local conditions and requirements, the Social Forestry Project, Orissa was started with the following objectives (OFD, 1987a).

- a. To create sustainable forest resources for the people and by the people with the help of the government.
- b. To create resources primarily to meet the needs of the people for products of importance in the local economy such as sustained supply of fuelwood, fodder and wood for construction, agricultural implements, small scale industries, handicrafts and MFPs.
- c. To provide employment to rural unemployed and underemployed to generate income to meet their basic consumption needs.

The major focus of the project is the village i.e. the villagers should participate and interact with the project personnel and the resources created shall belong to the village and should be shared, regenerated and extended to everybody.

### 2.4.4.2 Components

The major components of the Social Forestry Project of Orissa are:

- i. Village wood lots (VWL),
- ii. Reforestation and rehabilitation of degraded forest (REFO and RDF),
- iii. Institutional plantation,
- iv. Farm Forestry,
- v. Forest Farming for the Rural Poor (FFRP).

**i. Village wood lots :** The main concept of the VWL is that the project will support some or all of the villagers to organise and carry out a tree plantation programme for the benefit of villagers. Crucial tools for establishment of VWL are the Village Forest Committee (VFC) and the Joint Management Programme (JMP). A brief description of VFC and JMP is given in Appendix 2.3. These are important because the other components, including FFRP, are also guided through these two management tools.

**ii. Reforestation and rehabilitation of degraded forest:** The aim of these components are to reforest and rehabilitate those depleted and degraded forest areas which are in the vicinity of the villages. This task is done by or with the help of the villagers. The intention of these components is to generate direct links between people and forest where their role will be extended from that of consumer only to producer as well.

**iii. Institutional plantations:** These are similar to village wood lots except that schools, non-governmental organisations, voluntary organisation, panchayats and community centres are encouraged to participate in the programme which aims to benefit the institutions and communities. This includes plantations along the coast, roadsides, railway lines and canals.

**iv. Farm forestry:** Farm forestry aims at assisting the individual farmer /organisations/institutions to plant fuelwood, small timber, fodder and fruit trees on private or leased out land. Under this component, seedlings up to 500 in number are provided free of charge to the individual farmers. The scheme is mainly directed towards motivating, encouraging and assisting the landless (with homestead land) and marginal and small farmers to undertake tree planting as an integrated part of the farm production system.

**v. Forest farming for the rural poor (FFRP):** The main aim of this component is to enable landless families, including tribals, to practice agri-silviculture or density forest farming on marginal and unused degraded government land in and around the village. The major objectives of this activity are (a) to meet the subsistence needs of the landless poor by engaging them in land use programmes and (b) to increase the productivity of unused and degraded land.

#### 2.4.4.3 The physical and financial achievements

During implementation of the Social Forestry Project, an attempt was made to popularise the programme in rural areas especially among the poorer sections of the communities by free distribution of seedlings. The quick growing and hardy species such as eucalyptus were chosen for the majority of the plantation. The Social Forestry Project of Orissa started with the financial assistance of Swedish International Development Agency (SIDA) during 1983. Since then it has successfully completed its two phases (Phase 1 from 1983 / 84 to 1987/ 88 and phase 2 from 1988/89 to 1992/93). Table 2.14 below summarises the physical and financial achievements of the Social Forestry Project in Orissa during both the phases of its implementation.

**Table 2.14 Physical and financial achievements of the Social Forestry Project of Orissa during phase 1 (1983/84 to 87/88) and phase 2 (1988/89 to 92/93).**

Activities	Phase 1	Phase 2	Total
1. Plantation (ha)	33592	55510	89102
2. Rehabilitation of degraded forest (ha)	14184	14195	28379
3. Farm forestry distribution of seedling (million)	34.93	112.65	147.58
5. Employment generated (million man days)	14.33	22.82	37.15
6. Total expenditure (in Rs. million)	270.8	892.1	1162.9

Source: Compiled from the official records of the Social Forestry Project, OFD (1994).

This indicates that plantation of nearly 90000 hectares, rehabilitation of nearly 30000 hectares, seedling distribution of close to 150 million seedlings and employment generation of over 37 million man days have been achieved with a financial investment of Rs. 1163 million during the period 1983/84 to 1992/93.

The next section discusses the salient features of the Forest Farming of Rural Poor (FFRP) component of the Social Forestry Project of Orissa.

## **2.5. Forest Farming for Rural Poor (FFRP)**

### **2.5.1 Introduction**

FFRP is an important component of the Social Forestry Project of Orissa. Two practices under the FFRP component are undertaken depending on the ecological conditions. One has an emphasis on agroforestry (agri-silviculture) practice where the beneficiaries during the initial three years grow agricultural crops in conjunction with tree crops. The other practice relates to the density type of plantation without the intervention of agricultural crops. The present study deals with both the practices of the FFRP. Both the practices are subsistence oriented and individual-based biased towards the weaker and landless (rural and tribal) poor of the society. FFRP has similar objectives to the Economic Rehabilitation of Rural Poor (ERRP) programme for rural development in Orissa which has been working in parallel. ERRP is also a land use programme for agricultural production preferably practised on the degraded and unused surplus land. This is also a subsistence oriented and individual based programme and is biased towards the weaker and landless (rural and tribal) poor of the society. The performance of the agriculture component of the ERRP programme will later be compared with that of the FFRP.

### **2.5.2 Aims and Objectives**

#### **2.5.2.1 Aims**

The main aim of the FFRP is to enable the landless families, including tribals, to practice intensive forest farming on government owned, unused, surplus land in and around the villages and give them usufruct rights. The latter entitles the villagers free rights to agricultural and forestry products from agroforestry and forestry established on government land without inferring any ownership right to the land itself. During the off season there is no work for landless labourers especially in the dry season, and thus these labourers can be utilised for the tree crops.

### 2.5.2.2 Objectives

The major objectives of FFRP are as follows:

- i. To meet the basic needs of the landless poor for staple food, fodder, fuelwood and small timber for construction and agricultural implements,
- ii. To raise the income and consumption level of the landless rural poor by providing additional employment in a land use programme,
- iii. To provide environmental benefits through the improvement of marginal lands.

### 2.5.2.3 Working modalities of the FFRP

#### 2.5.2.3.1 Selection of beneficiaries and land

The landless rural poor are selected as the beneficiaries for this programme. Selection of beneficiaries is done in accordance with the principles of the existing rural development programme of Economic Rehabilitation of Rural Poor (ERRP) of Orissa. The ERRP is another land use programme under a joint control of the Rural Development and Agriculture Departments. Government unused surplus lands available in and around the villages are utilised for both of the practices. Plate 2.1 below exhibits a typical site selected for the plantations in the FFRP. Degraded areas having the status of cultivable wasteland as per the records of the Revenue Department are generally preferred. Each beneficiary is allotted 0.5 ha of land.



Plate 2.1 A typical site selected for the agroforestry and forestry plantations in the FFRP.

### **2.5.2.3.2 FFRP (agroforestry)**

The most commonly used agroforestry practices in Orissa are those where the trees alternate with strips of food crops (agri-silviculture). The spacing of the tree is 4m-1mX 1m-4m i.e. two rows of trees at a spacing of 1m X 1m separated by alleys of 4m width aiming at a plant population of 4000 trees per hectare. Plate 2.2 below exhibits the planting configuration in agroforestry plantation in the FFRP. Agricultural or horticultural crops are raised in the 4m interspace between the rows only for initial three years. Pruning and thinning for improving the tree quality is taken up as and when required as determined by the project management. Selection of tree species are made depending on adaptability to soil and climatic condition. The existing consumer preference and market demands are also given proper consideration. Generally the tree species having characteristics of faster rate of growth, deep root zone, light branching, capability of atmospheric nitrogen fixation, palatability of leaf as fodder, compatibility with agricultural/horticultural crops, capability of withstanding heavy lopping and pruning, capacity for stabilising soil and ability to withstand adverse climatic conditions are normally given preference. The Eucalyptus hybrid constitutes about 90 to 95% of the total species planted under the FFRP (OFD, 1989b).

### **2.5.2.3.3 FFRP (density forestry)**

Selection of beneficiaries and land is done in a similar fashion to that in the agroforestry practices. Unlike agroforestry, the density plantation constitutes only monoculture forestry species (mainly Eucalyptus hybrid species). Trees are planted at a spacing of 2m X 1m, aiming at a plant population of 5000 trees per hectare. The planting configuration of the density forestry in the FFRP is exhibited below in Plate 2.3. Other provisions for implementation of the density model are similar to that of the agroforestry practices.

### **2.5.2.3.4 Extension and input**

Choice of tree and crop species is made with the mutual agreement of beneficiary and project personnel. The project assists the selected beneficiaries with suitable seedlings, fertilisers, insecticides and wages for soil preparation, planting, weeding and other operations during the first three years in order to establish the plantation. The project also provides funds for raising agricultural crops in agroforestry for the first three years. Technical support and guidance are regularly being provided by the project



personnel. However, the protection of the plantation is the responsibility of the beneficiary.



**Plate 2.2** Standardised planting configuration for the agroforestry plantation in the FFRP (planting spacing 4m-1m X 1m-4m i.e. 4000 trees/ha).



**Plate 2.3** Standardised planting configuration for the density forestry plantation in the FFRP (planting spacing 2m X 1m i.e. 5000 trees/ha).



### 2.5.2.3.5 Rights and obligations

The beneficiaries are given tree patta<sup>3</sup> in writing within two years of planting to ensure the usufructory rights from the plantation including the agricultural produce. The tree patta confers legal rights on beneficiaries which are actionable in a court of law. Usufructory rights under tree patta includes the right to gather grass, dead branches, to take twigs and lopping of branches, to harvest produce such as fruits, flowers, seeds, leaves and to carry on other activities such as bee keeping, lac production and the coppicing of trees. Plate 2.4 below exhibits an example of the intermediate benefit from silvopastoralism in an agroforestry plantation in the FFRP. The patta holder would be permitted to cut and take the timber of the trees on their attaining the agreed rotation age. Plates 2.5 and 2.6 below, exhibit an example of the harvesting of trees and final products respectively from one of the agroforestry plantations in the FFRP. The holder of the patta has no ownership or any other rights on the earmarked land on which trees are planted and the ownership of land shall continue in the hands of the government. The owner of tree patta is not allowed to transfer, sublet or create any interest in land or trees except to the extent permitted in the patta. Disputes related to any matter connected with the tree patta shall be decided by the Tahsildar<sup>4</sup> (Revenue Officer) or any other designated authority. Appeal can be made to the District Collector whose decision would be final.



**Plate 2.4** Intermediate benefits from silvopastoralism in the agroforestry plantation of the FFRP.



## 2.5.2.3.6 Rotation age



Table 2.10 Annual physical and financial achievement in the FFRP (agroforestry and forestry) in Orissa during phase I and phase II

**Plate 2.5 Harvesting in FFRP (agroforestry) plot in the Coastal Zone of Orissa.**



**Plate 2.6 Beneficiaries discussing the final products from a FFRP (agroforestry) plot in the Coastal Zone of Orissa.**

### 2.5.2.3.6 Rotation age

Short rotation crops such as *Eucalyptus* hybrid, *Acacia auriculiformis*, *Cassia siamea* and bamboo are preferred for the FFRP plots. The rotation age of the *Eucalyptus* hybrid and other species has been fixed at 7 to 9 years (OFD, 1989b).

### 2.5.2.3.7 Physical and financial achievements under FFRP

The agroforestry and forestry practices of the FFRP commenced in 1983. In the first phase (1983/84 to 1987/88) these were practised in nine districts namely Keonjhar, Mayurbhanj, Dhenkanal, Sambalpur, Bolangir, Cuttack, Puri, Balasore and Ganjam. On successful completion of its first phase (1983/84-87/88), the programme was extended to the whole of Orissa covering all the 13 districts. Table 2.15 below presents the annual physical and financial achievements under the FFRP during the first and second phases.

**Table 2.15 Annual physical and financial achievement in the FFRP (agroforestry and forestry) in Orissa during phase 1 and phase 2.**

Year	Physical achievement (ha)	Financial achievement (Rs. in million)
1983-84	nil	0.01
1984-85	68.0	0.41
1985-86	245.0	1.70
1986-87	304.5	2.65
1987-88	891.5	7.12
<b>Total phase 1</b>	<b>1509.0</b>	<b>10.89</b>
1988-89	1008.0	9.15
1989-90	1354.0	9.31
1990-91	1388.0	12.65
1991-92	201.0	9.94
1992-93	643.5	11.99
<b>Total phase 2</b>	<b>4594.5</b>	<b>53.04</b>
<b>Grand total</b>	<b>6103.5</b>	<b>63.93</b>
Extended period (up to 30.9.93)	700.0	7.55

Source: Compiled from the annual report of the Orissa Social Forestry Project, OFD (1993).

This indicates that during phase 1, about 1500 hectares of plantation were carried out with an investment of Rs. 10.89 million. After successful achievement of the target fixed for phase 1, the area and investment were expanded to 4594.5 hectares and Rs. 53 million respectively benefiting nearly 10000 landless poor in phase 2. Thus, both phases of the FFRP have covered a total area of 6103.5 hectares and investment of Rs. 63.93 million. After an expiry of the second phase, SIDA, the Government of India and the Government of Orissa agreed to extend the FFRP activity for a further two years which will be expired in March 1995.

## **Summary**

The land use pattern and economy in India and Orissa as well as the initiatives undertaken by the governments to rehabilitate the degraded lands are discussed in this chapter. It is evident from the preceding discussion that nearly half of the total land area is degraded both in India as a whole and in Orissa. Both agricultural and forest lands are under continuous degradation and are unable to meet the basic requirements of the massive population. In chapter 1, it was seen that nearly one third of the population in India as a whole and half of the population in Orissa are unable to meet their basic needs (i.e. are below the poverty line). With an object to tackle the problems of poverty (to meet basic needs) and degradation of lands, the Government of India has taken a number of initiatives since the mid seventies which subsequently covered almost all the states of India. Massive afforestation through social forestry was one of the important initiatives. This programme was started in Orissa during the early eighties with the financial aid of SIDA as well as the national and state government. FFRP is an important plantation component of the Social Forestry Project in Orissa which is targeted at the landless rural poor for meeting their basic needs by establishing agroforestry and forestry on degraded lands. Similar to the FFRP, another initiative called ERRP, is also directed to the landless poor to meet basic needs through agricultural production on degraded lands.

Although a huge amount of money has already been spent on these projects, no systematic evaluation has so far been carried out based on field information to assess the impact of these projects on financial profitability and basic needs fulfilment. Part II (Chapters 3 - 5) of this thesis examines these issues and seeks suitable methodologies to assess the above impacts of the projects after reviewing the work hitherto carried out on project evaluation.

**Notes:**

- 1 The Forest Conservation Act of 1980 specifies that no forest land in any state is to be diverted for non-forestry purpose without the permission of the central government of India. There should be compensatory plantations for the areas used for non-forestry purposes. The act was amended in 1988 with the inclusion of stringent penalties for the violation of the provisions made in the act.
- 2 Information describing typical agricultural systems and cropping pattern in Orissa is called package of practices. Packages of practices for each individual agricultural and horticultural crops are published by the Department of Agriculture (information wing), Government of Orissa.
- 3 Tree patta is a legal document which entitles the FFRP beneficiaries to use the usufructory rights from the plantation including the agricultural produce. It is issued by the Revenue Department of the Government of Orissa after 2 to 3 years of the plantation and is valid to the end of the rotation of the standing trees.
- 4 Tahsildar is an administrative officer in the Revenue Department, Government of Orissa who is responsible for collecting the government revenues from various sources.

**PART - II**  
**REVIEW OF LITERATURE AND METHODOLOGY**  
**(CHAPTERS 3, 4 AND 5)**

## Chapter 3

### Evaluation of Land Use Projects : A Review

It is evident from the discussion in Chapter 2 that the FFRP is one of the most important plantation components within the Social Forestry Project of Orissa. Both agroforestry and forestry sub-projects of the FFRP aim to meet basic needs such as food, fuelwood, fodder and small timber for the rural poor. This chapter attempts to review the literature concerning the evaluation of land use projects with particular reference to their suitabilities in different development strategies which largely determine the aims and objectives of the projects. To analyse these aspects, the chapter is divided into five sections. The salient features of project evaluation and various development strategies are described in sections 1 and 2 respectively. Section 3 examines the various techniques applicable in the evaluation of land use projects. The theoretical framework and application of cost benefit analysis in the evaluation of land use projects is reviewed in section 4. Section 5 examines the suitability of cost-benefit analysis in the context of different development strategies.

#### 3.1 Project evaluation : the salient features

A project in general is a planned set of activities designed to achieve certain specific objectives within a given budget and within a specific period of time. It is the smallest operational element prepared and implemented as a separate entity in national programmes or sub-programmes. Several programmes or sub-programmes, in turn form a part of a plan.

Gittinger (1984) defines the project as:

"..a specific activity with a specific starting point and specific ending point, intended to accomplish specific objectives" (Gittinger, 1984, p. 5).

The purpose of a project is to convert a set of resources into desired results (objectives) through a set of activities or processes. The set of resources are called inputs. The results are divided into three broad categories, e.g. outputs, effects and impacts of which the latter two correspond to a project's short term and long term



objectives respectively. These four terms e.g. inputs, outputs, effects and impacts are defined as follows (FAO, 1985):

Inputs are goods, services, manpower, technology and other resources provided for an activity with the expectation of producing outputs and achieving the objectives of a project. For example, land, seed, labour, fertiliser, pesticide and polythene bag are important inputs in forestry plantation projects.

Outputs are the specific products or services which an activity is expected to produce from its inputs in order to achieve its objectives. For example, the supply of timber, poles, firewood and minor forest products are the important outputs in forestry projects.

Effects are the outcomes of the uses of the products. Fulfilment of basic requirements in terms of forest products and a reduction in illicit felling in natural forests due to a supply of forest products from plantations are the important effects of forestry plantation projects in India.

Impacts are the outcomes of the project's effects. An impact may also be defined as the ultimate change in the condition of the beneficiaries resulting from a project. Thus, change in living conditions, literacy and the nutrition of beneficiaries are the examples of the impact of the Social Forestry Projects in India.

Project evaluation<sup>1</sup> in general, is a process by which project managers or planners can assess the progress of a project's implementation towards the achievement of its objectives. It also enables management to assess the relevance, efficiency and effectiveness of a project.

More precisely, FAO (1985) define evaluation as:

" ..a systematic process which attempts to assess as objectively as possible the relevance, effectiveness and impact of a project in the context of the project objectives" (FAO, 1985, p. 6).

The evaluation helps (i) in analysing the rationale and logic of a project (objectives and design), (ii) in reviewing the implementation of a project (inputs, activities and outputs) and emerging results (outputs, effects and impacts) and (iii) in assessing the validity and relevance of a project. Thus evaluation is an action-oriented process which seeks to improve the effectiveness, relevance and impact of currently operating projects, completed projects and of future projects.

Evaluation may be taken up by different groups of people such as a sponsoring agency, project management, a planning agency or some external agency. However, the evaluation unit preferably should include persons with planning skills such as university staff.

Evaluation is also not limited only to the completed project. It may be taken up before, during and after the implementation of a project as described below.

**Ex-ante evaluation:** This is done before the start of a project which helps in determining the feasibility of a possible future allocation of resources. These are carried out for planning purposes on the basis of the estimates of costs and returns.

**On-going (concurrent) evaluation:** This is done during the implementation of the current project. It involves the feedback of information and opinions from participants and others to the project staff. This information can assist the decision makers in making any needed adjustments of objectives, policies as well as for future planning. It is undertaken several times within the project cycles.

**Ex-post evaluation:** This is done at the completion (terminal evaluation) or some years after completion of a project and is used to evaluate a past allocation of resources. It is based on the actual inputs expended and outputs generated during the full production cycles. Its purpose is to assess the overall achievements of a project in terms of its intended objectives and to provide lessons to assist the planning of future projects.

When a project is completed in two or more phases, the evaluation is taken up after each phase, such evaluation is called mid-term evaluation.

Depending on the focus and emphasis of a project, evaluation may be purely qualitative, purely quantitative or a combination of both qualitative and quantitative. It is relatively easy to quantify the direct benefits such as agricultural produce, timber and fuelwood. In the case of indirect and intangible benefits such as watershed profits (erosion control), pressure of bio-diversity and aesthetic benefits which are often quantified in a qualitative sense, there is more of a problem.

The evaluation of a project depends on the objectives of the project. The following examples of traditional forestry and social forestry projects illustrate this statement.

Tree planting and management in traditional forestry has as its two broad objectives: commercial exploitation and environmental protection, which all have limited attention directed at welfare aspects concerning basic needs for the rural poor. Social forestry on the other hand has different sets of objectives and different management styles. Although some of the products of social forestry projects overlap traditional forestry to some extent, having commercial and market outlets, most of them are for indigenous consumption by the rural poor. They include fuelwood, fodder, charcoal, poles, small timber and minor forest products. In a broader sense, social forestry aims to increase rural employment and to raise the living standards of the rural poor by promoting self reliance through their active participation. This is done, not by increasing the output and income of the project, but by redirecting the project income and benefits to the poorest groups of the rural poor. This means an important objective of an evaluation in social forestry should be to assess whether the project is meeting the needs of the rural poor.

The achievement of different project objectives requires a different type and style of project management. For example, as seen above, decision making in traditional forestry is taken up by management while in social forestry the decision and execution involve both management and participants whose views are considered important. The emphasis in the case of traditional forestry projects tends to be mainly on evaluation of project inputs, outputs and financial flow. In social forestry on the other hand, more emphasis will be placed on an evaluation of project effects and impacts in addition to the project inputs, outputs and cash flow.

Thus, it can be concluded that the nature of evaluation depends on the objectives of the project and the objectives of a project are decided through the development strategies of the nation. The objectives of a project can therefore be expected to be a reflection of the development strategy of a nation. The next section examines the salient features of different development strategies.

### **3.2 Development strategies : the salient features**

To achieve economic growth and social objectives, virtually every country has a systematically elaborated national plan. A project provides an important means by which investments and other development expenditures foreseen in the plan are clarified and realised (Gittinger, 1984). Thus projects are a part of overall development strategies and planning processes. According to Wilber (1969), development means the qualitative changes which imply the creation of a new economic and non-economic structure. It

differs from growth in the sense that growth is a quantitative process, involving principally the extension of an already established structure of production while development implies changes in institutional structures as well. It is argued that growth is a necessary, but not sufficient, condition for development (Nair, 1981).

Taking into the account the social and political realities in developing countries, the International Labour Organisation (ILO, 1976) and Lisk (1977) divide development strategies into three categories namely (a) a growth oriented strategy (b) an employment oriented strategy and (c) an anti-poverty oriented strategy. The salient features of these strategies are given below.

### **3.2.1 The growth oriented strategy**

The growth strategy is an outcome of a view that the objectives of development are directed at improving the conditions in less developed countries relative to those prevailing in the developed countries (Streeten, 1979). Generally, an abundance of unskilled labour and scarcity of resources such as land, capital, skilled labour and foreign exchange are considered as important causes of underdevelopment. Thus capital formation becomes the crucial factor for development (Dopfer, 1979).

The growth strategy therefore aims primarily at increasing the rate of output within an economy over a period of time mainly by increasing the rate of capital formation (Lisk, 1977). It places an emphasis largely on how much to produce and not about what to produce and how to produce. A mobilisation of savings and investment is encouraged. Investment in physical capital increases the stocks, machines and other productive assets while investment in human capital increases the skills and thereby labour productivity. As these investments generate future consumption, the growth strategy discourages present consumption. This is based on the assumption that current consumption will lead to a redistribution of income in favour of the lower income groups which may jeopardise growth by reducing savings and investments. Within the growth strategy it is assumed that the rapid growth of GNP automatically improves the living standard of the poor through the trickle down effect (Hicks and Streeten, 1979).

### **3.2.2 The employment oriented strategy**

The employment oriented strategy reflects a wider definition of development by including the improvement in the living condition of an individual in addition to economic

growth. Growth objectives are modified in the employment oriented strategies so as to maximise, not only output, but also the rate of labour absorption. In other words, it reflects the desire to reconcile economic growth with broader distribution of income through an increase in the level of production employment. The central role of employment rests on two major concepts. Firstly, it provides an individual with an opportunity to participate in society and enhances their sense of worth and dignity. Secondly, it provides income and generates output (Bequele and Freedman, 1979).

For the above reasons, the employment strategy cannot be treated as entirely different from the growth strategy. It retains most of the objectives of the growth strategy but with employment generation as an additional objective.

### **3.2.3 The anti-poverty oriented strategy**

After the experience of the effects of growth and employment strategies during the 1950's and 60's in developing countries it was realised that the trickle down effect failed to tackle the problem of underdevelopment (Brent, 1990; Hicks and Streeten, 1979). This inadequacy led to the formulation of a new strategy called the anti-poverty strategy or 'redistribution with growth' strategy (ILO, 1972; Chenery et al., 1974). This strategy aims at the redistribution of wealth assets and outputs mainly through the reallocation of productive resources in favour of explicitly defined poverty groups. The poverty groups concern mainly small farmers, landless labourers and the rural and urban unemployed.

The anti-poverty strategy seems to be a variant of growth strategies in the sense that economic growth is treated as relevant for the entire economy and only a marginal redirection of investments is made to bring the target group into the main stream economy. In a sense, this approach permits only a part solution to the problem of poverty. Hopkins et al. (1976) in their simulation study on the Philippines concluded that a marginal redirection of investment had very little impact on income distribution. In another study, Chenery et al. (1974) point out that in a developing country a transfer of investable resources from rich to poor led to an initial slowing down of economic activity in private enterprise. A slowing down of the growth rate of the upper income group is likely to affect the income earning opportunities and hence the living standards of the poor (Lisk, 1977). Thus, this strategy seems to be an incomplete solution and is vulnerable to some of the same criticisms that are raised against the growth strategy. According to ILO (1976 and 1977), what is required is the redirection of the content and technique of growth

to meet the requirement of poverty groups rather than a redirection of investment to raise their income. This aspect is dealt with in some detail in the next chapter.

The main difference between the employment strategy and the anti-poverty strategy lies in the fact that the anti-poverty strategy is intended to benefit specific groups exclusively where the employment strategy seeks to raise the level of aggregate employment.

### **3.2.4 The basic needs strategy**

As discussed earlier, the conventional development strategies were found inadequate for solving massive unemployment and widespread poverty in developing countries until the mid seventies (ILO, 1976 and 1977 ; Lisk, 1977; Harberger, 1978; Hicks and Streeten, 1979 ; World Bank, 1980; ICIDI, 1980; Brent, 1990). Subsequently, concern was shifted towards the alleviation of poverty by concentrating on basic human needs. The composition of production and its benefits rather than the index of total production became the principal concern in development strategy.

The ILO<sup>2</sup> (1977) proposed a redefinition of development strategy in terms of fulfilment of basic needs and defined basic needs as:

"..the minimum standard of living which a society should set for the poorest group of its people. The satisfaction of basic needs means the basic requirement of a family for personal consumption: food, shelter, clothing; it implies access to essential services such as safe drinking water, sanitation, transport, health and education; it implies that each person available and willing to work should have an adequate remunerated job" (ILO, 1977, p.7).

The essential concept involved in the above definition of basic needs includes the following two aspects: (i) a minimum requirement of a family for private consumption: food, clothing and shelter and (ii) access to essential services provided by society such as health and educational facilities, safe drinking water, public sanitation, and transport.

It is difficult, however, to precisely define basic needs on a global basis. Opinions diverge considerably because different countries will have different requirements due to differences in their social, economic, political and cultural characteristics. Opinions also vary within a country, between regions, depending on age, sex, class, caste, group and other factors. However, a general consensus exists as regards what constitutes a socially acceptable minimum standard of living. There are certain minimum levels of personal

consumption and access to public services that can be universally regarded as essential to a decent life (Sinha et al., 1979).

Efficacy of interventions to alleviate poverty within the basic needs strategy depends not only on how much is produced but "what is produced" and "how it is produced". The latter two elements give rise to the concept of "product mix" and "factor mix" (Bequele and Freedman, 1979 and ILO, 1977). Product mix concerns the supply of essential goods especially in a closed economy, whereas the factor mix concerns the technique of production. This means that within the basic needs strategy growth is not denied, rather the contents and methods of production are redirected towards production and distribution of essential goods and services.

Within the above conceptual framework, the salient features of a basic needs strategy now can be outlined as below :

- a. It encourages the production of essential items and discourages investment in non-essential items.
- b. It automatically incorporates distributional considerations.
- c. It encourages employment generation to provide basic needs income and should be complementary to the production of basic needs goods.
- d. It argues for self reliance and development based on local resource and skills.

The basic needs strategy is not synonymous with, but similar to, the anti-poverty strategy in many respects. There are however some fundamental differences: first where the conventional anti-poverty strategy is directed at specific poverty groups, the basic needs strategy aims to satisfy the essential requirements of the population as a whole. Secondly the anti-poverty strategy aims to raise the income of the specific poverty group through redirection of investment, whereas the basic needs strategy is concerned with both raising income as well as with increasing the supply of goods and services by changing the content and technique of production.

The basic differences between the growth strategy and the basic needs strategy are :

- a. A growth oriented strategy aims mainly to enhance capital formation to achieve the maximum GNP without encouraging the production and consumption of essential items, while the basic needs strategy emphasises production and present consumption of essential goods and services.
- b. A growth oriented strategy is mainly concerned with how much to produce and not about what to produce (product mix) and how to produce (factor mix). In a basic needs strategy, by comparison, these two components are incorporated through proper consideration of composition of produce and technique of production.

Although economic growth is an important condition for the alleviation of poverty, since rapid growth generates more output, more employment and hence higher income, several studies show that for developing countries there is no strong or obvious relationship between the rate of economic growth and improvement in the living standards of the poor (Brent, 1990; Mc Granahan et al., 1970).

Adelman and Morris (1973), in their study of 43 developing nations and the ILO's (1977) study of rural poverty in seven Asian countries indicate a deterioration in the relative (sometimes in absolute) income position of the poor. To check the correlation between the basic needs indicator and GNP per head (growth indicator) the results, (based on 1970 data from the Worlds Bank social data bank) are presented in Table 3.1 (Brent, 1990). We can conclude from the results shown in Table 3.1 that a moderate correlation ( $r^2 = 0.50$ ) exists between 7 basic needs indicators and GNP per head when all countries are pooled together. However, when the basic needs indicators are disaggregated into a sample of developing and developed countries, the correlation coefficients for both the groups drops significantly (average  $r^2 = 0.25$  and  $0.18$  respectively). These studies suggest that an increase in income will not necessarily increase the satisfaction of basic needs in developing country. However, some recent studies show that an emphasis on basic needs does not necessarily lead to a decline in the growth rate. Sri Lanka may be cited as an example where the growth rate of per capita GNP is higher than other low income countries in spite of the emphasis given to meet the basic needs such as life expectancy, literacy rate and infant survival (World Bank, 1980).

Whatever the link between the growth and basic needs, the two approaches are certainly distinct and different in their characteristics.



**Table 3.1 Correlation ( $r^2$ ) of basic needs indicator and GNP per head.**

Basic needs indicator	All countries	Developing countries	Developed countries
1. Expectation of life at birth	0.53	0.28	0.13
2. % of required calorie consumption	0.44	0.22	0.22
3. Infant mortality	0.42	0.34	0.25
4. Primary enrolment	0.28	0.24	0.05
5. Literacy	0.54	0.47	0.16
6. Average persons per room	0.58	0.08	0.29
7. % of house without pipe water	0.74	0.13	0.36
8. Average $r^2$ of all indicators	0.50	0.25	0.18

Source: Brent (1990).

### 3.2.4.1 The choice of basic needs strategy

A society is called ideal when the satisfaction of basic needs is given foremost priorities (Galtung, 1980). A similar approach has also been followed by earlier thinkers for example Marx (1975) and Gandhi (1966).

However, the feasibility of the application of basic needs strategy will depend on the existence of a decentralised and democratic decision making institution (ILO, 1976). Several studies show that reorientation from the growth strategy needs changes in the social and economic structure (Sinha et al. 1979). This is possible through mass participation in decision making. To encourage public participation in decision making requires the setting up of an institution to enable decentralised decision making at grass roots level. These pre-requisites, however, disqualify most developing countries from adopting a basic needs strategy. Yet, in spite of these problems, there is increasing concern with basic needs, not only in developing countries, but also in developed countries (World Bank, 1980; Nair, 1981; ICIDI, 1980; and E.I.U., 1981).

The necessity of basic needs fulfilment was recognised as the principal aim of development in India after a few years of independence. However, it received proper attention only after realisation of the inadequacy of the first four five year plans (1951 to

1970) in the alleviation of poverty. During these five year plans, development strategies of India were aimed at increasing the economic growth mainly through heavy industrialisation with least attention towards the consumption needs of the rural poor (chapter 1). Since the sixth five year plan, the concept of a basic needs strategy was given added emphasis when a number of land use programmes were launched throughout the country. Afforestation through the Social Forestry Project was one of them. Subsequently, the development strategy of the nation is now aiming to meet the basic needs of nearly one third of its population who are below poverty line.

Techniques for evaluation depend upon the objectives of the evaluation and these in turn are determined by the development strategy of the nation (Nair, 1981). Against this background therefore, a review of the studies on the application of various evaluation techniques in land use projects is given in the next section.

### **3.3 Evaluation techniques and their application in land use projects**

Whenever input and output data is available, computation may be made to quantitatively evaluate the performance of land use projects. Computational methods available for the evaluation of land use projects can be divided into two broad groups namely (a) optimisation and (b) non-optimisation techniques (Hoekstra, 1987).

An optimisation technique enables the analyst to find the optimum solution while a non-optimisation technique determines which of the alternative solutions is a better one, not necessarily the optimum one. A brief description of the methodology and application of different approaches under both techniques is given below.

#### **3.3.1 Optimisation techniques**

##### **3.3.1.1 The linear programming approach**

Linear programming is a computer based technique, which leads to the selection of that mix of activities which maximises or minimises an objective function subject to a series of resource constraints. The objective functions may comprise a list of objectives generating different amounts of revenue and requiring different amounts of resources. Conversely it may comprise activities generating different cost levels. In the former case the objective function will be maximised and in the latter it will be minimised. A variation (multiple objective programming) allows the identification of more than one objective

function which can then be used to generate alternative as opposed to just one optimal solution (Mendoza, 1987; Wojtkowski et al., 1989). Basic text books on linear programming explaining the theory as well as construction of matrix are written by Beneke et al. (1978) and Heady et al. (1958). Its application in agroforestry has been made by Dykstra (1980), Verinumbe (1981), Verinumbe et al. (1984), Raintree et al. (1980) and Lubega (1987). Most of them have developed a linear programming model in an evaluation of the economic attractiveness of various types of hedgerow intercropping. The main objective in their study was to maximise the annual net revenue. Linear programming has been applied by Spall et al. (1988) and Mendoza et al. (1987) in assessing the profitability of silvi-pasture agroforestry systems.

### **3.3.1.2 The non- linear programming approach**

Studies based on non-linear techniques use models that allow for non-linear relationships. These include changing returns to scale in input use, other non-linear constraints or a non-linear objective function. Analyses based on this technique in agroforestry are very limited in number (Swinkles and Scherr, 1991). Wojtkowski (1989) has developed a bio-economic model to simulate a polycultural (multi species, multi variable agroforestry) system to find level of productivity and system formulations yielding greatest economic benefits. Wojtkowski et al. (1989) have also used this approach in handling non-linear constraints with non-linear objectives functions in bio-economic modelling of multi-canopied agricultural system.

A mathematical model utilising non-linear programming to generate land use allocation alternatives for an agroforestry system has been developed and its use was illustrated with a case study in hedgerow intercropping (Mendoza et al., 1986 and 1987).

### **3.3.1.3 The production- function approach**

Production-function analysis looks in detail into the relationship between inputs and outputs graphically within a given budget constraint. The relationship can be linear or non-linear and is depicted via production possibility curve. It evaluates marginal changes in quantities or prices of inputs and outputs in the short to medium term in order to identify the optimal point of operation, explains how economic variables change in relation to each other and allows comparison of different agroforestry products. This approach was applied by Gregory (1955) considering two possibilities i.e. timber and forage. It has also been used by Paraffina (1989) in assessing environmental benefits in agroforestry

projects and Rangnathan et al. (1989) in evaluating biological productivity in intercropping. Although the production function technique provides a better understanding of variables in a system and allows optimisation over a continuous range, its weaknesses lie in its difficulties in handling the complex land use system such as agroforestry mathematically with regards to the selection of key variables. It requires many observations of inputs and outputs at different levels of inputs. Such type of data can be available either through experimental observation (designed specifically to generate production response) or through field survey where farmers operate with different levels of inputs.

Because of rather a large amount of data requirement for long period, optimisation techniques are not very common in the evaluation of land use projects such as agroforestry and forestry. They are also not appropriate when we are simply trying to appraise the profitability or impact of land use projects (as in the present study) and selecting the best alternatives, rather than optimising.

For the above reasons, Etherington et al. (1983) argued that whereas an analytical approach purely based on mathematical equations and graphical presentation may be useful for academic purposes, for field use a tool such as partial budgeting and cost-benefit analysis are more appropriate.

### **3.3.2 Non-optimisation techniques**

#### **3.3.2.1 Farm budgeting approach**

Farm budgeting is one of the approaches which can be used where the objective is insight rather than optimisation. A microscopic view is provided in terms of costs and returns of a farm or farm enterprise in a particular season or year or for a few years or seasons. Such analysis may be carried out to quantify the effects of an agroforestry intervention by comparing such costs and returns on cash. It is usually conducted at a farm level and operates in two process (a) whole farm budgeting and (b) partial budgeting. This technique has been described in detail by Dillon et al. (1980) and Rae (1977). A brief review of the studies using both categories of farm budgeting approach is given below.

The whole farm budgeting approach assesses the overall impact of an agroforestry technology on the whole system and includes a budget for the whole farm. The feasibility

of the technology is tested in terms of its resource requirement and how this affects other farm activities. An analysis of agroforestry system using whole farm budgeting has been done by Mary et al. (1987) in a home garden and Mary et al. (1981) and FAO (1981) in a taungya afforestation project. Because of the huge amount of data required when using this technique, examples of the application of whole farm budgeting in agroforestry are few.

A partial budgeting approach is used where it is assumed that an agroforestry technology or practice only affects a particular enterprise or subsystem on the farm, which can then be considered separately. Only those items which are likely to change i.e. additional resources which arise from the use of the technology, are included in the partial budgeting exercise.

Its application in the analysis of agroforestry systems has been found in a larger number of studies in comparison to whole farm budgeting. Some of the important studies using partial budgeting in agroforestry systems include Kass et al. (1989), Mittal et al. (1989), Balasubramanian (1983), Thomas (1990), and Avila (1989) for hedgerow intercropping. Nair (1979) and Shekhawat et al. (1988) had used this approach in evaluating intercropping where trees were mixed with annual crops; Mishra (1979) and Lahiri (1972) and Thomas et al. (1991a) in taungya plantation and Kumar (1981) and Lagemann et al. (1983) in intercropping where trees were mixed with perennial inter crops.

### **3.3.2.2 Cost-benefit analysis approach**

Among the various non-optimisation techniques available, the cost-benefit analysis (now on wards CBA) approach is more commonly known, having been used since its development in 1936 in the United States in the context of water resource projects.

CBA is a systematic method of assessing the impact of a project by comparing its costs and benefits. It is defined as "...an economic appraisal of the costs and benefits of alternative courses of action whether those costs and benefits are marketed or not to whomsoever they accrue, both in present and future time, the costs and benefits being measured as far as possible in a common unit of value" (Price, 1989)

The main objectives of undertaking CBA are firstly to estimate in qualitative terms the impacts of a given alternative on a specific objective and secondly to identify those

which contributes most to the object to help in decision making. It provides a valuable framework for evaluation of a project. CBA has been used to evaluate land use projects in developing countries by many workers and institutions (Leslie, 1967; Little and Mirrlees, 1974; Irvin, 1978; UNIDO, 1978; FAO, 1979; ODA, 1988; Kumar, 1988 and Khan, 1993). A distribution of economic studies based on different types of analyses included in recent bibliographies on the economic analysis of agroforestry technologies (Swinkles and Scherr, 1991) is presented below in Table 3.2.

It is clear that applications using a cost-benefit approach outnumbered (55%) all other analyses in the context of agroforestry. Only 13% of the total entries used any type of optimisation technique whereas a further 20% used budgeting of one kind or another. CBA using economic prices were very few (3%) and there was not even a single cost benefit analysis which explored the impacts of an agroforestry project based on actual field data from a social perspective. Within cost-benefit analysis itself, *ex-ante* analysis far outnumbered *ex-post* analysis.

**Table 3.2 Distribution of studies based on types of economic analysis in agroforestry.**

Type of analysis	No. of documents	% distribution
<b>(1) Optimisation technique</b>		
a. Linear programming	18	8
b. Non-linear programming	5	2
c. Production - Function	8	3
<b>(2) Non-optimisation technique</b>		
a. Whole farm Budgeting	9	4
b. Partial budgeting	36	16
<b>(3) Cost-benefit technique</b>		
a. <i>Ex-ante</i>	67	29
b. <i>Ex-post</i>	29	13
c. <i>Ex-ante</i> and <i>ex-post</i>	22	10
d. Economic	6	3
e. Social	0	0
<b>(4) Agroforestry sector analysis</b>	27	11
<b>(5) Regression analysis</b>	3	1
<b>All analyses</b>	<b>230</b>	<b>100</b>

Source : Compiled from Swinkles and Scherr (1991).

CBA as a technique is a way of setting out the factors which need to be taken into account when making certain economic choices by estimating the net beneficial effects (Prest and Turvey, 1965). It also takes into account the time value of money by incorporating the discounting decision criteria (Stocking et al., 1991). The unit of measurement known as the numeraire used in CBA is either expressed in units of local (UNIDO, 1978) or foreign currency (Little and Mirrlees, 1974). However, according to Price (1989) it is convenient if numeraire is taken as the "value at present day prices of domestic currency used for consumption by citizens having the mean income level for the country".

The guidelines of OECD (1968) and UNIDO (1972) provided the first step towards the application of modern CBA in developing countries. The methodologies were evolved for studying the desirability of projects from the point of view of the requirements of the Third World countries. Subsequently, the guidelines have been revised and further developed (Little and Mirrlees, 1974; UNIDO, 1978). Under various requirements and situation these two methodologies have been refined and applied by many workers (Squire and van der Tak, 1975; Bruce, 1976; World Bank, 1976; ODA, 1977; Irvin, 1978; Bruce et al., 1978; FAO, 1979; Gittinger, 1982 and 1984; ODA, 1988; Brent, 1990). Nevertheless, the two most widely known methodologies in the field of applied cost-benefit analysis are:

- i Little and Mirrlees (LM) methodology (1974) and
- ii Modified UNIDO methodology (1978)

The Little and Mirrlees methodology, briefly referred to as LM methodology, was developed in its present form by I.M.D. Little and J.A. Mirrlees in their book - Project Appraisal for Planning for Developing Countries, 1974. The modified UNIDO methodology, simply referred to as UNIDO methodology, now has been proposed and discussed in the book-Guide to Practical Project Appraisal : Social Benefit-cost Analysis in Developing Countries, 1978. There is little difference between both these methods, as they stand today, in terms of their fundamental perspective on project evaluation.

The main difference between the present form of the two methodologies is essentially the unit of account or the numeraire used. In the Little and Mirrlees method, the numeraire is measured in terms of uncommitted social income in terms of convertible foreign exchange whereas UNIDO numeraire is the aggregate consumption of an average income consumer measured in domestic currency.

In the Little and Mirrlees method, the numeraire is measured in terms of convertible foreign exchange available to government for investment. This focuses directly on trade efficiency and hence the values of inputs and outputs are expressed in terms of border prices. The border price is defined as the price of tradable goods at a country's border or port of entry: for exports the f.o.b (free on board) price; for import the c.i.f (cost, insurance and freight) price. The border price is a measure of economic opportunity cost and can be expressed in dollars or border accounting prices. The border prices in dollars, if multiplied by official exchange rate<sup>3</sup>, would be converted into a border accounting price. This method is easier to grasp when inputs and outputs are entirely traded. The ratio of border prices in dollars of an average basket of goods to its domestic market price expressed in dollars in official exchange rate is called the "Standard Conversion Factor"<sup>4</sup> and is typically used to convert the market prices into border prices.

In the UNIDO method the numeraire used is the domestic currency rather than the border prices. The domestic accounting prices of UNIDO are however different from domestic market prices in that the former reflects a shadow price relationship whereas the latter reflects the market price relationship. The domestic accounting price is also different from border accounting prices in that it includes the average distortion between border and market prices. Border prices plus a premium on foreign exchange<sup>5</sup> become values measured in domestic accounting prices. These aspects are dealt with in detail in the next section.

Another difference is that the Little and Mirrlees method tends to treat goods as tradable. As such, it deflates the non-tradable to their border prices. The UNIDO method on the other hand, tends to treat goods basically as non-tradable without any foreign exchange impact, recognising maximisation of benefits within the prevailing trade barriers. It examines the willingness of consumer to pay for goods in the domestic market, so the tradable are raised to average domestic price levels.

The two methodologies nevertheless reach the same conclusion concerning the relative desirability of projects provided the parameters mentioned above are estimated on the same assumption (Khan, 1993; Trivedi, 1987).

Matters concerning the distortion of market prices and distributional issues in the developing world, have led to CBA being divided into following three major types.



- a. Financial cost-benefit analysis (FCBA)
- b. Economic cost-benefit analysis (ECBA)
- c. Social cost-benefit analysis (SCBA)

**a. FCBA**

FCBA provides a practical means of assessing the profitability of an investment and its financial impact on potential investors including farmers, the private entrepreneur and profit oriented enterprises (FAO, 1991). In other words it measures the financial or commercial profitability of a project or enterprise from the point of view of the private individual or entrepreneur. It achieves the efficient allocation of resources by maximising the net benefits accruing to the owner. It forms an integral part of project design because technical, economic, social and institutional aspects are all interrelated. The costs and benefits are evaluated at market prices.

**b. ECBA**

In ECBA the perspective from whose point of view the analysis is done changes from private individuals or enterprise to the society or nation as a whole. The aim of ECBA is to examine the project in terms of its contribution to the general objectives of the economic growth for the society or a nation as a whole. In other words it is concerned with the efficient allocation of resources for maximising the profit of the project for the society or nation as a whole. The analysis is concerned with the real resource flow and hence distortion in market values of costs and benefits are adjusted on several points to reflect the withdrawal and addition of inputs and outputs to the society or nation. Nevertheless, it does not tell the user anything about the distribution of benefits and costs among the different groups of society. Rather it assumes that the existing distribution of income is correct from a society point of view, i.e. the marginal utility of income is equal for all income levels.

**c. SCBA**

In SCBA an attempt is made to consider the aspects of efficiency and distribution of income together. It examines the social impact of a project from point of view of the distribution of a project's income amongst the various groups of the society (Squire and van der Tak, 1975). The distributional element in SCBA is concerned with two dimensions of income distribution.

- a. Distribution between contemporaries (inter-personal dimension) and
- b. distribution between present and future (inter-temporal dimension).

The financial and economic data provide the basic input to which adjustments are made (discussed in detail in next section) to reflect the different values attached to distribution of income between rich and poor groups in society and between consumption and investment in general (Squire and van der Tak, 1975). Thus it is more subjective in nature than either FCBA or ECBA and requires a detailed description of costs and benefits. Currently, SCBA is of greater significance because governments in many developing countries are making huge investments of public funds for development activities which have significant impact on large sections of the society. There is therefore an urgent need for the full justification of these projects from a social perspective. While the whole philosophy of SCBA appears to be conceptually sound, a difficulty in its application lies in the computation of the necessary distributional weights due to lack of generally acceptable income weights for different groups of society (FAO, 1979). These aspects are discussed in detail in the next section.

A framework for CBA and its application in land use projects, particularly agroforestry, forestry and agriculture, are discussed in the next section.

### **3.4 A theoretical framework of CBA and its application in land use projects**

#### **3.4.1 FCBA**

The logical framework for an evaluation of project alternatives is one which maximises the net benefits over time. The main objective of financial analysis is to demonstrate the financial cash flow expected to be generated by it, are attractive to the perspective investors inducing them to contribute equity funds to the particular project rather than to employ them elsewhere. Thus financial analysis is essentially taken for the following purposes.

- a. to determine the financial viability of a project or enterprise.
- b. to assess adequacy of a financing plan for new project or business.
- c. to advise the method of improving the viability of a project or enterprise.
- d. to plan and control project enterprise operation

### **3.4.1.1 Steps of financial evaluation**

Within the above mentioned framework the financial evaluation of a project broadly involves the following steps.

- a. Identification of project's inputs and outputs.
- b. Quantification of project's inputs and outputs.
- c. Valuation of project inputs and outputs at market prices (adjusted to account for inflation).
- d. Choice of suitable discount rate.
- e. Selection of suitable decision criteria.
- f. Computation of financial profitability using suitable decision criteria and selection of best alternatives.

#### **3.4.1.1.1 Identification of inputs and outputs**

The identification will involve the setting up a logical framework as to what is going in and what is coming out in a project. The individual details of the inputs and outputs involved in each project need to be identified from various sources. The inputs involved in land use project may include, for example land, labour, seeds of agricultural and forestry crops, seedlings, polythene bags, fertilisers, insecticides and tools and equipment. These may be referred to as direct inputs. Besides these, there may be other inputs involved indirectly in various activities of a project. For example, salaries and allowances to permanent staffs, maintenance of office buildings and vehicles and the inputs involved in research, training, monitoring, evaluation and protection of the plantations. These types of inputs may be referred to as indirect inputs (Khan, 1993).

Like inputs, identification of outputs is equally important for financial evaluation. The identification of the outputs for financial analysis is confined only to the direct outputs (FAO, 1991). The direct outputs obtained from the land use project may include (a) the agricultural products and (b) the forestry products. The former comprise the food grain crops such as paddy, maize, black gram, green gram, red gram, horse gram, sesamum and groundnut as well as vegetable and fruit crops such as dioscorea, and pineapple respectively.

The trees from the agroforestry and forestry projects may provide a variety of intermediate products such as grasses, dry leaves, twigs, fodder, bamboo and minor forest products and final products such as main timber and firewood of various species.

#### **3.4.1.1.2 Quantification of inputs and outputs**

The next step after identification of inputs and outputs is their physical quantification. This involves putting the numbers (such as kgs, grams, quintals, hectare, litre etc.) to different inputs and outputs involved in a project over different period of time preferably on annual basis or crop year basis in land use projects. The details of the annual requirements of various inputs and production of various outputs of a project can either be collected through field survey or through official sources or both. Like inputs, the benefits accruing from a project can also be divided into direct and indirect benefits. It is relatively easy to quantify the direct benefits such as agricultural products, timber, fuelwood and intermediate benefits of trees obtained from land use projects. The quantification of indirect benefits, particularly the environmental services side of forestry and agroforestry are more of a problem. They are quantified in terms of their qualitative sense e.g. benefits from watershed protection, preservation of bio-diversity, aesthetic benefits and contribution to tourism. However in financial evaluation, only direct benefits are taken into consideration (FAO, 1991).

The quantification of intermediate benefits from trees such as dry leaves, twigs, grass, minor forest products and firewood if not available in records, can be undertaken through the questionnaire survey. Also, where the trees have not been harvested, benefits from the trees can be estimated on the basis of the yield tables.

Inputs and outputs are also scheduled within a time frame, that is, the points in the lifetime of the project when they occur are estimated.

#### **3.4.1.1.3 Valuation of inputs and outputs**

After identification and quantification of inputs and outputs in physical terms over a period of time the next step is to give them an appropriate value. Valuation of inputs and outputs in a financial evaluation involves the use of market prices (Vergara, 1982; Hoekstra, 1985). In projects like agroforestry and forestry, where the major part of the investment is made in the initial years as with plantation establishment, while the major benefits start accruing at a later stage of the project, it becomes essential to deal with the

effects of inflation. One approach is to express all costs and benefits in real terms if the analysis is carried out as an *ex-post* basis (Khan, 1993). This is done by multiplying the annual costs and benefits by appropriate inflating factors. Year wise inflating factors are computed from the wholesale price index of all commodities with the base year shifted to the desired year. Using costs and benefits in real terms annual cash flow generated by the project is then computed by subtracting the annual costs from annual benefits.

Many evaluators have avoided the consideration of indirect cost in the financial evaluation of projects (Arnold et al., 1987/88; Verma, 1988; Singh and Ballav, 1989; OFD, 1987b; World Bank, 1990; Desmond et al., 1992; Search India, 1991 and ORG, 1991). However, this does not seem to be justified, because indirect costs also have an effect on the financial profitability of any project (Khan, 1993).

#### **3.4.1.1.4 Choice of suitable discount rate**

When we are considering investment in a new project which will last for more than one year such as agroforestry and forestry, it is essential to know whether or not it is both profitable (worthwhile) and practically possible (feasible). To discover the profitability one would expect to simply add net benefits (benefits minus costs) for each year of the project in order to see if the stream of future net benefits was greater or less than the initial investments. However this is not correct because, the money tomorrow is not the same as money today (Bright, 1991; Price, 1989). Again the question arises as to why not ? This is because of the opportunity cost of capital. If capital is tied up in this project one has to forgo the opportunity to invest it and so generate a return or interest in its next best alternative use. Alternatively, if one has to borrow the money in order to invest, then one must pay interest on the sum outstanding each year. Either way money today is not the same as money tomorrow. In other words, value of a rupee in hand today is not same as a value of a rupee in hand after one year (Price, 1989).

Future net benefits must be therefore expressed in terms of the money at a particular point of time if it is to be added up. It is like trying to add amounts expressed in pesos, roubles, sterling, dollars and francs - in order to add them they must be put on same basis i.e. conversion factors are necessary. In other words to make a comparison between the costs and benefits of a project which have different flows of cash, costs and benefits are brought back to a common denominator, normally the present value. This is done by a procedure called discounting, the formula for which is presented below:

$$V_0 = \frac{V_t}{(1+r)^t} \quad (3.1)$$

where  $V_0$  is the present value ;

$V_t$  is the value in year  $t$  ;

$r$  is the discount rate ;

$t$  is the number of years until future values occur and

$\frac{1}{(1+r)^t}$  is termed the discount factor.

Vergara (1982) and Hoekstra (1985 and 1986) reported that selection of a discount rate when evaluating an agroforestry system needs careful consideration, especially when dealing with subsistence-oriented farming. The marginal investment rate should normally be equivalent to the opportunity cost of a firm's investment funds if being financed from its equity holdings or the market rate of interest if funds are being sought. Usually the formal market rate of interest is taken as the discount rate for calculating the financial profitability. However, these interest rates are expressed in nominal terms and if costs and benefits are to be expressed in real terms, the discount rate must be expressed in real terms too.

An estimation of the real interest rate over the lifetime of the project requires an estimation of the inflation rate over that period. The real interest rate can be calculated using the following formula (Bright, 1992):

$$r = (1+i) / (1+f) - 1 \quad (3.2)$$

where  $r$  is the real interest rate;

$i$  is the nominal market interest rate and

$f$  is the rate of inflation.

In general, evidence suggests that the most commonly applicable market interest rates can be taken as between 10 and 20% under Indian conditions (Sharma, 1990; Trivedi, 1987; Khan, 1993 and Mathur et al., 1984). Similarly inflation during the nineties varied between 5 and 12% per annum. This would tend to give a slightly lower real discount rate than 10% used for the financial NPV and BCR both in a Social Forestry Project application in Gujarat by Khan (1993) and also in evaluation of the Social Forestry Project in Orissa by Sharma (1990). However, in view of the impact of different

discount rates on measures of project worth it is important to utilise sensitivity analysis (Khan, 1993 and Sharma, 1990).

#### 3.4.1.1.5 Selection of decision criterion

To measure the profitability of an investment or relative profitability of several incompatible or competing investments a suitable decision criterion plays a very important role. The following are the most commonly used performance indicators associated with discounting procedures:

- i. Net Present Value (NPV);
- ii. Benefit Cost Ratio (BCR) and
- iii. Internal Rate of Return (IRR).

NPV is the difference between the sum of discounted benefits and discounted costs and the ratio of these is called the BCR. The IRR is the discount rate at which the sum of discounted benefits and discounted cost are equal. Mathematically these three indicators can be expressed as :

$$NPV = \sum_{t=1}^n \frac{(B_t - C_t)}{(1+r)^t} \quad (3.2)$$

$$BCR = \sum_{t=1}^n \frac{B_t}{(1+r)^t} \bigg/ \sum_{t=1}^n \frac{C_t}{(1+r)^t} \quad (3.3)$$

and IRR is the  $r$  (discount rate) which makes

$$\sum_{t=1}^n \frac{B_t}{(1+r)^t} = \sum_{t=1}^n \frac{C_t}{(1+r)^t} \quad (3.4)$$

where  $B_t$  is the benefit in year  $t$ ;

$C_t$  is the cost in year  $t$  ;

$r$  is the discount rate ;

$t$  is the year of project and

$n$  is the life time of project.

NPV therefore reflects a process whereby the future costs and benefits from a project are discounted to a present value at a rate of interest which in turn should reflect the marginal investment rate. The marginal investment rate should normally be equivalent to the opportunity cost of a firm's investment funds. The NPV is measure of the difference between these benefits and costs. If the NPV is positive at the chosen discount rate the project is financially viable. If it is negative, it is not. NPV can be expressed as per unit of any production factor, for example, per hectare of land.

BCR is computed by dividing the present value of benefits by present values of cost. A project having a benefit-cost ratio of more than one indicates a financially viable project. BCR, as Mishan (1975) states, is a variant of NPV.

IRR is the rate of interest which the project can just afford to pay (Barnard and Nix, 1978) or "the rate of return on capital outstanding per period while it is invested in the project (Merrett and Sykes 1963, p.38)." More precisely, it is the discount rate which when used to discount the net benefits associated with a project, reduces its NPV to zero. It thus gives a measure of the 'break even' rate of return of an investment, since it shows the highest rate of interest at which the project makes neither a profit nor a loss. If the IRR of a project is greater than the rate of discount then that project is worth undertaking and conversely if the IRR is smaller.

Above expressions (3.1 to 3.3) indicate that these three measures are closely related such that if using the discount rate  $NPV = 0$ , then  $BCR = 1$  and  $IRR = r$  and if  $NPV > 0$ ,  $BCR > 1$  and  $IRR > r$ .

Nevertheless, there are certain relative advantages and disadvantages to these indicators which must be examined before an indicator is selected.

In general, all of the above criteria arrive at a similar decision in the case of independent projects having no operational resource constraints such as funding. However, when projects are interlinked or mutually exclusive (acceptance of one of the projects excludes the selection of the remaining projects) or when there are constraints on investment funds available, differences in ranking between alternative projects can emerge from using different decision criteria.



There has been an extensive debate during the last few decades over the choice of the correct decision criteria and ways to overcome the drawbacks in their uses (Trivedi, 1987). According to Irvin (1978), NPV is the most relevant criteria where capital funds are unlimited and projects are mutually exclusive. In the use of IRR two clear groups have emerged. Feldstein and Flemming (1964), Das Gupta and Pearce (1972), Gansner and Larsen (1969), Price and Nair (1984) and Brent (1990) are critics of the use of IRR whereas Foster and Brooks (1983), Schallau and Wirth (1980) and others are in favour of its use (Trivedi, 1987).

The main advantage of IRR is that it is expressed as a single percentage figure and so comparison, either with costs of borrowing or rate of return from alternative projects is easy. Nevertheless, its use has been criticised because of three main problems.

The first one concerns the problem of multiple roots. That is, there may be more than one discount rate which gives an NPV of zero. This may occur when the project cash flow changes sign more than once (from negative to positive and back to negative, for example). This may be overcome by using the admittedly, not wholly satisfactory, extended yield method whereby the later values are discounted back one at a time using the discount rate until the cash flow stream changes sign only once.

The second problem is due to the cross over discount rate. If two projects have different patterns of cash flows it is possible for ranking according to IRR to differ from that using the NPV's. Although the IRR indicates the project with the greatest percentage return, it does not necessarily indicate that project with the highest amount of profit.

The third problem arises in the case of mutually exclusive projects. If projects are of different sizes and lifetimes, ranking according to its IRR can differ from that of NPV, and in such a situation if maximum profit were desired, the latter would give the correct ranking. Adjustment to IRR can be made, but these only add to the complications.

IRR does not give the correct decision mainly because it ranks the project irrespective of market rate of interest (Trivedi, 1987) for example, if there are two projects with IRR equal to 15% and 18% and the market interest rate is 12%, the IRR criterion only infers that both the projects are independently worth accepting and not the projects with highest IRR (18%) is preferable. The above exclusive discussion on IRR concludes that it

does not give straightforward decision like NPV. However it continues to be used by many international development agencies such as the World Bank (Gittinger, 1982).

BCR can also be misleading and suffers from a few criticisms (Gittinger, 1984). It is merely a ratio and unable to indicate the true value of net benefit. For example, a project with rupees 100 as the sum of discounted costs and rupees 150 as sum of the discounted benefit has the same BCR (1.5) as another project with rupees 150 as cost and rupees 225 as benefit, but NPV for the former is lower than the latter.

Thus, the NPV per unit area is, in general the more preferable criterion, both in independent as well as mutually exclusive projects, to assess the desirability of the project and compare with alternatives.

Financial evaluation using NPV as a decision criterion in agroforestry has been employed in several studies. For example, for alley cropping, Hoekstra (1983); Avila (1989); Reddy et al. (1985); Chatterji (1985); Ngambeki (1984 and 1985), Arnold (1987), Thomas et al. (1991b) and Vergara (1982) in alley cropping measure according to NPV.

Similarly, for studies on intercropping, where trees are mixed with annual crops, Sharma (1990); Kurtz et al. (1984 and 1985); Reiche (1988); Shah (1988); Duldulao (1985); FAO (1981); Hosier (1987 and 1989); Reddy et al. (1985), Sekar et al. (1989), Joseph (1986); Craca et al. (1986); Harou (1983); Srinivasan et al. (1990) and Thomas et al. (1992) use NPV as have Etherington et al. (1981 and 1983) and Garrett et al. (1983) in assessing the economics of perennial crops mixed with trees. Hoekstra (1978); Ball (1977); Vega (1979); Mruthunjaya (1981) and Hofstad (1978) have used NPV for assessing the financial profitability of taungya projects.

In forestry plantation projects, NPV has been used as the criterion to measure the profitability (Price and Nair, 1984; Price, 1989; ODA, 1988 and Brent, 1990). According to Sharma (1988) NPV has been found suitable for analysing subsistence oriented social forestry project in Indian condition. Bromley (1981); FAO (1979); Gupta et al. (1982); Gupta (1982); Openshaw et al. (1989); Srivastava et al. (1979); Mathur et al. (1984); Khan (1993); Kala et al. (1975) and Trivedi (1987) have also used NPV as decision criterion in assessing the financial evaluation of forestry projects.

Ideally all three measures should, however, be used to increase the transparency of an investment decision (Khan, 1993; Trivedi, 1987) .

### **3.4.1.1.6 Computation for financial profitability**

The final steps in the financial evaluation are the computation of the performance indicator and the selection of the most suitable project. A sensitivity analysis can also be carried out at different discount rates to test the variation in profitability. On the basis of the decision criteria the alternative whose performance is found best is selected as the best alternative.

### **3.4.2 ECBA**

As discussed earlier, in economic evaluation, the perspective from which the analysis is done changes from that of private individuals or enterprise to that of the society as a whole. Although the underlying tools used in financial and economic analysis are not different, there is a difference in approaches as ECBA takes a broader view of costs and benefits than FCBA. The approaches differ in the following important ways.

#### **1. Valuation of inputs and outputs**

In FCBA, inputs and outputs are evaluated at market prices but market prices can be taken as true economic worth of resources and commodities only under the existence of a perfectly competitive market. Due to distortions in the current workings of the price mechanism in the Third World countries, the market prices do not necessarily reflect the true value of inputs and outputs. The inherent imperfections of market mechanisms, irrational government interventions by way of foreign trade controls, industrial licensing and various forms of price controls (taxes and tariffs) are all important causes of distortion. However, some of these assumptions had been challenged. For example, Lal (1983 ; 1985) questions the validity of the issue of inherent imperfections of market mechanisms and Price (1987) questions the validity of measuring the opportunity costs at market prices when market prices are not accepted as a direct measure of value. In spite of these contradictions, correction of distortions in prices are however, still increasingly being recognised as applicable in any economy (Khan, 1993).

In order to overcome the above mentioned deficiencies of market prices, a technique of shadow pricing was developed to replace the market prices by shadow prices. According to Squire and van der Tak (1975) shadow prices can be defined as " the value of the contribution to the country's basic socio-economic objectives made by any marginal change in the availability of a good or factor of production." In other words, the shadow

prices are the imputed prices which reflect the real costs of inputs and value of outputs to the society or nation and are taken as internationally competitive prices. The shadow prices derived in pursuance of the growth objectives alone are called "efficiency prices or accounting prices or economic prices" whereas those based on growth with equity objectives are called "social prices". The analysis based on efficiency or economic prices is called ECBA and that based on social prices is called SCBA.

Economic shadow pricing is done by expressing the value of resources in terms of their opportunity costs i.e. the output forgone in the alternative use of resources. In ECBA the financial prices of tangible items are adjusted in three successive steps to reflect the economic prices. These are (a) adjustment for direct transfer payments and receipts, (b) adjustments for price distortions in traded items and (c) adjustments for price distortion in non-traded items. A brief descriptions of three adjustments are given below.

**a. Adjustments for direct transfer payments and receipts**

In financial analysis all payments that reduce the monetary resources of a project are costs and all receipts that increase the financial resources of a project are benefits. Economic analysis, on the other hand, includes as costs only those payments which reduce national real resources and includes as benefits only those receipts which increase national real resources. "Monetary resources are different from real resources by the fact that there are certain payments and receipts which are in the nature of a transfer from one section of the society to another section of society and, do not in any way affect the total availability of real resources to the economy as a whole" (FAO, 1991). These are called direct transfer of payments and receipts. Taxes and direct subsidies are the most common example of transfer payments and receipts in land use projects. The first step in adjusting financial prices to economic value is to eliminate all the items under direct transfer payment and receipts.

Before adjusting the financial prices of traded and non-traded items of a project, it is important to understand the aspect of a premium on foreign exchange (Gittinger, 1984). This is needed because in many Third World countries, as a result of national trade policies (including tariffs and taxes on imported goods and subsidies on export), people pay a premium on traded goods over what they pay for non-traded goods. This premium is not adequately reflected when the prices of traded goods are expressed in domestic currency equivalent at the official exchange rate. The premium represents the additional amount that users of traded goods, on average are willing to pay to obtain one more unit

of traded goods. By applying the premium to traded goods it becomes possible to compare the values of traded and non-traded goods by the criterion of opportunity cost. Although this premium is commonly referred to as the foreign exchange premium, it is actually a premium for traded goods as foreign exchange itself has no intrinsic value.

Depending on the methodology of CBA (i.e. LM or UNIDO) the premium on traded goods can be incorporated in two ways. The first is to multiply the official exchange rate by the foreign exchange premium which yields a shadow exchange rate<sup>6</sup>. The shadow exchange rate is then used to convert the foreign exchange price of traded items into domestic currency. The effect of using a shadow exchange rate is to make traded items relatively more expensive in domestic currency by the amount of the foreign exchange premium. This approach has been used in UNIDO guidelines (UNIDO, 1972 and 1978).

The alternative way is to use a standard conversion factor which is derived by taking the ratio of the values of all exports and imports at border prices to their values at domestic prices (Squire and van der Tak, 1975, p. 93). Border prices reflect the prices of export goods (f.o.b.) and prices of import goods (c.i.f.) at a country's border or port. Little and Mirrlees and Squire and van der Tak both adopt this approach. This is sometimes called "conversion factor approach" and is the simplest form based on straightforward efficiency approach. This approach bears a close relation to a shadow exchange rate approach. Indeed the standard conversion factor may be determined by dividing the official exchange rate by the shadow exchange rate or by taking the reciprocal of 1 plus the foreign exchange premium stated in decimal terms. The market prices of non-traded items are then multiplied by this conversion factor which reduces them to their appropriate economic value. The relationship between both the approaches can be seen in the equation given below (Gittinger, 1984).

OER X (1+ Fx premium) = SER and

$$\frac{1}{(1 + f x \text{ premium})} = \text{SCF}$$

so that, as Squire and van der Tak note ((1975, p. 93)

$$\text{SER} = \frac{\text{OER}}{\text{SCF}} \text{ and } \text{SCF} = \frac{\text{OER}}{\text{SER}}$$

where OER is the official exchange rate ;

SCF is the standard conversion factor ;

SER is the shadow exchange rate and  
Fx premium is the foreign exchange premium.

#### **b. Adjustments for price distortions in traded items**

The second step in adjusting the financial prices to economic values is the adjustment for distortions in the market prices of the traded items. Traded items are those whose "production or consumption will affect a country's level of import and export on the margin" (Gittinger, 1984).

First of all the valuation of border prices (i.e. c.i.f for export and f.o.b. for export items) is carried out. The border prices are then adjusted to allow for domestic transport and marketing cost between the point of import or export and the project site.

If the conversion factors are being used to allow for the foreign exchange premium, the economic value of a traded item would be obtained by converting the foreign exchange price to its domestic currency equivalent using the official exchange rate.

If the shadow exchange rate is being used to allow for the foreign exchange premium, the economic value of a traded item would be obtained by converting the foreign exchange price to its domestic currency equivalent using the shadow exchange rate.

#### **c. Adjustment for price distortions in non-traded items**

Non-traded items are "not traded across the national boundaries of a particular country either because of their cost of production or because of restrictive trade practices" (Gittinger, 1984). Often these items are bulky and by nature tend to be cheaper to produce domestically than to import. Some examples are straw, bricks or perishable materials such as vegetable, milk. Some non-traded items involve using significant amounts of imported raw materials such as machinery assembled domestically from imported components such as "neptha" as an ingredient in polythene manufacturing used for raising seedlings for plantation.

If the non-traded items are bought and sold in relatively competitive market, the market price is generally the best estimate of an opportunity cost. However, for

institutional reasons of one kind or another (as stated earlier) the market prices vary significantly from the opportunity cost of items to the society. Two such non-traded items in land use projects are land and labour.

The economic price of land is same as the opportunity cost of land i.e. net value of production forgone when the use of land is changed from its without project use to its with project use . But the main problem is to find a correct equivalent value for this.

The market wage rate in many developing countries may not necessarily reflect the opportunity cost of shifting labour from its without project occupation to its with project use. This is mainly due to existence of unemployment and underemployment. Thus the measurement of unemployment becomes the crucial factor in the real wage estimation of the labour. The real wage rate (also called shadow wage rate) of labour is estimated on the principle of the opportunity cost i.e. the marginal value product or the net economic value of labour foregone elsewhere before of its use in the activities of the project.

It is easy to estimate the shadow wage rate of skilled labour in developing countries because such labours are considered to be in rather short supply and would most likely to be fully employed even without the project being considered. The wages paid to these workers are assumed to represent the true marginal value product of these workers and the market wage rate reflects the shadow wage rate.

However, there are problems in the case of unskilled labour in a labour surplus economy such as India where there are probably peak seasons at planting and harvesting when most rural workers can find employment. At those seasons the market wage rate paid to rural workers is probably a reasonably reliable estimate of its marginal value product. The problem of course is that except for peak season there may be little or virtually no productive outlay for their energies in the off season. In other words, the marginal value product of such labour - the amounts such labour adds to the national income is very close to zero. Some of the recent studies in an Indian context show that plantation activities such as the Social Forestry Project in India provide some employment for those labours during the off season too (Sharma, 1990; Khan, 1993). This means the marginal product of rural labour in India depends on the extent of employment during off season. For these reasons virtually all economists now agree that the marginal product of labour engaged in land use projects such as agriculture and forestry on an annual basis is more than zero (Sharma, 1990; Khan, 1993; Gittinger, 1984). In most of the discussion of the marginal value product of labour, the standard is

the productivity of marginal agriculture labour not only for agriculture projects but also for other sector projects. This is based on the assumption that additional manufacturing employment, for example, will tend to reduce the number of unemployed agriculture labourers.

However, using a nation-wide shadow wage rate in a particular project may underestimate the true opportunity cost of a labour actually engaged in a project. The peak season in Punjab and Harayana states of India for example, may find all agricultural labour fully employed, but in the state of Orissa in the same country marginal labour in agriculture is not fully employed.

## **2. Choice of discount rate**

For FCBA, the discount rate is usually the marginal cost of money to the farm or firm for which analysis is being carried out. This often is the rate at which the individual or enterprise is able to borrow money. In ECBA also the opportunity cost of capital is taken as the discount rate, but from the point of view of the government or society. In other words the marginal product of capital in the public sector measures the opportunity cost of capital, reflecting the rate of return to government investment funds (Squire and van der Tak, 1975). This implies that the economic discount rate (EDR) is equal to the marginal product of capital if the funds come from the investment funds from the government. Although good as a theoretical definition of EDR, it is difficult to estimate practically (Adhikari, 1987; Gittinger, 1984) mainly due to the ambiguities surrounding the concept of capital which is further compounded by a lack of adequate data.

Sharma et al. (1989) suggest that the entire resources, including human resources, which are used to produce domestic product form capital. Therefore it is an agent of change and should be measured in terms of consumption foregone in propelling the economy forward instead of leaving it in stationary state. However they also suggest a second best alternative to estimate EDR from projected output capital ratio using the national level statistics at constant labour by subtracting the wage bill (which approximate the share of labour) from total output. But marginal efficiency of investment decreases as the amount of investment increases. This occurs because initial investments are usually made of best opportunities and therefore yield higher rates of returns in comparison with the later investments which are usually less productive and secure progressively decreasing returns. This implies that a time series analysis is needed in estimation of EDR. According to Gittinger (1984) the economic discount rate in developing countries



usually ranges between 8% to 15% in real terms and a common choice in most cases may be 12%. For example Sharma et al. (1989) have estimated 14.2% for social forestry project in India while Phillips (1986) and Adhikari (1987) have suggested 14% and 9% respectively for Nepal. Some rates are relatively high possibly because of a shortage of investments funds and hence marginal productivity of capital is high. Others are lower possibly because they are considering the rate on funds from various external agencies e.g. World Bank interest rate 8%.

### **3.4.3 SCBA**

FCBA seeks to evaluate gains and losses to the individual or project authority whereas the ECBA seeks to evaluate gains or losses to the economy as a whole. The utility of a project is a function not only of the value of benefits generated, but also of the manner in which they are distributed to various income groups. Mere algebraic addition of gains or losses to all the individuals is not equitable because equal cash flows to individuals at different income levels and different instants of time have different values. It is these values which need to be added up at the ultimate stage of the project evaluation. SCBA addresses this task by incorporating the distributional impact of the project. In SCBA, an attempt is made to consider the aspects of efficiency and distribution of income together (Squire and Van der Tak, 1975). In fact SCBA is an extension of ECBA in covering the distributional aspects. There are however some fundamental differences in approaches underlying ECBA and SCBA. These are outlined and discussed below.

#### **1. Valuation of inputs and outputs**

In SCBA, the economic prices undergo further adjustments resulting in social prices. The social prices differ from economic prices by the fact that these reflect the different values (weights) to different groups of the societies and between different period of time. In other words the distribution of income between rich and poor and between consumption and investments are incorporated through appropriate weight (Squire and van der Tak, 1975).

Thus the distribution of income in SCBA has two dimensions (a) inter-personal income distribution and (b) inter-temporal income distribution. The first dimension involves the relative weighting of benefits to individuals at different consumption levels at a time and the second dimension involves relative weightings of present consumption and

future consumption (or present savings) of individuals at the same consumption level. The weights are, therefore, quite crucial in SCBA because they reflect relative value attached to the income of different groups of society. Any change in income can be valued by applying appropriate weights to the monetary values. The value or weight for distribution of income assumes that a rupee in the hands of a poor person has greater social value than a rupee in the hands of a rich person (Price, 1989). In other words, an extra unit in the hands of the poor is given greater importance by applying higher weights.

#### **a. Estimation of inter- personal distributional weight**

The inter-personal distribution is handled by applying weights reflecting the extra utility associated with extra consumption of workers or individuals sharing the consumption generated by the project. The additional consumption to individuals at a given consumption level is not of the same value as the same amount of additional consumption to individuals at different consumption levels, even if both additions to consumption are generated at the same instants of time. Equity demands that the additional consumption to individuals at lower consumption level be given more weight. The project income should be broken down into the consumption it generates to various groups of individuals and the incremental consumption of each group should be multiplied by the suitable distributional weight of that group.

Categorisation of beneficiaries is possible on the basis of income/consumption level, propensity to save/consume, public/private sector, national/ foreign (ODA, 1988). The average level of consumption in a given year can be estimated from the total consumption in national account statistics. Subjectively, the weights can be dictated by government or through the past preference noted in government decisions while deciding the projects. However, the befitting weights needs details of changes in consumption levels for different groups of the society due to project activities (Khan, 1993). Using per capita monthly consumption for different income groups, the marginal utility weight (i.e. change in utility per unit change in incremental consumption) for each group can be computed using the following formula (Trivedi, 1987).

$$d_c = (C / C_r)^{-n} \quad (3.5)$$

where  $d_c$  is the weight for the marginal consumption;

$C$  is the per capita consumption at consumption level  $c$ ;

$C_r$  is the per capita consumption at reference consumption level and

$n$  is the elasticity of marginal utility of income.

This means that as long as  $n$  is positive,  $d_c$  will be less than 1 for groups having  $C_r > C$  and higher the value of  $n$ , the lesser will be the value of  $d_c$ . Reverse is the case when  $C_r < C$ . In other words with increase in  $n$  the spread between the weights associated with the lowest and the highest consumption groups grows larger.

#### **b. Estimation of inter-temporal distribution weights**

The inter-temporal distribution operates through the savings consumption web. Whatever a project gives to various sectors in economy is totally consumed, totally saved or partly consumed or partly saved. The savings are reinvested to generate future consumption through saving-consumption chain. Consumption is the end point of economic activity and the worth of a project has to be evaluated ultimately in terms of the total consumption it generates in the economy.

To generate future consumption a part of the present income needs to be saved and reinvested. For SCBA, it is necessary to evaluate the part of income which is saved or reinvested in terms of the future consumption it generates. If we add this to the part of income which is consumed at present, we get the total consumption generated.

Before aggregating the consumption generated it has to be decided how much relative weight should be attached to consumption at different instants of time. Is future consumption as valuable as present consumption, and, if not, how should the value of future consumption be discounted. However, equity demands that the future generation is as valuable as that of the present generation, just as for an individual the present consumption is as valuable as consumption at future during his life time. This means we need to estimate the current consumption equivalent of saving. This is achieved by a factor called value of public income ( $V$ ) in Little and Mirrlees methodology and  $P_{INV}$  in UNIDO methodology. This factor converts the value of savings or reinvestments or forgone present consumption into the presented discounted value of future consumption. Thus social value of income ( $V$ ) measures the aggregated discounted consumption generated by a unit of investment and is derived by the following formula (UNIDO, 1978 and Little and Mirrlees, 1974).

$$V = [ (1 - s)q / (r - sq) ] \quad (3.6)$$

where  $V$  is the social value of public income;

**s** is the marginal propensity to save;  
**q** is the marginal productivity of capital and  
**r** is the consumption rate of interest.

The marginal propensity to save is the percentage of incremental income saved. Its value is derived by using the annual income statistics of gross national product, consumption and saving. It can be determined by applying a regression co-efficient through linear regression using GNP (**Y**) as an independent variable and saving **S** as the dependent variable. Thus :

$$\mathbf{S = a + s * Y} \quad (3.7)$$

where **a** is a constant

The marginal productivity of capital (**q**) indicates the opportunity cost of capital which is the return on assets forgone elsewhere by committing assets to the present project. If all investment alternatives are ranked in descending order to their economic profitability, the return of the last unit of investment undertaken would indicate the marginal productivity of capital.

The consumption rate of interest (**r**) is the rate of interest at which the value of one unit of average consumption falls over time. It indicates the social discount rate (SDR). and is derived by applying the following formula (Khan, 1993):

$$\mathbf{r = n * g + p} \quad (3.8)$$

where **n** is the elasticity of marginal utility of income or consumption;  
**g** is the growth rate of income (per capita consumption) and  
**p** is the pure time preference rate.

At an operational level, the above description means, integrating all these aspects to derive the distribution weights which could be applied to adjust the cash-flows expressed at economic prices. The weight should reflect the marginal utility of income in the case of factors of production and consumer, and the value of investible funds in case of project agencies.

## **2. Choosing a discount rate**

The estimation of social discount rate is more complex than the economic discount rate because it involves both the value of public income and distribution of social income. Since social costs and benefits are expressed in terms of consumption, the social discount rate should indicate the rate at which the value of consumption changes with time. This rate is called the consumption rate of interest (CRI) which is defined as the rate at which the value of one unit of average consumption falls over time. Thus the CRI represents the social discount rate (SDR) in SCBA. This CRI is derived by multiplying together the elasticity of marginal utility of consumption and the growth rate of per capita consumption. This is based on an inherent assumption that utility is a function of consumption level alone (Trivedi, 1987). If it is regarded as function of pure time preference also the CRI can be derived by using the above formula (expression 3.8).

The pure time preference is a percentage measure of the premium attach to people enjoying things today instead of a year from now, even if their income stays the same. Use of pure time preference rate may be justified from an individual point of view, it is questionable from social point of view. According to Das Gupta and Heal (1979) it may be interpreted as reflecting the probability of the extinction of the society which is negligible under the normal circumstances. Thus putting a value to  $p$  seems negligible and hence the case for discounting future consumption on account of time preference rate is not justified.

Depending on time and weights to different income groups, the SDR vary from 0 to 30% (Price, 1989). Its value may be even zero or negative under condition of scarce resources and inadequate technological advancement (Khan, 1993). According to Price and Nair (1985) application of mean growth rate to derive a nation-wide consumption rate of interest is not enough for many of these variations. Some of the estimates for CRI made in Indian conditions are 2.05% by Sharma et al. (1989), 1.52 to 3.56% by Kumar (1988), 2% by Sharma et al. (1991) and 1.97% by Trivedi (1987).

From the above discussion, it would appear that SCBA plays a significant role in assessing projects in terms of their social impact on large sections of the society. This is particularly important in developing countries where a large amount of public funds are invested in developmental activities for the weaker sections of the society for social justification. It is also a useful instrument to assess the desirability and viability of a

project in terms of income distribution in the light of the nation's overall development strategy.

### **3.5 CBA : its application under various development strategies**

From the earlier discussion it is evident that there are three stages in application of CBA. The first stage is FCBA, which examines the commercial feasibility of the projects. At the second stage the costs and benefits of projects are evaluated using accounting prices and is called ECBA. This stage is recognised as the stage at which actual CBA starts (Khan, 1993; Trivedi, 1987; Nair, 1981). SCBA is carried out at the third stage where distributional impacts of projects are evaluated.

Now question arises “..do development strategies have any relevance for the formulation and application CBA method? or in other words can one use existing CBA methodologies irrespective of the development strategies adopted?”(Nair, 1981, p. 69). It is evident that these different stages of CBA, financial, economic and social, have not been evolved in a vacuum; rather each stage has been influenced by the prevalent development strategy at a particular point of time. It is argued that ECBA evolved with the emergence of growth strategies while SCBA has reflected a focus on the “redistribution (or anti-poverty strategy) with growth” strategy. Some examples presented in the subsequent sub-sections substantiate these views.

#### **3.5.1 ECBA and the development strategies**

Scarcity of resources such as skilled labour, capital and foreign exchange, has been singled out as an important cause of underdevelopment; hence achieving specified growth rates of GNP is thought to depend upon whether resources are allocated efficiently between the available alternatives. As discussed in earlier sections, valuation of resources-inputs and outputs using accounting prices is primarily guided by efficiency objectives. How far the concepts and assumptions underlying the growth strategy have influenced ECBA is illustrated in the following examples.

Firstly, at one time rapid industrialisation was seen as an important means of accelerating the process of development within the growth strategy. Accordingly the methodologies developed initially were intended for industrial projects only. The emphasis of Little and Mirrlees (1968) and UNIDO (1972) guidelines on industrial projects

are the two most notable examples. In both of the guidelines, emphasis was given to industrial projects,

.... in these guidelines we are taking for granted that the government has decided to embark on a plan for industrialisation.."

and hence methodology is

..concerned with evaluating industrial projects that compete for available funds." (UNIDO, 1972, p. 65).

Secondly, savings and investments are emphasised in the growth strategy on account of the lack of capital in underdeveloped countries. ECBA also emphasises savings by providing a premium to the income that is saved.

Thirdly, shortage of foreign exchange arising from the imbalance in trade is regarded as an important feature of a underdeveloped economy. The growth strategy aims to increase foreign exchange with a view to reducing the trade imbalance. In ECBA a premium to the foreign income earned or saved is given through the shadow exchange rate (UNIDO, 1972). The Little and Mirrlees methodology (Little and Mirrlees, 1974) uses world prices as accounting prices to relate the impact of projects to the balance of payments.

Fourthly, a growth strategy based on industrialisation aims to increase labour productivity by transferring unemployed and underemployed labour from the traditional, rural sector to the modern industrial sector. According to surplus labour theory this withdrawal does not affect the total output in the sector from which the labour is withdrawn. The marginal product of labour tends to be close to zero in a situation of unemployment and underemployment (discussed in detail in next chapter) and hence it is argued that the real resource cost of using such labourers is less than the market wage rate. In order to estimate the loss in marginal productivity of labour, ECBA pays considerable attention to estimating the shadow wage rate (Lewis, 1954).

Finally, market prices in developing countries are often not considered as appropriate in economic cost-benefit analysis on the premise that prices are usually distorted owing to imperfections in the market mechanism arising from monopoly, oligopoly and government interventions. It is believed that resource allocation efficiency,

which is supported by the growth strategy, is constrained by the distortion in market prices (Nair, 1981). Such distorted prices are corrected in ECBA analysis. The above examples thus suggest that ECBA is based on the concept of the growth strategy.

### **3.5.2 SCBA and development strategies**

As stated earlier, SCBA ranks projects on the basis of their impact on income distribution and is carried out subsequent to ECBA. Being an extension of ECBA it retains the concepts of allocational efficiencies with the distributional aspect added. The distributional aspect in SCBA aims to achieve income redistribution through a marginal redirection of investment as contemplated in the "redistribution with growth" strategy (or anti-poverty strategy).

As discussed earlier inter-temporal aspects are incorporated in SCBA by using a social discount rate, usually derived on the basis of the expected growth rate of per capita income (UNIDO, 1978). The higher the expected growth rate the higher the social discount rate, giving priority to projects which yield an immediate return. This point substantiate the premise that although distributional consideration are incorporated in SCBA, the basic framework of the growth strategy is retained intact. In other words, SCBA is also linked with growth strategy.

From the foregoing discussions it is clear that conventional CBA is implicitly or explicitly based on the growth strategy or its variant, the "redistribution with growth" strategy. When fulfilment of basic needs becomes the objective, it is doubtful whether existing CBA techniques will be appropriate for evaluating alternatives. Doubt arises due to two main reasons: firstly that the parameters used in CBA are implicitly or explicitly based on growth strategy or its variant redistribution with growth strategy and secondly that CBA does not consider the question related to product mix which is an essential component in basic needs strategy. This aspect has been dealt with in detail in the next chapter.

#### **Summary:**

Literature concerning the evaluation of land use projects with particular reference to their suitability in different development strategies has been discussed in this chapter. From the examination of the merits and weaknesses of the existing techniques, it was found that CBA is possibly the most appropriate and widely used technique for evaluation



of land use projects. It was also seen that the choice of an evaluation technique depends on the objectives of the project and these in turn are dependent upon the development strategies of a nation. In order to trace the link between CBA and development strategy, the different types of development strategies were discussed. It was seen that the growth strategy differs from the basic needs strategy in the sense that the former focuses only on how much to produce and not on what to produce and how to produce, while the basic needs strategy emphasises both what to produce and how to produce. Then the implicit strategy underlying CBA was examined. It was seen that the existing cost-benefit methodologies are based on the growth strategy or its variant the redistribution with growth strategy. In other words, CBA does not incorporate the product mix which is essential component in basic needs strategy. Thus, when the basic needs fulfilment becomes the development strategy, it is doubtful whether existing methodologies are appropriate for its evaluation because the basic needs strategy differs drastically from the growth strategy. However, some attempt has been made in the recent past to extend the scope of CBA in this direction. The next chapter deals with these aspects in the context of basic needs analysis in an attempt to address this deficiency.

#### Notes:

- 1 Evaluation is to be distinguished from 'appraisal' which is an ex-ante (before project) evaluation that is to say, the examination of a project before it is under taken (see FAO, 1985, p. 7)
- 2 See also Streeten and Burki (1977), ILO (1977), Sinha et al. (1979), Lisk and Wemeke (1976) and Hopkin (1977).
- 3 OER is the official exchange rate which is defined as " the rate, established by the monetary authorities of a country, at which domestic currency may be exchanged for foreign currency. Where there are no currency controls, the official exchange rate is taken to be the market rate. The official exchange rate would always be used in financial analysis " (see Gittinger, 1984, p. 489).
- 4 SCF is the standard conversion factor. "It is a number, usually less than 1, that can be multiplied by domestic market price, opportunity cost, or value in use of a non-traded item to convert it to an equivalent border price that reflects the effect of trade distortions on domestic prices of that good or service. A standard conversion factor is the reciprocal of 1 plus the foreign exchange premium stated in decimal form" (see Gittinger, 1984, p. 463).

- 5 Fx premium is the foreign exchange premium. The proportion by which the official exchange rate overstates the real value of local currency or of non-traded goods and services relative to traded goods and services, generally stated as a percentage. It is used to calculate the shadow exchange rate and standard conversion factor.
- 6 SER is the shadow exchange rate. "It is the shadow price of foreign exchange and reflects the foreign exchange premium. It is the official exchange rate multiplied by 1 plus the foreign exchange premium stated in decimal form" (see Gittinger, 1984, p. 499).

## Chapter 4

### Basic Needs Evaluation : A Theoretical Framework

In Chapter 3, it was pointed out that the methodology for a project evaluation depends on the objectives of the development strategies. Thus, a methodology appropriate for one development strategy need not be relevant and appropriate under different strategies. When a project is oriented towards the basic needs strategy one needs to examine the project's impacts with regards to basic needs fulfilment. Since the existing evaluation methodologies are based on the growth strategy or a variant of growth strategy, it is doubtful if they would be appropriate for evaluating projects under the basic needs strategy.

This chapter therefore examines the suitability of cost-benefit analysis (CBA) for basic needs evaluation and outlines an alternative methodology. Section 1 examines the suitability of cost-benefit analysis in the context of the basic needs evaluation. The salient features of the work done hitherto on evaluation of basic needs impacts are discussed in section 2 and a brief description of basic needs evaluation improving upon Nair's (1981) approach is given in section 3.

#### 4.1 Application of CBA in basic needs evaluation

As discussed earlier, the growth strategy differs radically from the basic needs strategy in that it does not incorporate the concepts of product and factor mix<sup>1</sup> which are two important considerations in the basic needs strategy (Bequele and Freedman, 1979). Since CBA is based on the growth strategy and its variant (redistribution with growth), it is plausible to assume that CBA is unsuitable for the evaluation of the basic needs strategy.

However, before discarding the cost-benefit technique as inappropriate for evaluating basic needs impact, two aspects need to be examined. The first aspect is the reason why the technique itself is not appropriate. The second aspect is the feasibility of extending the scope of available methodologies to incorporate the principles underlying the basic needs strategy.

### 4.1.1 Inappropriateness in the CBA technique

In CBA's the consideration of the choice of product mix is completely ignored. The basic justification for the neglect of product mix is the assumption of the open economy in which income can be readily converted to the desired basket of basic needs goods. However, it is not applicable in the closed economy which prevails in most of the developing countries such as India. In these countries where basic needs of the majorities are not being met, confidence can not be placed on the ability of the market to allocate resources for producing essential goods (Nair, 1981). In other words, if the supply within an area is highly inelastic, increased demand will not be met by increases in the supply of the goods demanded. In fact, at the extreme, prices will rise and no extra goods will be produced, leaving the consumer no better off. Thus, the CBA does not consider the product mix which is an important aspect as far as basic needs is concerned.

Even in terms of SCBA's consideration of the factor mix, there are still two conceptual problems in applying the methodology within the basic needs strategy. These two problems concern (a) the group-specific distributional weights and (b) the social value of public income. As discussed in Chapter 3, the former indicates the relative benefits to the individual at different consumption levels and changes in consumption are assessed in terms of their income. Thus the value of a group-specific weight depends on the elasticity of the marginal utility of income. This is defined as the rate at which the marginal utility of an additional unit of income declines with increases in the level of income (UNIDO, 1978). The group specific weight will be larger for those who have less income.

Although, in SCBA, through the group specific distributional weight, projects help the relatively poor people, it does not deal specifically with the extent to which a project is providing for basic needs.

The second conceptual problem in consideration of factor mix in SCBA concerns the estimation of the social value of income which measures the aggregated discounted consumption<sup>2</sup> generated by a unit of investment. Derivation of the parameters involved in estimation of the social value of public income (see Chapter 3) in the context of basic needs is criticised on the grounds that it takes into account the aggregated discounted consumption which is also contrary to the assumption underlying in basic needs (Squire and van der Tak, 1975; Scott et al., 1976).

### **4.1.2 Feasibility of the extended scope of CBA**

In order to overcome the above problems of SCBA, there has been some attempt to extend its scope by suggesting the goods specific weight (UNIDO, 1978; Veitch, 1978). This additional stage of analysis is called merit want analysis (Nair, 1981) where it is recommended that goods should be given a merit want premium. In other words, when meeting basic needs is an objective, basic needs goods will attract a higher weighting. The merit want analysis, however, has also been criticised on two grounds.

Firstly that no specific method has been prescribed for deriving the goods specific weight and secondly that merit want analysis is an additional stage of analysis which often increases complication, particularly when mutually conflicting assumptions are introduced at different stages. Prescribing an additional stage rather than devising an alternative approach may increase the scope for misuse of CBA in the opinion of Nair.

Thus CBA, even with its amendments exhibits certain shortcomings when directed towards basic needs evaluation. There is a need therefore for a methodology which can facilitate the analysis of the project with proper consideration of the choice of the product and factor mix with specific regard to basic needs fulfilment. The next section deals with the salient features of the approaches developed for the evaluation of projects designed to fulfil basic needs.

## **4.2 Basic needs evaluation : the various technical approaches**

The basic needs strategy has been discussed by many workers, for example, ILO (1976 and 1977); Sukhatme (1977); Lisk (1977); Hicks and Streeten (1977); Streeten (1979); Sinha et al. (1979); World Bank (1980); Harberger (1978 and 1984); Bequele and Freedman (1979) and Nair (1981). However, the methodology for basic needs evaluation has been relatively little explored until recently. Nevertheless, two approaches can be identified, the cost-effectiveness approach and the Nair's basic needs approach. The former is fairly limited, nevertheless both are discussed below.

### **4.2.1 Cost-effectiveness approach**

In this approach, a project is appraised in terms of how cheaply it can provide benefits gauged according to a poverty indicator. This least-cost approach was adopted by Retlinger and Selowsky (1976) of the World Bank in evaluating the cost of providing one extra calorie

to a particular group of consumers (Brent, 1990). Although the cost-effectiveness approach is a simple means of project evaluation, Scandizzo and Knudsen (1980) point out that it is an inadequate method for basic needs evaluation particularly on the grounds that it only permits the ranking of projects with a single basic needs indicator. It does not allow the comparison of projects having different basic needs indicators, for example one targeted to raise the calorie level and another targeted to achieve a certain percentage of literacy in a country.

#### 4.1.2 Nair's basic needs approach

Nair (1981) contradicted the application of CBA in basic needs analysis and developed a full fledged methodology for basic needs analysis. His approach aims to identify the impacts of land use alternatives in terms of both the production of basic needs goods (goods effect) and the generation of basic needs income (income effect).

These two objectives are examined by preparing two separate balance sheets referred to as the goods balance sheet (or net goods effect) and income balance sheet (or net income effect) respectively. The former indicates the net impact of the project on the supply of basic needs goods while the latter assesses the net impact of the project in terms of generation of basic needs income. To rank the projects these two effects are aggregated by assigning weights. Basic needs consumption at market prices is used as the numeraire. Costs and benefits accruing at different periods of time are not discounted on the assumption that the value and utility of basic needs goods do not change over a period of time particularly in the case of the low income group, unless there is a drastic change in their consumption patterns. The criterion for comparing an alternative option is chosen as:

$$\text{BNV} = \frac{b_g (\text{GE} - \text{Sc}_g) + b_i (\text{IE} - \text{Sc}_i)}{N} \quad (4.1)$$

where BNV is the net annual aggregated basic needs value;

GE is the goods effect;

IE is the income effect;

$\text{Sc}_g$  is the social cost of project incurred in the production of basic needs goods;

$\text{Sc}_i$  is the social cost of project incurred in the generation of basic needs income;

$b_g$  is the aggregation weight for the net goods effect or goods balance sheet;

$b_i$  is the aggregation weight for the net income effect or income balance sheet  
and N is the project life

BNV, like NPV, indicates a worthwhile project if its value is positive and enables projects to be ranked in order of the highest BNV.

The goods effect indicates the basic needs value of the goods while the income effects show the basic needs value of the income. The basic needs value of a good is estimated by multiplying the market value of goods by the basic needs conversion factor (BNCF). The BNCF indicates the proportion of input or output which directly or indirectly enters the basic needs consumption basket and ranges from 0 to 1. Thus a BNCF value of 1 is used for the goods that are wholly used to satisfy the basic needs while a value of 0 is assigned to those which are not used for basic needs satisfaction at all. Similarly, the basic needs value of income is estimated by identifying the proportion of income generated from the output as well as inputs of the project which is utilised for basic consumption needs. Nair's approach thus incorporates the concepts of both the product mix and the factor mix with on-off (1, 0) distributional weights.

The double weightings, one at the stage of the social valuation of goods and income in terms of basic needs fulfilment and the other at the aggregation stage, allow the decision maker to evaluate the alternatives after deciding what relative weight should put on the aggregate basic needs value of output relative to the aggregate basic needs value of income. Within the above conceptual framework Nair's approach can be divided into the following steps.

1. Identification of basic needs goods for the country or region.
2. Estimation of basic needs income for the country or region.
3. Identification, quantification and valuation of goods at market prices produced by the projects.
4. Social valuation of goods in terms of basic needs fulfilment (goods effect)
5. Social valuation of income in terms of basic needs fulfilment (income effect)
6. Social costing of projects incurred in the production of basic needs goods and generation of basic needs income
7. Estimation of net goods effect (goods balance sheet) and net income effect (income balance sheet)
8. Estimation of aggregation weights for net goods effect and net income effect.
9. Aggregation of net goods effect and net income effect and choice amongst the projects

Figure 4.1 below shows Nair's basic needs evaluation procedure in more detail.

From the foregoing discussions, it is clear that Nair's approach is the only approach which outlines the detailed methodology for basic needs evaluation. However, although Nair's methodology appears conceptually sound, there are some problems in its practical application. Nair himself admits that,

".. problems in deriving the various parameters, especially in respect of the country with a weak data base, would be one of the serious objections in making the approach practically useful. Refinements are required to improve the usefulness of technique" (Nair, 1981, p. 263).

The next section deals with the practical and conceptual shortcomings of Nair's methodology and suggested modifications.

### **4.3 Steps of basic needs analysis**

This section elaborates the basic steps outlined in the previous section.

#### **4.3.1 Identification of basic needs goods for a region or country**

As discussed in Chapter 3, basic needs are defined as the quantities of goods and services which can be regarded as essential to maintain a minimum standard of living (ILO, 1976 and 1977). These are divided into private consumption goods such as food, clothing and shelter and the public utilities services such as health, education and transport (Sinha et al., 1979).

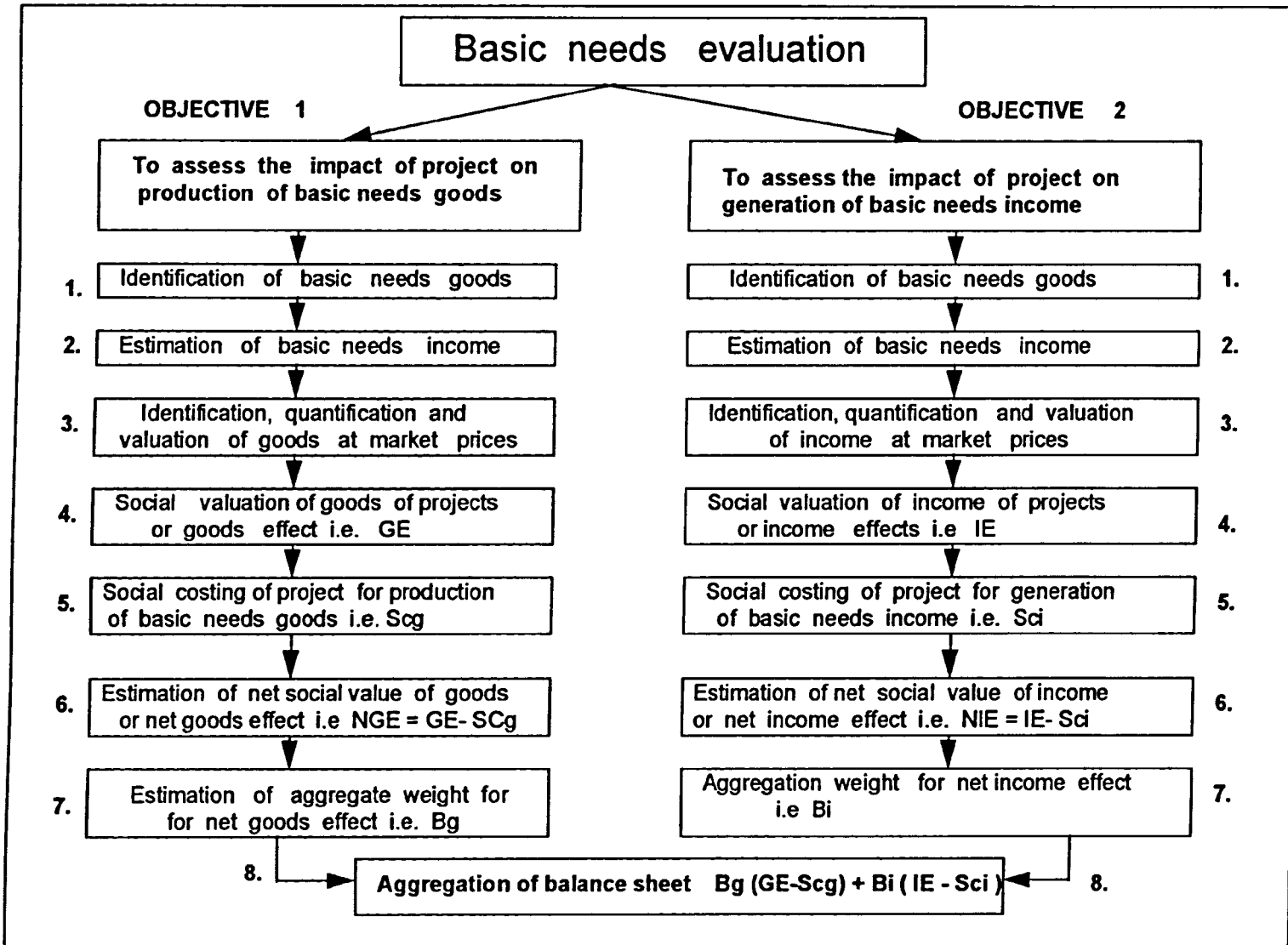
Consumption of basic needs goods also varies within the country due to a number of factors such as the variation in socio-economic and political condition, as well as variation in price structure and activity status of the population (GOI, 1993). The implications of all these conclude that, there is a need of a suitable methodology to identify the basic needs goods in a particular situation.

Apart from falling victim to the above criticisms Nair's approach of basic needs analysis does not deal with the identification of the basic needs goods and services. He himself admits that ,

" .. here the precise method for identifying the consumption level of basic needs goods and services is not dealt with and emphasis is given to the methodology on the assumption that the basic needs baskets and basic needs income have already been identified " (Nair, 1981, p. 98).



Figure 4.1 Steps of basic needs evaluation.



This means the basic needs goods and basic needs income in Nair's approach are based not on the primary data, but on an average estimate made from the published literature at the national level which does not necessarily apply to a specific region of the country.

What constitutes the acceptable level of consumption of basic needs goods and services is a debatable and subjective issue. It may be either a value judgement or may be based on some biological norm (Bardhan, 1970; Minhas, 1970; Panikkar, 1979). Using the latter to estimate the minimum requirement has been subject to criticism for two main reasons. Firstly, due to its failure in prescribing the exact norm for non-food items such as clothing, house requirements and fuelwood (GOI, 1993) and secondly its inadequacy in dealing with inequalities in the distribution of income and wealth.

#### **4.3.2 Estimation of basic needs income for an average family for a region or country**

Production of basic needs goods alone is however not a sufficient condition for fulfilment of basic needs. Consumption can materialise only if goods are accessible, which primarily depends on the income at the disposal of the households which provides the necessary purchasing power.

Basic needs income is defined as the adjusted value of basic needs goods obtained both from the monetised and non-monetised sector<sup>3</sup> which are used for basic consumption needs. It excludes the values of essential public services such as health care, education and sanitation on the assumption that these will be provided free by government as a public good (GOI, 1993 and Ahluwalia et al., 1979). Thus basic needs income can be expressed as

$$\text{BNI} = \sum Q_g \times P_g + \sum Q_{ng} \times P_{ng} \quad (4.2)$$

where BNI is basic needs income;

$Q_g$  is quantity of gth good;

$P_g$  is price of gth good;

$Q_{ng}$  is the quantity of gth good obtained from non-monetised sector and

$P_{ng}$  is the imputed price of gth good obtained from non-monetised sector.

In order to overcome the above shortcomings the following improvements may be made in the context of a land use project.

- a. A household survey of rural poor to identify their consumption pattern.
- b. Identify each item under food and non-food categories in order to prepare a complete basic needs basket.
- c. Taken into account the goods derived from the non-monetised sector such as fuelwood freely collected from forest, valued in terms of the time and effort expended in their collection.
- d. Assess the extent to which the current food basket meets physiological requirements and then adjust to meet any shortfall.

These aspects as applied to the current area of study, are dealt with in detail in Appendix 8.1 .

#### **4.3.3 Identification, quantification and market valuation of goods produced from projects**

Identification, quantification and market valuation of goods produced from the projects are done in the similar fashion to that for financial cost-benefit analysis discussed in chapter 3. Market prices are used to arrive at the comparable values for different goods and services. Using market prices as first approximation in basic needs analysis is justified on the following grounds.

1. Market prices represent the values at which goods and services are actually exchanged between individuals and groups in society hence basic need income is based on market prices.
2. Market prices are used in the early stages of all conventional methodologies (Little and Mirrlees, 1968 and UNIDO, 1972).

#### **4.3.4 Social valuation of goods in terms of basic needs fulfilment (goods effect)**

The valuation of goods in terms of basic needs fulfilment is carried out to assess the impact of a project on the production of basic needs goods. At this stage, the extent to which a good produced from the project is a basic or non-basic good i.e. one which is or is

not, used to meet basic needs is gauged by the researcher. This gives the BNCF for that good or service. Following this, the market prices of goods are multiplied by the BNCF's. Thus the social value of goods or goods effect can be mathematically expressed as:

$$GE = \sum Q_g \times P_g \times BNCF_g \quad (4.3)$$

where GE is the goods effect;

$Q_g$  is the quantity of g th good;

$P_g$  is the market price of g th good and

$BNCF_g$  is the basic needs conversion factor of g th good.

The BNCF can be readily derived in the case of directly consumed goods, but it is difficult for those goods which go through a series of processing to reach the final consumption stage. Estimation of the BNCF for these goods requires high degree of disaggregation so as to estimate the distribution between basic and non-basic uses. This implies that it is necessary to know the end utilisation pattern of goods for estimation of BNCF. The following examples illustrate how the BNCF can be derived.

In forestry, the wood of a tree may fully be utilised for basic needs consumption, non-basic needs consumption or partly for both. This depends on the quality as well as the utilisation pattern of its products. For example, in the case of *Casurina equisetifolia*, a coastal belt tree species of Orissa, the wood is used either as the fuelwood for cooking and heating or for the construction and repair of houses in rural areas. In both the cases the utilisation is primarily for fulfilment of basic needs and a BNCF value of 1 would be appropriate.

With *Tectona grandis*, however, a quality timber species of western India, the wood is mainly utilised for decorating purposes such as wood panelling, in hotels and superior houses or for high quality furniture. In both cases the wood is not directly used by poor people and hence it is assumed that the consumption is for non-basic purposes. Thus a BNCF value of 0 would be appropriate.

Finally, *Dendrocalamus strictus* is a bamboo species of central and north-eastern India. Some 60% of the total production of bamboo is utilised for pulp and paper making, construction of town buildings, bridges and roads. The remaining 40%, constitutes the branches and leaves which is used in rural areas for cooking and heating, construction and repair of low cost houses and household and farm fencing. Thus 60% is used for non-basic

needs consumption and 40% is used for basic needs satisfaction. Hence, a BNCF value of 0.40 would be appropriate for this species.

These examples suggest that it is not difficult to estimate the BNCF of goods whose end utilisation patterns are known. Where the end uses are not known however, Nair suggests that the existing, rather than future, end uses of goods should be taken into account to estimate the BNCF of future outputs in a project. However, in the case of those goods which produce a number of intermediate use goods, estimating the BNCF becomes extremely difficult. These require examination of the different production processes undergone and the identification of the proportion that ultimately enters in the basic needs basket. The alternatives of using ready made input-output tables to identify the intermediate and final uses have been criticised, due to their being based on average and aggregated data.

Nair himself estimated BNCF's subjectively, using simplifying assumptions and admitted that

"..these values are tentative and are derived primarily to illustrate the application of the basic needs analysis" (Nair, 1981, p. 300)

He did not incorporate the intermediate goods such as leaves, twigs, branches, grass, poles and minor forest products produced in the projects but suggested that:

"..considerable refinement needs to be brought about in the estimation of BNCF of intermediate goods which depend on how best the actual uses are identified" (Nair, 1981, p. 260).

In order to address the deficiencies of Nair's approach in the estimation of the BNCF, the following improvements are proposed.

- a. Information related to the end utilisation pattern of the goods produced by the projects should be gathered through household surveys of the rural poor as well as from official records.
- b. Data related to the production of intermediate products within project should also be collected in the same ways.

Estimation of the BNCF for goods and inputs involved in the projects in the current study area are discussed in detail in Appendix 8.2.

#### **4.3.5 Social valuation of income in terms of basic needs fulfilment (income effect)**

Income generation in any project can be analysed from two angles. Firstly, through the revenue generated from the sale of the goods and secondly through the payments made to the owners of the various factors of production. Nair's view was that the profit from the sale of a good in a project remains with the project agency and the rest are distributed in the society in the form of payments towards the supply of the inputs. The income received by the owners of the factors of production is either saved or consumed or both. The consumption may be for basic needs fulfilment or on luxury goods or both. The income actually spent on basic consumption needs is taken into account for the estimation of the basic needs income. Thus the income effect measures the impact of a project in terms of the generation of the basic needs income and its distribution in the society. Figure 4.2 below shows income generation and its distribution in land use projects.

The social valuation of income in terms of basic needs fulfilment is more difficult than that of the social valuation of goods, mainly due to consideration of factors of production in the former case. Nair argues that the estimation of basic needs income in the case of commonly used factors of production such as land and labour is relatively easy. Estimation of the basic needs income generated from these inputs is made by comparing the income received from the project with that of the required basic needs income (estimated for a region or country). If the project's income received by the owners of the factors of production is less than the required basic needs income, the entire income is treated as basic needs income. If, on the other hands the project's income received by the owners of factors of production exceeds the required basic needs income, the excess income is treated as non-basic income. Saving or reinvestments is not taken into account on the simplifying, but probably realistic, assumption that the all income saved is consumed immediately.

In the case of material inputs such as fertilisers, insecticides, polythene bags, tools and implements, the estimation of basic needs income needs a detailed analysis of two aspects. Firstly, the payments should be split between factors of production and secondly they must be distributed amongst the various income groups of the society. This is important because the inputs used in the project generate income in the process of their own production. For example, if inputs used in the projects are produced using a labour intensive technique then these inputs have substantial income effects on the project. The payments made to factors of production can be estimated by identifying the distribution of (a) the value added,

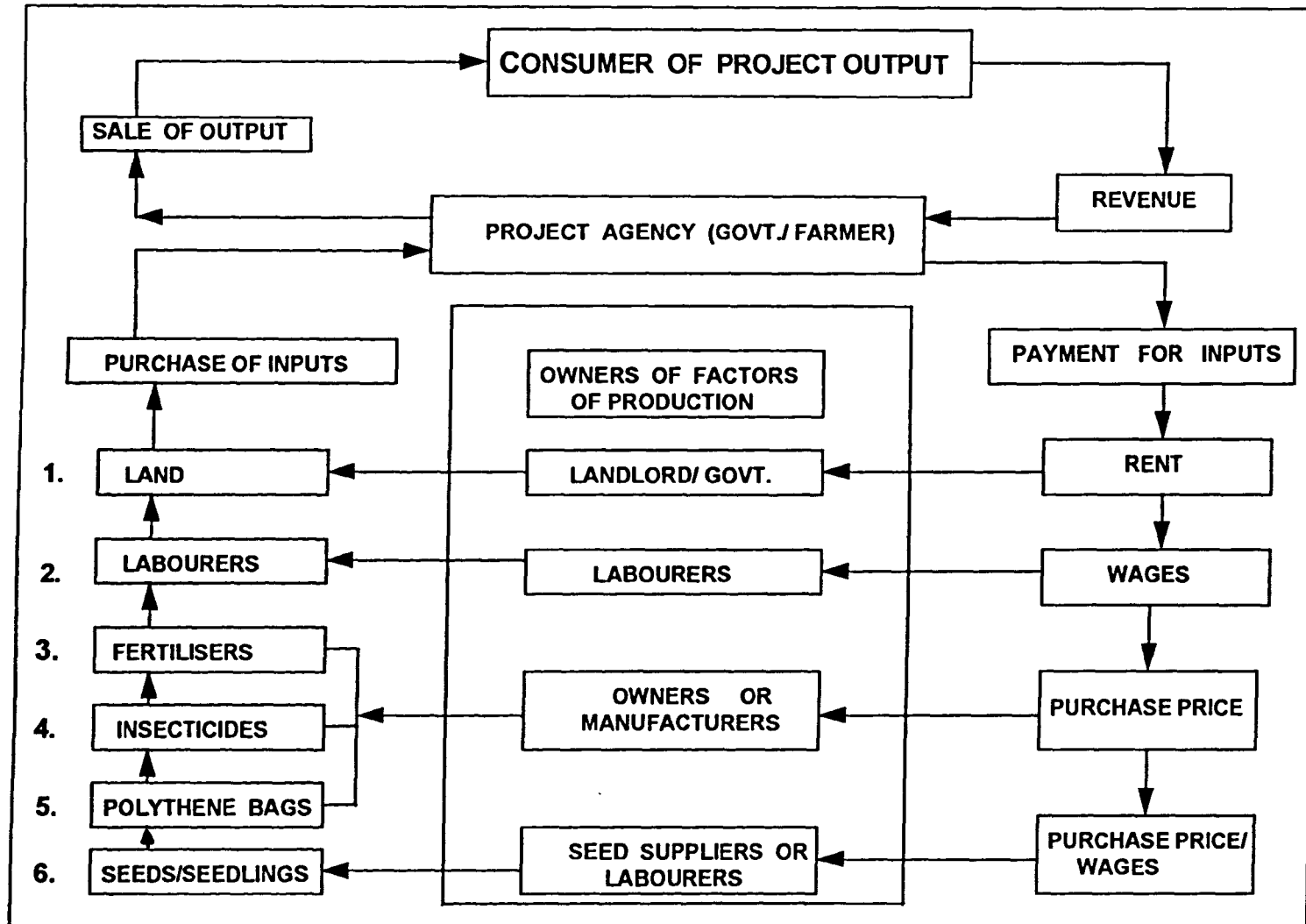
(b) the cost of intermediate inputs and (c) the profits amongst different suppliers of inputs. For example the production of fertiliser can be disaggregated into its various components such as in-factory cost, retail and wholesale margin, taxes and excises and subsidy and profit. The factory costs can further be disaggregated into the labour cost, the cost of material inputs and the profits. In the case of imported fertilisers it will further include c.i.f prices of imported inputs, cost of transport, taxes and retail and whole sale margin. In order to avoid the above complications Nair carried out the analysis on the following basis:

1. Disaggregation of the components of the factors of production is confined to the first stage of production.
2. In case of the imported inputs payments made to the external factors of production are excluded since the recipients of these payments are beyond the economy of the domestic people.
3. For the countries having a closed and subsistence economy, such as India, it can be assumed that savings generated by basic needs oriented projects are immediately consumed and reinvestment effects are not taken into account.

To identify the basic needs income distributed among various groups of society, Nair classified the recipients of various categories of income into three groups as (1) the households (2) the corporate groups and (3) the government agencies using Saluja's (1972) input-output table for the Indian economy. The income directly accruing to the household was taken into account in the estimation of the income effect. All addition to income up to the basic needs income (discussed in Appendix 8.1) is given a social weight of one and a weight of zero is given to that which exceeds the basic needs income.

To derive the distribution of value added and other income amongst the three income groups, estimates given by Sinha et al. (1979) were used. Sinha et al. have estimated the distribution of value added and other income of the major industrial and agricultural sectors of the Indian economy among three groups namely bottom, middle and top. Nair categorised their bottom and middle income groups to those whose income is below basic needs income and assigned into group I. The top income group was assumed to spend their marginal income on luxury consumption or for saving and was assigned to group II. Government agencies and corporate groups were assumed to invest the profit to earn interest. These two groups together were assigned into group III. Group II and III are excluded from basic needs income and all payments made to group I are considered as basic needs income with a social weight of 1.

Figure 4.2 Income generation and its distribution in land use projects.





It appears from the above description that Nair weighted income equally whatever the degree of poverty existed in the society. This means that the effects of household far below the basic needs income are given an equal weight to the effects on household only a little below that level. Similarly the effects on households just above basic needs income are excluded. The fact is however that, the real society does not consist of two clear cut groups; rather there is a continuous spectrum from the lowest income group to the highest income group. Thus there is a disparity even within the households below the basic needs income and above the basic needs income and project benefits accruing to all groups need to be weighted relatively.

However, this is a basic needs analysis and hence this approach, although based on certain simplifying assumptions is conceptually sound. The only improvement is to update the information, although it would have been preferable to use local rather than national level data.

Appendix 8.3 gives the details of the procedure for estimation of the basic needs income from the inputs and the outputs involved in the projects under current study.

So far, attention from a methodological perspective has been focused on estimation and valuation of project's outputs and inputs in terms of production of basic needs goods and generation of basic needs income. There are, nevertheless, costs which have to be considered since resources devoted to basic needs fulfilment are by definition not available for anything else and certain goods which would otherwise have been produced will not be produced. The next section therefore, examines the methodology associated with social costing of projects in terms of production of basic needs goods and generation of basic needs income.

#### **4.3.6 Social costing of projects incurred in the production of basic needs goods and the generation of basic needs income**

When resources are used in a project the opportunity of using them in other alternatives is forgone. The net forgone value from the next best alternative use of a resource is called its opportunity cost (Mishan, 1975) and this is the value used as a cost in economic and social appraisal. This is also referred to as the shadow price. Such prices when used in economic appraisal are referred as economic or efficiency prices and those used in social or basic needs evaluation as social prices. The estimation of opportunity cost of a resource involves two stages:

- a. The identification of the next best alternative (i.e. alternative which gives maximum net benefits) from all possible alternatives and
- b. The estimation of net social benefits from the most suitable alternative.

Taking identification first, ideally the identification of the most suitable alternative requires analysis for all the possible alternatives. Practically, however, this may be difficult because of time and resource constraints. Thus it is typically argued that the opportunity cost should be based on the most feasible alternatives (Marglin, 1976 and UNIDO, 1972) rather than all possible alternatives.

Considering the above argument the current or existing use of resources as the alternative use is used for purposes of estimating the opportunity cost of the resources involved. It is assumed that the existing use of resources is likely to continue throughout the project life particularly in a project of short duration. According to Nair the application of the principle of the opportunity cost in basic needs analysis should be restricted to the forgone basic needs fulfilment. In other words the opportunity cost of resources should be estimated in terms of the production of basic needs goods which is forgone and the generation of basic needs income which is also forgone. Based on the above principle, Nair used the social cost of goods and income both in the goods and income balance sheets. In the former the social cost is based on the loss of production of basic needs goods while in latter the same is based on the reduction in generation of basic needs income. Using the social value of goods, social value of income and social cost of the project, the net goods effect (goods balance sheet) and net income effect (income balance sheet) are computed as follow:

$$\text{NGE} = (\text{GE} - \text{Sc}_g) \quad (4.4)$$

where NGE is the net goods effect or goods balance sheet;

GE is the goods effect or social value of goods and

$\text{Sc}_g$  is the social costs of project in terms of production of basic needs goods

$$\text{NIE} = (\text{IE} - \text{Sc}_i) \quad (4.5)$$

where NIE is the net income effect or net social value of income;

IE is the income effect or social value of income and

$\text{Sc}_i$  is the social cost of project in terms of the generation of basic needs income

The social cost estimated for the net goods effect, need not be identical to that for the net income effect. Diversion of land from a teak plantation, for example, may not give rise to any loss in basic goods production owing to its non-basic use, but would cause a substantial loss in income generation due to its employment of unskilled labour.

Resources used in land use projects can broadly be divided into two groups namely (a) labour inputs and (b) non-labour inputs which can further be divided into land and material inputs such as seed, seedlings, fertilisers, insecticides, polythene bags and tools and implement.

#### **4.3.6.1 Labour**

Estimating the social cost of labour is complicated particularly in economies with surplus labour such as India. This is because the market for labour is not perfectly competitive and both unemployment and underemployment exist simultaneously.

In economic appraisal, the wage rate is estimated on the principle of opportunity cost. The value of the net output foregone in the labourer's previous occupation is taken as the measure of its productivity. In developing economies where the unskilled labour supply is elastic, employment of unskilled labour in a project is assumed to cause no loss of production elsewhere in the economy as the labour can be readily taken from those sections of the labour force which are under or unemployed. Thus the wages paid do not represent the opportunity cost and hence the social cost of labour tends to be lower than the market wage rate depending largely upon the degree of unemployment.

Four different criteria have been devised for the measurement of unemployment. These are time, willingness, productivity and income. The time criterion regards a worker as unemployed or underemployed if he or she is gainfully employed for a number of days (hours) less than the specified days (hours) defined as constituting full employment. This criterion is usually adopted for measurement of national level employment in many countries. The National Sample Survey Organisation (NSSO) of India being one example. This is an useful criterion in measuring unemployment when there is marked seasonality in employment as for example in forestry and agriculture in India (Sharma, 1990).

The willingness criterion takes into account the willingness of an individual to work, irrespective of time of unemployment. Often unemployment exists when it is voluntarily chosen and an estimate based purely on the time criterion without taking into account the

willingness of the individual to work would be an over-estimation of unemployment. A person may opt to remain unemployed (voluntary unemployment) if the reservation wage becomes higher than the existing wage (Harberger, 1971).

According to the productivity criterion the underemployment and unemployment exist when the withdrawal of workers from a sector does not affect the total production. The surplus labour theory is based on this criterion and is usually adopted for shadow wage rate estimation in cost-benefit analysis. The details of the estimation of the shadow wage rate are explained in the following paragraphs.

Finally, the income criterion regards employment as a means of providing an acceptable level of living. To the extent a person's employment is inadequate to fulfil this, he can be considered as underemployed (Dandekar and Rath, 1971). Hence, it is argued that, underemployment exists when a person's employment is inadequate in quantitative and qualitative terms in relation to the specified norm (ILO, 1966).

Nair disapproves of the criteria based on time, willingness and productivity. In support of his view he argues that the time criterion can be used only when there is a marked seasonality in employment. Most often, however, work and leisure are inseparable in a subsistence economy.

In criticism of the productivity criterion, Nair argues that although the criterion is theoretically appropriate, there is no precise method of its estimation. He further adds that there is a little agreement on whether the marginal product of labour in a surplus labour situation is zero or positive. For example, in the Indian context, Bardhan (1973); Harberger (1972) and Rajkrishana (1973) reported the existence of positive marginal product of labour while Desai and Mazumdar (1970) and Mazumdar (1965) pointed out that the marginal product is not significantly different from zero.

Finally, Nair argued that the estimation of the marginal product of labour (or the foregone output from previous employment) fails to take into account the consumption benefit derived by persons other than workers employed in the project and states that,

"..even when the marginal product of labour is positive it is assumed that project employment does not affect basic needs goods production and basic needs income generation in the sector from which labour is withdrawn" (Nair, 1981, p. 154).

He suggests that the estimation of the social cost of labour should be based, not on the marginal product foregone, but on the opportunity cost of the funds involved in paying the

wages to the labourers. The opportunity cost of funds depends on the uses to which the funds would have been utilised in absence of the project. The uses of funds foregone would have generated both goods effects and income effects. Thus social cost of labour in terms of basic needs fulfilment can be expressed as: (Nair,1981 p.155)

$$AWR_g = C.V_{bg}$$

$$AWR_i = C.V_{bi}$$

where  $AWR_g$  is the accounting wage rate in terms of the production of basic needs good ;

$AWR_i$  is the accounting wage rate in terms of the generation of basic needs income;

$C$  is the market wage rate;

$V_{bg}$  is the opportunity cost of investment in terms of the production of basic needs goods and

$V_{bi}$  is the opportunity cost of investment in terms of the generation of basic needs income.

Although Nair's above approach is theoretically appropriate, there are practical complexities in the estimation of the opportunity cost of the investment funds in the context of the basic needs analysis. Some of the problems are described below.

The use of investment funds in a project involves a cost in terms of benefits forgone from the alternative investments (or other uses). Several models have been developed to estimate the opportunity cost of investments. According to the models suggested in project appraisal hand books (UNIDO, 1978; Little and Mirrlees, 1972), the opportunity cost of an investment or social value of public income ( $V$ ) is expressed as: (Price, 1989)

$$V = \frac{(1 - S)q}{r - Sq} \quad (4.6)$$

where  $V$  is the social value of public income;

$s$  is the marginal propensity to save (proportion of revenue which is reinvested);

$q$  is the financial rate of return on investment and

$r$  is the social discount rate.

Opportunity cost of investment is an important concept in both the project evaluation methodologies. The difference arises only due to difference in numeraire in which different values are expressed. In other words, in Little and Mirrlees methodology, consumption generated by investment is converted into its income equivalent whereas in UNIDO

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Marglin (1963) has modified the above method by incorporating the reinvestment of project income to estimate an aggregated opportunity cost. According to Marglin, if  $s$  (in expression 4.6), the proportion of project income is reinvested and yields a net return of  $q$  in perpetuity then expression (4.6) becomes,

$$V = \frac{(1-s)q}{r-sq} \bigg/ \frac{(1-s)r}{r-sq} = \frac{q}{r} \quad (4.7)$$

This indicates that the reinvestment of income generated need not be taken into account at all. In other words the reinvestment on the cost side and the benefit side is balanced. Hence the opportunity cost of investment can be estimated without incorporating reinvestment effects (Nair,1981).

Although expression (4.7) seems simple, the derivation of the social discount rate and the marginal product of investment poses a problems in the context of basic needs evaluation. When a zero discount rate (discussed below in para 4.3.10) is used for basic needs evaluation the value of  $V$  (in expression 4.7) will be  $\infty$  indicating that investment is always a good thing and consumption is always a bad one which is not acceptable to any society.

In the face of this problem, an alternative procedure is needed for basic needs evaluation so that the values of parameters such as marginal product of investment and social rate of return can be derived without resorting to discounting. In the line of the above problem Nair attempted to devise such an alternative procedure whose salient features are given below.

marginal product of investment, for example, requires that at any time the public sector or even private sector has a list of projects or investment alternatives from which a project will be selected when funds will be available. If all investment alternatives are ranked in descending order according to their economic profitability the return of the last unit of investment undertaken would indicate the marginal productivity of the investment. Its value is equal to the opportunity cost of the capital which is the return on the assets forgone elsewhere by committing assets to the present project (UNIDO, 1978). Such a list is unlikely to be available. Another problem arises from the empirical complexities in deriving these parameters.

The estimation of the social cost of labour based on the opportunity cost of investments therefore seems to be practically unsuitable, particularly in a country having a weak data base, such as India.

Although Nair suggested the use of the opportunity cost of investment in estimation of social cost of labour, he himself did not apply the approach in his study. While estimating social cost of labour as zero in his study, he concludes that

"...most of the plantation works are carried out by unskilled labour. Unskilled labour supply is highly elastic and is unlikely to affect basic needs goods production and basic needs income generation elsewhere. Hence the direct social opportunity cost of labour is assumed as zero" (Nair, 1981, p. 315).

It is obvious that his estimation is based on the productivity criterion (surplus labour theory) of the measurement of unemployment rather than the opportunity cost of investment.

To overcome the shortcomings raised in Nair's approach it is appropriate to use the productivity and time criteria for measuring unemployment. In other words the social cost of labour can be estimated on the basis of the marginal productivity i.e. in terms of forgone production of basic needs goods and foregone generation of basic needs income (Kumar, 1988, Sharma, 1990 and Khan, 1993). The approach seems to be more appropriate in projects where mostly unskilled and semi-skilled labour are likely to be employed. In rural areas for labourers, the main alternative activity is likely to be subsistence agriculture (NCAER, 1988). The employment of such labourers in a project will therefore have a direct impact on the productivity of agriculture, which directly affects the basic needs fulfilment of the rural poor.

Because of peak and slack period in the agriculture cycle, under and unemployment will vary over the year. The labour engaged in the peak season is classified as the main labour and those without work in slack season as the surplus labour (Trivedi, 1987). The social cost of main labour (i.e. labour required during the period coinciding with the peak of the agriculture season) is approximated by the existing market wage rate in agriculture. On the other hand, for the surplus labour (i.e. the labour required during period coinciding with slack part of the agriculture season) is approximated as zero because there is no loss of productivity in employing such labour. Thus, it is argued that social wage rate should be a function of agriculture productivity and timings of agriculture and project operation. However, it is not easy to estimate the social cost of labour when unemployment and employment vary over the year. Furthermore, there are many informal labour opportunities and division of labour due to underemployment. Due to the unavailability of full time employment for all the family members the total work hours in the family farm is shared by a large numbers of workers, each working less than generally accepted norm, and hence there exists disguised unemployment called underemployment (Sen, 1962)

Nevertheless, for the sake of simplicity the use of calculating costs according to the proportion of the time fully employed is a practical means of costing labour in this context. To this end, considerable work has been done on the estimation of the marginal product of labour based on the productivity and time criteria in Indian context (Kumar, 1988; Sharma et al., 1991 and Khan, 1993). The procedure adopted by these workers can be followed as described below.

Based on the national level data on employment (NSSO, 1981) the rural workers are divided into two main groups i.e. the main worker and the marginal worker. Main workers are those who have worked for more than 3.5 days in a reference week and marginal workers are those who have either worked equal to or less than 3.5 days or did not work at all in a reference week. Based on these data, the weighted average of the number of employed and unemployed days are estimated for both the groups. Then the percentage distribution of workers under both the categories is known for the particular region or state for which marginal product is estimated. It is assumed that the labourers withdrawn for the project in a particular state or region remain in proportion to the total labour days of unemployment in each category of workers. Then the proportion of workers withdrawn from both the groups for the project is estimated as follow:



$$\frac{\text{Marginal worker days}}{\text{Main worker days}} = \frac{\% \text{ of marginal worker} \times \text{Average number of days unemployed for marginal worker}}{\% \text{ of main worker} \times \text{Average number of days unemployed for main worker}}$$

The marginal product of both the type of workers employed in the project is estimated as follow:

$$\text{Marginal product of main worker} = \frac{\text{No of days employed by main worker in a week}}{\text{Total number of days per week}} \times \text{wage rate}$$

$$\text{Marginal product of marginal worker} = \frac{\text{No of days employed by marginal workers in a week}}{\text{Total no of days in a week}} \times \text{wage rate}$$

Finally, the value of the marginal product forgone by society by employing one labourer in society is estimated as follow:

$$\frac{[(\text{No of main worker employed days} \times \text{marginal product of main worker}) + (\text{No of marginal worker employed days} \times \text{marginal product of marginal worker})]}{\text{Total number of days employed}}$$

Appendix 8.4 gives the detailed procedure for the estimation of the social costs of various inputs involved in the projects under current study. The next section looks at the methodology concerned with the social costing of non-labour inputs.

#### 4.3.6.2 Non-labour inputs

##### 4.3.6.2.1 Land

Based on the principle of opportunity cost, the social cost of land in the context of basic needs can be estimated in terms of the agricultural production foregone per unit of land (Sharma, 1990). However, in the case of forest or degraded and waste land the social cost can be estimated as the value forgone to the community who use it. In view of the difficulty of arriving at a figure for this, several workers have estimated the opportunity costs of such land as zero. For example, Little and Tipping (1972) in a study of the Kulai Oil Palm Project, Khan (1993) in a social forestry project in India and FAO (1979) in their manual for the economic analysis of the forestry projects have all used zero as the opportunity cost of land.

Although Nair's study did not involve degraded and waste land, he also suggested that the use of such land should have zero social value. Even if the land is barren, however, there is likely to be some beneficial use in the absence of the project. Thus its opportunity cost depends on its productivity continuing in its existing use. Although it is difficult to find the value forgone to the society in terms of the production of basic needs goods and the generation of basic needs income, it is possible to obtain an estimate through a questionnaire survey. These aspects are dealt with in detail in context of the current study again in Appendix 8.4.

#### **4.3.6.2.2 Material inputs**

Like land, the social cost of material inputs such as seeds, fertilisers, insecticides and polythene bags can be estimated in terms of the forgone production of basic needs goods and foregone generation of basic needs income.

To identify the alternative use of inputs, material inputs can be divided into two groups namely (a) imported inputs and (b) domestically produced inputs. Nair argues that the estimation of the social cost of imported goods depends on the social policies of the government. For example, if the government aims to increase foreign exchange earnings through the export of certain goods, then the social cost can be estimated in terms of forgone domestic consumption. Another example of government policies can be seen in the case of the government imposing quota restrictions on the import of certain goods. For example, the restriction on the import of 'neptha' (an important ingredient in polythene manufacturing) may affect polythene manufacture and thus plantation activities and finally reduce the consumption of basic needs goods. In this case the social cost can be estimated in terms of the forgone consumption of forestry goods that would have been generated through the use of polythene in plantation establishment.

In the case of domestically produced goods the social cost merely depends on the elasticity of the supply of those inputs. If the supply is inelastic, the use of such inputs in the project may adversely affect the production of basic needs goods and the generation of basic needs income elsewhere. For example, the inelastic supply of fertiliser may reduce the agricultural production and hence results in higher social costs.

Appendix 8.4 gives the detailed procedure for the estimation of the social costs of various inputs involved in the projects under present study.

### **4.3.7 Estimation of the net goods effect and net income effect**

The difference between the goods effect and the social costs of projects in terms of the production of basic needs goods measures the net goods effect and is also referred to as the goods balance sheet.

Similarly the difference between the income effect and social costs of a project in terms of the generation of basic needs income measures the net income effect and is also referred to as the income balance sheet.

The net goods effect and the net income effect are expressed as shown earlier in expressions 4.4 and 4.5 respectively.

### **4.3.8 Estimation of the aggregation weights for the net goods effect and the net income effect**

The net goods effect and net income effect of a project in themselves would give a clear picture of the actual impact of a project. However, if a choice has to be made from a number of projects, it is necessary to aggregate these two effects to give a single value based on which projects can be ranked. Mere aggregation of these two effects may be misleading and thus weightings of these effects are needed to provide a single index. This requires that the aggregation weights will reflect the relative priorities to be given to basic needs goods production or basic needs income generation. In an open economy, where there is adequate supply of basic needs goods, a relatively high weight can be given to income effects. On the other hand, where basic needs goods supply is inelastic and the economy is more closed, equal weights may be given so that goods production and income generation are balanced.

$$\text{Thus } b_g + b_i = 1$$

where  $b_g$  is the aggregation weight for the net goods effect and  
 $b_i$  is the aggregation weight for the net income effect.

According to Nair

"..weights for aggregation can be derived on the basis of the situation as regards basic needs fulfilment that exists in the country, region or locality with which the project is concerned" (Nair, 1981, p. 208).

A preliminary approach prescribed by Nair for the estimation of the aggregation weights is described as below.

$$b_g = \frac{g - 1}{(g-1) + (i - 1)} \quad (4.8)$$

$$b_i = \frac{i - 1}{(i - 1) + (g-1)} \quad (4.9)$$

where  $g$  is basic needs supply co-efficient in a region or country and

$i$  is basic needs income co-efficient in a region or country.

" $g$ " can be estimated by knowing the requirements for and availability of basic needs goods in a region and can be estimated either as a composite value for all the items in the basic needs basket or for individual items produced by the project. Thus :

$$g = R / S$$

where  $R$  is the requirement of basic needs goods in a region or country and

$S$  is the availability of basic needs goods in a region or country.

Similarly, the basic needs income co-efficient can be estimated by knowing the total income needed to meet the basic needs and the existing average income of the persons concerned in a region, thus:

$$i = \frac{y}{Y}$$

where  $n$  is the number of household below poverty line;

$y$  is the basic needs income needed to fulfil basic needs consumption and

$Y$  is the existing average income of the households.

Although Nair suggested the above approach, he himself did not apply it in the analysis due mainly to the lack of the required information. He assumed an equal weight of 0.5 for both goods and income effects giving the reason that in a closed economy or where there is a scarcity of supply of basic needs goods there should be equal weighting given to both goods production and income generation.

Estimation of aggregation weight needs careful examination of the situation with regards to basic needs fulfilment in a country or a region with which the project is concerned. This is possible if the necessary information is available. Over long periods of time the values of the weights  $b_g$  and  $b_i$  are unlikely to remain constant. Therefore, the weights should be estimated for each year on the basis of the anticipated conditions as regards basic needs goods supply and basic needs income generation.

These aspects are dealt with in detail for the current study in Chapter 8.

#### **4.3.9 Aggregation of net goods effect and net income effect and choice among alternatives**

The net goods effect and net income effect represent two aspects of a project, indicating the effect on production of basic needs goods and generation of basic needs income respectively. As discussed in the last section, in order to rank the projects in terms of basic needs impact, these two effects are aggregated using the appropriate weight. The choice of best project from a number of projects is made on the following criterion discussed earlier in expression (4.1).

$$BNV = \frac{[ b_g (GE - Sc_g) + b_i (IE - Sc_i) ]}{N}$$

where BNV is the net annual aggregated basic needs value;

GE is the goods effect;

IE is the income effect;

$Sc_g$  is the social cost of project incurred in the production of basic needs goods;

$Sc_i$  is the social cost of project incurred in the generation of basic needs income;

$b_g$  is the aggregation weight for the net goods effect or goods balance sheet;

$b_i$  is the aggregation weight for the net income effect or income balance sheet

and

N is the project life

#### **4.3.10 Inter-temporal comparison of basic needs impact**

Nair has not discounted the costs and benefits occurring at different period of time despite the fact that CBA accepts the discounting as an important means for inter-temporal comparison of costs and benefits. As discussed in chapter 3, discounting implies that future costs and benefits are of lower value than present costs and benefits. In economic appraisal two methods are adopted to derive the discount rate. The first is based on social time preference and the second on the social opportunity cost or marginal productivity of capital. In the context of basic needs analysis however, the discounting of future consumption seems to be irrational. Some of the reasons in support of this argument are explained below.

The discount rate based on social time preference has been favoured by a number of workers for land use projects such as agroforestry and forestry (Price, 1989; Harou, 1985 and Kula, 1988). It is a function of two parameters : elasticity of social marginal utility of consumption (income) and growth rate of per capita real consumption (Sharma et al., 1991). The discount rate so derived is also referred as the consumption rate of interest (CRI) (Little and Mirrlees, 1974; Squire and van der Tak, 1975; UNIDO, 1978). The concept of diminishing marginal utility of consumption stresses that consumption at a low level of income gives rise to higher utility than at a higher level of income. This means discounting can only be justified when expected utility is likely to decline over a period of time with increases in income.

It is argued that decline in utility occurs not only due to time but also due to a number of other factors such as changes in tastes, change in technology, uncertainty and the possibilities of world destruction (Sen, 1962). However, utility in the case of basic needs goods remains more or less stable even with the change in these factors (Nair, 1981). It has been seen that the consumption pattern of basic needs goods has undergone very little changes over long period of time particularly in and among the lower income group. Consumption of fuel wood in developing countries such as India is a common example. Fuelwood has been the major source of domestic energy since human history and is still in use. There is likelihood that with increased income tastes may change but a change in taste does not mean the change in the essential qualities of essential goods.

Another factor which may affect the utility of goods is technological change. Through technological changes it is assumed that either the quantity of goods production is enhanced or new kinds of goods are produced which may diminish the utility of existing goods. Both

of these assumptions, however, seem to be less applicable in the case of basic needs goods since the share of technological change in fulfilling basic needs has been found to be very low (GOI, 1993; GOO, 1992). Machine-intensive technology has mainly been confined to the production of non-essential goods such as high quality clothes, machinery and export goods where expensive investment has been justified.

The growth rate per capita income is the main determinant of the social discount rate. It is clear from the discussion in Chapter 3 that rapid growth of per capita income has little effect on the basic needs satisfaction of poor people. Another important aspect is that the growth in per capita income need not necessarily bring changes in utility generated by basic needs goods for all people.

The aim of using the social opportunity cost (SOC) to derive the discount rate is to identify a rate that reflects the interaction between a society's saving schedule and investment opportunities. The argument for favouring the social opportunity costs concept (Baumol, 1968; Mishan, 1975) however, has been contradicted due to its failure in taking into account the inter-temporal consumption preferences of the society (Feldstein, 1964). Feldstein argued that opportunity cost is relevant in public investment decisions, but not for purposes of inter-temporal comparison. He also argued that the sole reliance on social time preference (STP) rate may lead to a misallocation of resources. This means the exclusive use of either of the concepts is still debatable and unresolved because social opportunity cost cannot be estimated without social time preference rate.

Evidently, inter-temporal comparison between the quantities of basic needs goods available today and the similar quantities of goods available in future is less relevant. For example, the importance and utility value of one kg of rice or a tonne of fuelwood for poor people would be same today as after five years unless the pattern of the consumption undergoes severe changes. The important point is that for many of the poor, they are not likely to be removed from the basic needs level after the project period, so their time preference rate should be zero.

A zero discount rate is therefore used in basic needs analysis; using time discounting as a method for identification of efficient projects is inappropriate in this context.

Further, it is also important to mention that the reliability of the methodology depends on the reliability of the assumptions made in the estimation of the parameters. Problems in deriving the various parameters especially in respect of a country with a weak data base

may pose a serious objection in making the approach practically useful. Therefore, what is important is to make assumptions based on as much factual information as possible so that the margin of the error can be reduced.

### **Summary:**

The applicability of CBA and other techniques developed for evaluation of a project designed to fulfil basic needs has been discussed in this chapter. CBA, even with its amendments, exhibits certain shortcomings when used within the context of basic needs strategy. It is evident from the discussion that Nair's basic needs approach is possibly the only approach which outlines a detailed methodology for basic needs evaluation because it takes into account the product and factor mix which are two essential components for basic needs evaluation. Nair's approach, although conceptually sound, needs refinement to apply practically in the evaluation of land use projects. An attempt has been made to refine Nair's approach by basing the estimates of various parameters on primary data. The steps to be taken according to the refined methodology have been outlined to apply to the current study.

Therefore in the context of the agroforestry, forestry and agriculture projects of Orissa, basic needs analysis has been used to evaluate the basic needs fulfilment. The financial cost-benefit analysis (FCBA) has been carried out to compare profitability of these projects from the point of view of the beneficiaries who are undertaking the project and the main implementing agency. The purpose of FCBA is to assist in comparing the degree of divergence in profitability from one farm to other and to gauge the extent to which it converges or diverges with the results of basic needs analysis. The ECBA and SCBA are not carried out due to their perceived shortcomings in the context of basic needs strategy.

In order to carry out the basic needs evaluation as mentioned in this chapter and the financial evaluation outlined in the last chapter, a large quantity of primary and secondary data are required. The next chapter deals with the methodology adopted for collection of these data. The computations for the financial and basic needs evaluation of the land use projects under current study are dealt with in detail in Chapters 7 and 8 respectively.



**Notes:**

- 1** For detailed description of product and factor mix, see 3.2.4 of Chapter 3 also see Bequele and Freedman (1979).
- 2** For aggregated discounted consumption see para 3.4.3 of Chapter 3.
- 3** Goods obtained from the non-monetised sector include non-marketable goods which are usually available free of cost. For example, fuelwood collected from the forest and cow dung are free. However, there are costs involved which need to be evaluated in terms of the foregone value of time and effort expended in collecting these goods.

## Chapter 5

### Data Requirements: Coverage and Methodology

To apply the methodologies outlined for financial and basic needs evaluations as well as to identify the socio-economic factors determining the profitability of land use projects, it was felt necessary to have a comprehensive database drawn both from the primary as well as the secondary sources. This chapter deals with the area covered, type of data required and methodology followed for the field survey. In order to cover these aspects in detail, the chapter has been divided into three sections. Section 1 deals with the sampling procedure followed in the selection of the area under survey. A brief description of the types of data required for the desired analyses is given in section 2 and the methodology followed for the collection of data is explained in section 3.

#### 5.1 Coverage

The study covers the evaluation of the three land use sub-projects (i.e. agroforestry, forestry and agriculture) in Orissa state of India. In fact, agroforestry and forestry are two sub-projects under the Forest Farming for Rural Poor (FFRP) component of the Social Forestry Project of Orissa. Agriculture is another sub-project which is covered under the rural development project known as the Economic Rehabilitation of Rural Poor (ERRP). Although FFRP and ERRP function on similar principles, the former is governed by the Forest Department while the latter by a joint co-operation of the Rural Development and Agriculture Departments. These three sub-projects (agroforestry, forestry and agriculture) however, are referred to from now onwards as three separate projects for the sake of convenience.

The FFRP was started during 1983-84. During the first phase (1983-84 to 1987-88) of the Social Forestry Project, the FFRP covered 9 out of 13 districts of the state. Subsequently in the second phase (1988-89 to 1992-93) it covered all 13 districts. The landless rural poor were selected as the target beneficiaries for the FFRP. The individual beneficiaries were selected on the basis of the list of the landless rural poor for each village maintained by the Rural Development Department of the Government of Orissa. The list was prepared with the help of the information gathered through a field survey (Mahapatra, 1994). Using this list, the required number of beneficiaries were selected according to the severity of their poverty. Each of the beneficiaries selected was allotted

0.5 hectare of degraded and unused waste land. A detailed description of the FFRP and ERRP has already been discussed in chapter 2. Although the FFRP started during 1983-84, planting did not commence until in 1984-85 and its actual physical existence came into effect only in 1985-86. Thus only the plantations established during 1985-86 have been taken into account for the present study because these were the oldest, having reached a rotation age of 9 years during 1993-94 (OFD, 1989b).

As stated above, the FFRP plantings established during 1985-86 covered 9 districts and were distributed amongst three out of the four different agro-ecological zones of the state. Considering the resource and time constraints, it was not possible however to cover all the 9 districts in this study. It was therefore decided to take a suitable sample which would provide an adequate representation of the whole state.

### **5.1.1 The sampling methodology**

A skilfully designed and well planned sample survey has been recognised as a practical way of gathering information (Atkinson, 1979; Som, 1973). Although various sampling techniques and designs have been prescribed (Jolliffe, 1986; Cochran, 1963; Moser and Kalton, 1971) most can be fitted into one of the two categories, namely probability and non-probability sampling.

In probability sampling various methods are used to draw samples from the population so that the probability of a particular individual in the survey is known or can be estimated with reasonable precision. This technique includes four main types of sampling (a) random sampling (b) systematic sampling (c) stratified sampling and (d) multi-stage sampling. Random sampling ensures that each member of the sampling population has the same probability of being chosen. In stratified sampling, the population is divided into a number of strata or groups on the basis of one or more characteristics of interest. Sub samples are then chosen randomly. Multi-stage sampling includes two or more stages such as a district and village. Probability sampling has been most commonly applied in field surveys (Sharma, 1990; Khan, 1993). Non-probability sampling is usually used when probability sampling does not prove to be practically possible.

As discussed in Chapter 2, Orissa state has four distinct agro-ecological zones, so a stratified, multi-stage (three stage), random sampling design was adopted to withdraw the samples of districts, villages and participants involved in the agroforestry, forestry and agriculture projects. This method facilitates the selection of samples with an equal

probability from all stages as well as from all relevant agro-ecological zones. It is important to mention here that out of 4 agro-ecological zones, the Eastern Zone has been excluded from the sampling procedure. This was done because the agroforestry and forestry were not initiated in this zone during 1985-86 and hence no empirical information would have been generated for the survey. Hence, the three stage sampling was confined to only 3 agro-ecological zones. The procedure followed for sampling at each stage is described below.

#### **5.1.1.1 Sampling at the district stage**

All the 9 districts covered under the 1985-86 agroforestry and forestry plantings were listed alphabetically and grouped into the three agro-ecological zones. A 50% sample of districts was selected randomly from each agro-ecological zone. Thus a total of 5 districts were selected out of the 9 districts. The distribution of districts in different agro-ecological zones were (a) Keonjhar and Mayurbhanj districts from the Northern Zone (b) Sambalpur district from the Central Zone and (c) Cuttack and Puri districts from the Coastal Zone.

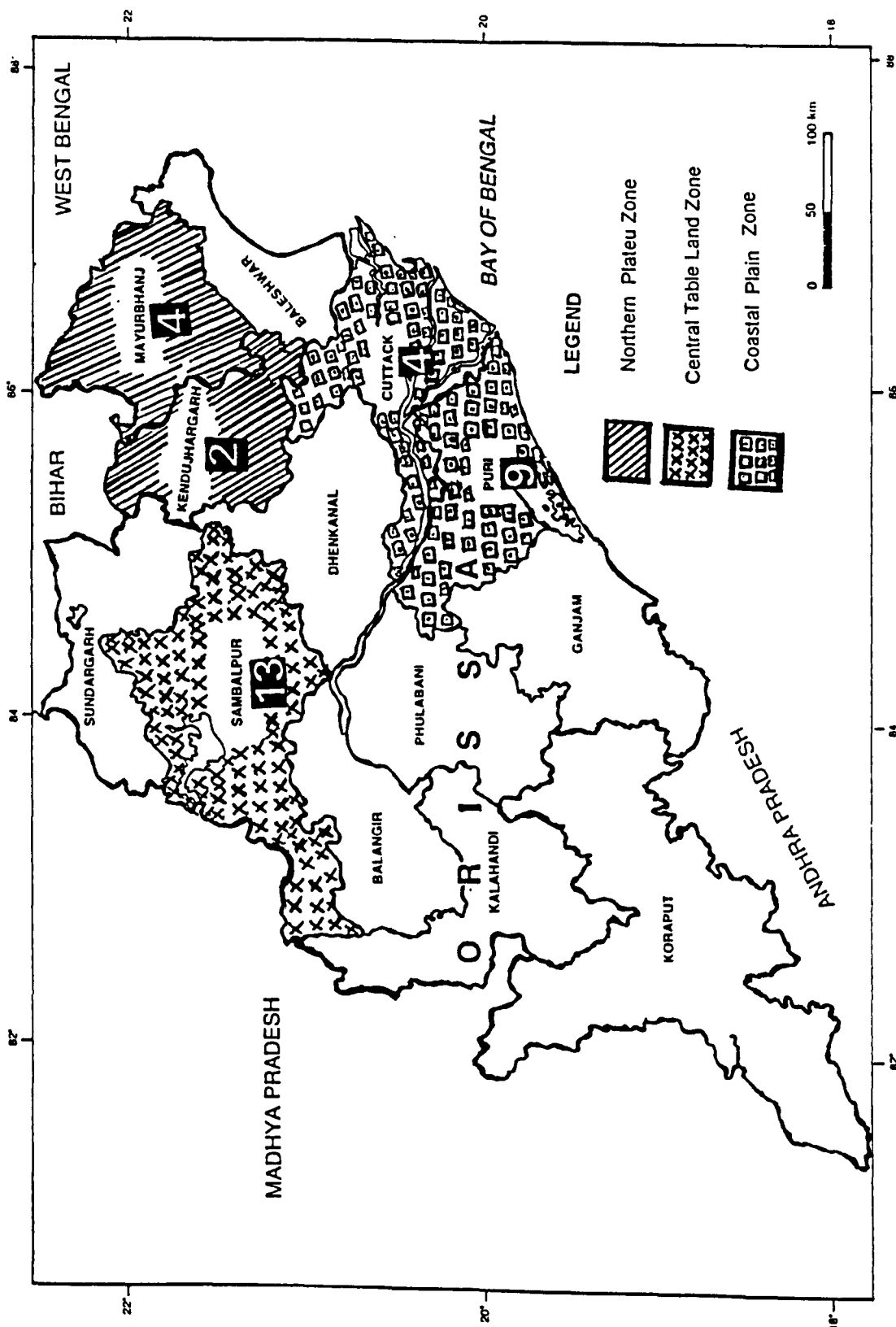
#### **5.1.1.2 Sampling at the village stage**

A complete list of the villages covered under the agroforestry and forestry projects in each of the sampled districts was obtained from the office of the Directorate of the Social Forestry Project. The names of the villages covered under the 1985-86 plantation under each district were arranged alphabetically. In order to represent all the districts appropriately a uniform sample of 20 % of the villages was withdrawn randomly from each of the sampled districts. This gave rise to a total of 32 villages from the 5 sampled districts. Map 5.1 below, exhibits the location of the sampled districts together with number of the sampled villages.

#### **5.1.1.3 Sampling at the participants stage**

The sampling of participants was carried out using a list of the participants known to be involved in the practice of agroforestry and forestry in each of the sampled villages. This list was obtained from the office of the local deputy directors of the Social Forestry Project. Adopting the same sampling procedure, a uniform sample of 20% of the participants was selected from the list of participants in each of the sampled villages. This provided a total sample of 140 participants split equally between agroforestry and forestry projects. A similar number of participants from the agriculture project was also

**Map 5.1** Location of sampled districts with number of sampled villages in sampled agro-ecological zones in Orissa.



Note: Numbers shown in highlighted agro-ecological zones indicate the numbers of sampled villages in respective districts.

selected. Thus, the final sample included 5 districts, 32 villages and 210 participants split equally between three projects. A complete list of sampled districts, villages and number of participants under agroforestry, forestry and agriculture projects is presented below in Table 5.1.

**Table 5.1 Zonal list of sampled districts, sampled villages and sampled number of participants in the agroforestry, forestry and agriculture projects.**

Zone	District	Village	Number of sampled participants in each project			Total
			AF	F	AG	
1. Northern Zone	1. Keonjhar	i. Ostapura	4	4	4	12
		ii. Duneipentha	2	2	2	6
	2. Mayurbhanj	iii. Baincha	4	4	4	12
		iv. Gardeulia	4	4	4	12
		v. Rugudi	2	2	2	6
		vi. Baunsabagan	4	4	4	12
<b>zone total</b>			<b>20</b>	<b>20</b>	<b>20</b>	<b>60</b>
2. Central Zone	3. Sambalpur	vii. Sikalposi	2	2	2	6
		viii. Tarang	2	2	2	6
		ix. Niktimal	2	2	2	6
		x. Ghosha	2	2	2	6
		xi. Gurupali	2	2	2	6
		xii. Chhatargadia	2	2	2	6
		xiii. Khinda	2	2	2	6
		xiv. Kumurapali	1	1	1	3
		xv. Baijapali	1	1	1	3
		xvi. Jamdarpali	1	1	1	3
		xvii. Gurlabahal	1	1	1	3
		xviii. Sahajbahal	1	1	1	3
		xix. Kurebaga	1	1	1	3
<b>zone total</b>			<b>20</b>	<b>20</b>	<b>20</b>	<b>60</b>
3. Coastal Zone	4. Cuttack	xx. Uttimara	4	4	4	12
		xxi. Nuagaon	4	4	4	12
		xxii. Betakholi	4	4	4	12
		xxiii. Brahamunia	3	3	3	9
	5. Puri	xxiv. Bhatsahi	2	2	2	6
		xxv. Dipisahi	2	2	2	6
		xxvi. Thakurpada	2	2	2	6
		xxvii. Nuapada	2	2	2	6
		xxviii. Sarada	2	2	2	6
		xxix. Kalikabadi	2	2	2	6
		xxx. Panchagaon	1	1	1	3
		xxxi. Pathargadia	1	1	1	3
		xxxii. Sundarpur	1	1	1	3
		<b>zone total</b>			<b>30</b>	<b>30</b>
<b>Total</b>	<b>5</b>	<b>32</b>	<b>70</b>	<b>70</b>	<b>70</b>	<b>210</b>

Note : AF, F and AG denote the agroforestry, forestry and agriculture projects respectively.

## **5.2 Data requirements**

As stated earlier the main objectives of the present study are threefold: firstly to assess the financial profitability of individual participants involved in agroforestry, forestry and agriculture projects ; secondly to assess the impacts of the three projects with regard to the fulfilment of basic needs and thirdly to identify the factors determining the profitability of the agroforestry and forestry projects. In order to follow the methodologies to reach these objectives, a large amount of quantitative and qualitative field level encompassing data of both a physical and socio-economic components was needed. A brief description of the different types of data required for the present study is given below.

### **5.2.1 Primary data**

The objective of collecting primary data was to create a detailed quantitative and qualitative data base covering the study area. There is a paucity of such information from secondary sources. The following types of primary data were required for the study.

- a. A socio-economic profile of the sampled villages.
- b. A socio-economic profile of the participants of the projects.
- c. Quantities of the items (food and non-food) consumed by the participants.
- d. Market prices of the items (food and non-food) consumed by the participants.
- e. Annual quantities of the various inputs incurred in the projects.
- f. Annual quantities of the outputs derived from the projects.
- g. Market prices of the inputs and outputs involved in the projects in different years.
- h. Growth (tree height and diameter) and survival percentage of trees from the agroforestry and forestry plots.
- i. Qualitative information with regard to the participant's knowledge, awareness, attitudes and opinions about outputs and various aspects of the projects.

### **5.2.2 Secondary data**

Secondary data also play a very important role especially in the evaluation of a government project. These are considered important to ensure the thoroughness and precision of evaluation results (King, Morris and Gibbon, 1987).

In Orissa, the office of the Director of the Social Forestry Project is the main source for state level information on the social forestry programme. At the regional level, the office of the Joint Director maintains the regional level information. However, the offices of the Deputy Directors at district level are the most important sources for obtaining the basic field level data. They are supported by a number of range offices at sub-divisional level. The Forest Department of Orissa has a well established system of maintaining a good data base on the individual plantations in the form of a standard record called 'The plantation register' This register is maintained at the range offices (sub-ordinate administrative office of the Forest Department) level. The following types of secondary data were collected for the present study.

- a. List and description of the agro-ecological zones, districts and villages covered under the projects.
- b. Expenditure details of the Social Forestry Project as a whole on different components on an annual basis, to estimate the indirect cost of the agroforestry and forestry projects.
- c. Agro-ecological data of different zones, districts and villages.
- d. Socio-economic backgrounds of zones, districts and villages.
- e. Cost estimates (prescribed by government) for agroforestry, forestry and agriculture.
- f. Cost estimates (prescribed by government) for harvesting of trees.
- g. Market sale prices of all outputs of the projects.
- h. Package of practices of different agricultural crops of the projects.
- i. The utilisation of all outputs from Orissa Forest Development Corporation, Orissa Forest Department and other departments
- j. Other relevant data from the district headquarters of the forest and revenue departments.

### **5.3 Field survey - the methodology**

#### **5.3.1 Tools for data collection**

When the sampling was completed in the study area, tools for data collection and a plan for the field survey were decided on. A structured and suitably designed questionnaire and formats were used as tools for this purpose. The collection of primary data was achieved by personal interview using a questionnaire comprising both open and closed typed questions. A copy of the questionnaire is presented in Appendix 5.1.



### **5.3.1.1 The questionnaire**

The questionnaire is recognised as an important tool for the collection of primary data (Sudman, 1982; Oppenheim, 1966; Moser and Kalton, 1979). The questionnaire designed for the present study consisted of two parts, the village profile and the main questionnaire. The village profile was designed to gather the salient features such as population structure, livestock details and land-use practices from the sampled villages. The main questionnaire included 35 questions consisting of both open and closed, attitudinal, quantitative and qualitative questions. Open-ended questions were included to capture the instantaneous responses and thoughts of the participants. An approach of combining both open and closed type questions was adopted to overcome the practical difficulties in analysing the open questions. Questions were carefully designed to capture (a) the socio-economic status of the participants and their expenditure on basic needs consumption (b) the knowledge and awareness of participants as well as (c) their attitudes and opinions with regard to acceptance and refusal of the practices. The 35 questions included in the main questionnaire were grouped into following six separate sections.

#### **5.3.1.1.1 Participant's socio-economic profile (q. no. 1 to 6)**

Questions in this section were designed to capture the basic social and economic profile of the participants involved in the projects. Socio-economic variables included in this group were family size, caste, literacy, occupation, nature of employment and income profile of the participants.

#### **5.3.1.1.2 Participant's expenditure on the basic consumption needs (q. no. 7 to 11)**

The purpose of this section was to collect information related to the consumption of the basic needs goods (food as well as non-food) and services by participants of the projects. The information in this section was mostly quantitative and was directly used to carry out the basic needs analysis.

#### **5.3.1.1.3 Participant's knowledge and awareness about the projects (q. no. 12 to 14)**

Questions under this section were framed to capture the knowledge and awareness of the participants with regard to their knowledge about the purpose of introducing the

FFRP, rights and obligation of the FFRP, type of the land used and the use of the land prior to the FFRP.

#### **5.3.1.1.4 Participant's involvement in the projects (q. no. 15 to 17)**

Participant involvement in any project is a very important aspect in making the programme a success. A set of questions were designed under this section to investigate the effort and interest taken by the participants in agroforestry, forestry and agriculture projects. Through these questions an attempt was made to gauge the survival percentage of the trees and possible reasons for low and high survival in the agroforestry and forestry plots amongst different participants..

#### **5.3.1.1.5 Participant's opinions about the actual benefits from the projects (q. no. 18 to 27)**

Although the agroforestry and forestry have reached their 9<sup>th</sup> year of establishment, no effort has so far been made to assess the actual benefits derived from the projects. In order to estimate the benefits generated from the various products a set of questions (q. no. 18 to 27) were framed to gather this information.

#### **5.3.1.1.6 Participant's attitudes and opinions about the projects (q. no. 28 to 35)**

The main purpose of incorporating this section was to find the attitudes, opinions and perceptions of the participants towards the projects. Most of the questions were designed to capture the free and unbiased suggestions and opinions of the participants. A few closed type questions were also included to avoid too much complexity during analysis. The responses in the form of suggestions and opinions such as quality of land and adequacy of marketing facilities, were thought to be of help in concluding the reasons for the success or failure of the project.

#### **5.3.1.2 The formats**

Additionally, since much of the data pertaining to the inputs and outputs of agricultural and forestry crops as well as growth of forestry trees were not available either from official sources or from published documents, collection of these from primary sources was also necessitated. Thus a set of formats was carefully designed for the

purpose. Annexures 5.1, 5.2 and 5.3 present the formats for collecting input, output and growth data respectively.

The growth data were collected in order to facilitate the estimation of the yield of standing trees from the agroforestry and forestry plots. This was needed because the harvesting did not take place in any of the plots (except one plot in the Coastal Zone) despite their attaining the rotation age during 1993-94. The reasons for non harvesting are mainly the delay in completing the bureaucratic formalities (Bose, 1994); these are discussed in chapter 6. In order to ascertain the output values of the trees, it was essential to estimate the yield of the trees. The detailed procedures for taking observations of height, diameter and survival percentage of trees are explained in section 5.3.2.2.1.

### **5.3.1.3 Sources of secondary data**

Secondary information was gathered from a variety of sources. These comprised personal communications with officials of government and semi-government departments, official records and reports and through published documents. The information gathered through these various sources is described below.

Lists of the beneficiaries of the projects, working modalities of the projects, cost estimates of the plantation, yearly expenditure under different components of the social forestry projects and daily wages of the labourers engaged in plantation were collected from the published documents, official records and personal communication with the officials of the Directorate of the Social Forestry Project, Orissa (OFD, 1987a; OFD, 1987b; OFD, 1988; OFD, 1989a; OFD, 1989b; OFD, 1993). Information describing typical agricultural system and cropping practices in Orissa, wages of labour employed in agricultural practices, cost of inputs and sale prices of outputs were gathered from the published documents as well as from personal communications with the officials of the Agriculture Department of the Government of Orissa (GOO, 1991; Das and Sarangi, 1994). Similarly, the climatological and socio-economic data of different agro-ecological zones and districts were gathered from the published documents from the office of the Directorate of Economics and Statistics, Government of Orissa (GOO, 1988; GOO, 1993). Data concerning the harvesting cost of trees, retail sale prices of various forest produce and the utilisation pattern of forest products of agroforestry and forestry were collected from the office of the Managing Director, Orissa Forest Development Corporation (OFDC, 1994). Information related to basic needs in India, minimum calorie

requirement, estimation of the poverty line etc. were collected from published documents from the Ministry of the Planning Commission, Government of India and the Indian Council of Medical Research (GOI, 1993 and ICMR, 1981). In addition, other relevant information was collected from various district headquarters as well as different departments of the state and central government.

### **5.3.2 Field work**

Field work was an important task because a major part of the study was based on the data collected from the field survey. Exhaustive planning for the field survey was considered essential in view of the large spatial extent of sample area (more than 50% of the total area) under study. The districts sampled were distributed in three different agro-ecological zones and were spread throughout the length and breadth of the state. The co-operation of the field and official staff of the departments concerned was therefore felt necessary. Hence the permission and support from the officials concerned was sought before proceeding for the field survey. A copy of the correspondence is given in Appendix 5.2.

#### **5.3.2.1 Interviewing the participants (questionnaire survey)**

As stated above, a questionnaire and formats were used to collect the primary data. Orissa has a separate regional language (called Oriya) therefore, in order to collect the data in a more convenient and realistic manner, an Oriya translation of the questionnaire was developed which was later on translated into English. In line with suggestions made in the literature (Kalton and Schuman, 1982; Nicholas, 1989; Casley and Kumar, 1982) a pre-testing of questionnaire was carried out in two districts, namely the Keonjhar district in the Northern Zone and Cuttack district in the Coastal Zone. Based on the responses received, a slight modification in the questionnaire was undertaken with the consent of the supervisor of studies who was also present during the early part of the field survey. After modification, the questionnaire was finalised with a set of 35 questions.

A six month period (mid October 1993 to mid March 1994) was devoted to the survey. Sampled participants were contacted personally and the purpose of the interview was explained clearly. The participants were then questioned without applying any undue force or pressure (Sudman, 1982). Nearly 95% of the participants were willing to cooperate in the interviews. Help from the local forest staff was also sought wherever it was felt necessary.

### 5.3.2.2 Collection of primary field data

As mentioned above, besides the questionnaire, formats (Annexures 5.1, 5.2 and 5.3) were also used to collect the yearly (from 1985 to 1993) input, output and growth data from the individual pots of the agroforestry, forestry and agriculture projects.

#### 5.3.2.2.1 Collection of data concerning forest products

The physical yield data with regard to the forestry products both from the agroforestry and forestry plots were not readily available from the official sources so it was decided to collect from primary sources. The primary aim of the collection of data related to the forest products was to investigate the resources created through agroforestry and forestry with regard to (a) the survival rate at maturity and (b) the production per unit at maturity. These could then be used to calculate the revenue generated from the trees. In fact, the forestry yield under the agroforestry and forestry projects should include everything from logs, poles and fuelwood to minor forest products like fruit, nuts, honey, medicine and environmental benefits. However, the survey was not able to cover everything due mainly to the time and resource constraints. Thus the survey was confined to investigate (a) the intermediate products such as grass, dry leaves, twigs and branches, poles and bamboo, before harvesting of the trees, and (b) the final products in terms of the timber volume and the fuelwood from the remaining part of the trees such as lops and tops and side branches .

The interviewing of the participants revealed that they derived a number of intermediate benefits such as grasses, dry leaves, twigs, poles and bamboo from the agroforestry and forestry plots after 2 to 3 years of the plantation until maturity. The silvicultural notes of the important species planted in agroforestry and forestry projects are given in Appendix 5.3. It suggests that most of the species for example, *Acacia auriculiformis*, *Dalbergia sissoo*, *Acacia nilotica* and Eucalyptus hybrid were used as fuelwood for cooking and heating, fodder for livestock feeding and small timber for household repair and farm fencing. After scrutiny of the official records of the Social Forestry Project, it was found that no effort had ever been made to quantify these benefits. Thus an attempt was made to quantify and evaluate the above items after obtaining the details from the participants. It was also clear during the interviews that these benefits were of great value to the participants. For example, the enclosure of the area during the first three years resulted in growth of grasses which were available as a fodder resource for participants. A major portion of these grasses was utilised by the

participants themselves with the remainder either sold for cash or bartered for other domestic goods like food grain, salt and sugar in order to fulfil their basic needs .

After three years of the plantation, the side branches were pruned to facilitate the better growth of the trees. These pruned branches and twigs were partly used as firewood for cooking and heating and partly were sold to earn some cash. The revenue received from these products was further utilised in basic needs fulfilment. After 3 to 4 years following the establishment of the trees, the dry leaves shaded by the trees were also utilised by the participant as cooking and heating fuel or marketed. During the later stages of the plantation (after 5 years), the minor species (here, other than Eucalyptus hybrid) were used as poles, firewood and fencing materials. In addition, some poles from Eucalyptus hybrid and bamboo were either used by the beneficiaries or sold locally. Thus, although the trees were not harvested legally, a considerable benefit in the form of intermediate products was already obtained by the participants. Details of annual quantities of the intermediate products and their local market values were procured from participants and local officials respectively.

Since none of the agroforestry (except one) and forestry plots had been harvested, the quantification of the final products was difficult. Hence, it was decided to estimate the yield of the standing trees (at maturity age i.e. 9 years during 1993 -94) in terms of the volume of timber and firewood. Since only the Eucalyptus hybrid species was standing in the agroforestry and forestry plots during 1993-94, standing volume of trees was estimated from the regression equation (discussed in following para) devised by Chaturvedi (1983). For this, it was necessary to collect data pertaining to height, diameter and number of the standing trees. As it was not possible to measure the height and diameter of each tree from sample plot, a small fraction of the population was selected. This was done by selecting sample plots within each stand plot. In principle five circular plots each of six metres radius were selected in a grid square system. This was done to cover a minimum of 10% of the area of the sampled plots under agroforestry and forestry projects. The location of the each sample circular plot was decided by using a mini random process.

To locate the circular plot, the survey map of each of the agroforestry and forestry sampled plots was obtained from the office of the local forest division and this was overlaid with a template square grid of transparent film (provided by a line of 100 x 50m i.e. 0.5 ha). Five circular plots (6 metre radius) were then selected randomly on the square grid template. Finally, with the help of the template square grid, the actual

location of the circular plot in the field was done by reading the scale on the template. The located circular plots were flagged by five different colours for taking measurements. The trees falling within the circular plot in the field were marked serially starting with number 1. Then the measurements of the height and diameter of each of the marked trees were taken following the procedures described below.

#### **a. Measurement of height**

The heights of the marked trees inside the circular plots were measured with the help of the Ravi Multimeter (Kumar, 1994). Small trees were measured using a five metre bamboo stick. Height was measured from the ground level to the top tip of the trees. The measurements taken were recorded and entered in the designed format (Annexure 5.3). The mean height of all the trees of a plot was considered as the mean top height of that particular plot for the estimation of the volume of the trees of that particular stand plot.

#### **b. Measurement of diameter**

The diameter at breast height (dbh) of all of the marked trees falling inside the circular plots was measured with the help of a lightweight calliper. Diameters were measured at breast height i.e. at a height of 1.37 metres above the ground and were recorded in the designed format (Annexure 5.3). This was accomplished on the conventional presumption that a tree which has a height of less than 1.37 metres is supposed to have zero diameter and consequently zero volume (Chaturvedi, 1983). When the tree had a very abnormal tapering at 1.37 metres then the average of two readings (i.e. one above 1.37 metres and other below 1.37 metres) was used. In some cases trees were found bifurcated above 1.37 metres in which case they were regarded as one tree only and diameter was taken at 1.37 metres. Trees which were found bifurcated below 1.37 metres were considered as two trees.

#### **c. Survival percentage of trees**

To know the total volume of the standing trees from each plot, the actual number of the trees standing in each agroforestry and forestry plot was required. Apart from the responses gathered through the participants and forest officials, the actual number of trees in each plot was cross-checked by personal counting of the all trees from each of the sampled agroforestry and forestry plots. This was possible because the size of the plot was very small (i.e. 0.5 ha).

#### **d. Estimation of stem volume**

The Eucalyptus hybrid has been studied in great detail with regard to its growth and yield. Considerable work has been undertaken in the Indian conditions and volume and yield tables have been prepared (Chaturvedi, 1973, 1974, 1983 and 1986; Pande and Chaturvedi, 1972; Sharma, 1978). However, to ensure the accuracy and precision with regard to the volume from the agroforestry and forestry plantation in the particular situation of Orissa, the actual growth data was used in the following regression equation for estimation of timber volume per tree of Eucalyptus hybrid devised by Chaturvedi (1983).

$$\text{Volume over bark} = - 0.0001 + 0.31145 D^2 H$$

where volume of a tree in cubic metres;

H is the mean top height of tree in metres and

D is mean diameter of tree at breast height in metres.

Using this equation the total volume of surviving trees from each agroforestry and forestry plot was estimated by multiplying the total number of trees by the estimated volume.

#### **e. Estimation of firewood**

The estimation of firewood from standing trees was based on a yield study undertaken by Das (1994) for the eucalyptus and other species planted in almost identical design of social forestry plantations in Orissa. According to Das's estimates, the average amount of firewood produced from a mature (9 years old) eucalyptus tree is about 8 kgs/tree in an agroforestry and around 10 kgs/tree in a forestry plantation. Applying these estimates, the total firewood likely to be procured from agroforestry and forestry plots was estimated on the basis of the surviving number of trees from each plot.

#### **5.3.2.2.2 Collection of data concerning agricultural products**

Quantities of the annual agricultural outputs (from 1985 to 1994) from agricultural and agroforestry plots were collected from the participants concerned. Input data for agroforestry and forestry plots were collected from the office of the Directorate of the Social Forestry Project, because the same inputs were applied in all agroforestry and



forestry plots according to the government prescribed norms. Inputs data from the agricultural plots were collected from the individual participants.

### **5.3.3 Problems in field work**

Being a senior officer of the Indian Forest Service of Orissa state, from where the field data were collected, the officials as well as respondents were, by and large known to me. This had both a positive as well as a negative impact. The former was in the sense that firstly I got full co-operation both from government officials as well as from respondents in terms of their willingness to spend their time with me. Secondly I was quite aware of the facts and figure on several aspects of the study. The negative impact was in terms of certain sensitive issues such as the question, "how many times did the project officials visit your FFRP plot ?". Such questions might created conflict between respondents and the forest official. Such issues were envisaged before undertaking the field survey and questionnaire was designed so as to avoid getting subjective and speculative answers (Saxena, 1992). Although the initial point of entry in the village was always with some of the forest officials, the officials were asked to leave after the initial introduction in order to create a free and unbiased atmosphere in which respondent would express their view with trust.

### **Summary**

Realising the necessity of a large amount of qualitative as well as quantitative data for the intended study, the field work was designed to gather all relevant information. A well structured and carefully designed questionnaire and formats were used for this purpose. The logistics of field work was carefully planned in advance. The field survey was conducted between mid October 1993 to mid March 1994 and relevant information was collected with the help of the officers and staff of the forest and other departments of the Government of Orissa.

The next four chapters (Chapters 6, 7, 8 and 9) discuss the results of the uses of the information gathered through the methodology outlined in this chapter. Chapter 6 examines the results of the questionnaire survey. Details of the financial and basic needs evaluation of agroforestry, forestry and agriculture projects are discussed in Chapters 7 and 8 respectively and Chapter 9 discusses the identification and interpretation of the socio-economic factors determining the profitability in agroforestry and forestry projects.

**PART - III**

**APPLICATION OF METHODOLOGY, RESULTS, DISCUSSION,  
CONCLUSIONS AND SUGGESTIONS**

**(CHAPTERS 6, 7, 8, 9 AND 10)**

## **Chapter 6**

### **Results of the Questionnaire Survey**

Based on the requirements and methodology discussed in Chapter 5, necessary information was gathered through the primary and secondary sources. The primary source was the questionnaire survey while the secondary source consisted of official records, reports, personal communications and published documents. This chapter presents the analytical results of the information collected through the questionnaire survey. As discussed in the last chapter the questionnaire used in the survey comprised two parts: the village profile (Appendix 5.1, part 1) and the main questionnaire (Appendix 5.1, part 2). A brief description of the sampled villages with regard to their average population, livestock and land uses is given in section 1 while the results of the participants' responses to the main questionnaire are discussed in section 2.

#### **6.1 Description of the sampled villages**

##### **6.1.1 Data entry and computation**

The questionnaires (both village profile and main questionnaire) after the field survey was completed, first sorted for each of the three land use projects and for each of the three agro-ecological zones.

A summary of the responses gathered through the village profile was prepared to give a broad idea of the sampled village with regard to the average human and livestock population and the distribution of farmers and land use practices in different zones. From the main questionnaire, the responses were sorted out for each question in the form of a frequency table. Annexure 6.1 gives a complete enumeration of the responses for each question (except the open ended questions) from participants in each of the three zones, three projects and three survival categories. This was done with a view to present an overall picture of the distribution of responses from various viewpoints. These absolute responses were converted into percentages to reflect a comparative proportion with respect to the total population.

Using the responses obtained, chi-square tests were carried out to establish if there are any significant differences among the responses of the participants between and

within the zones and projects. The results of the responses under each question are presented and discussed below.

### 6.1.2 Characteristics of the sampled villages

Details of the human and livestock population and land use practices in the sampled villages were collected through the village profile. Table 6.1 below presents the average population, number of household and percentage of different categories of farmers in sampled villages in each agro-ecological zone.

**Table 6.1 Details of the average population, household and percentage of farmers in the sampled villages by agro-ecological zone.**

Zone	Average population per village	Average house hold per village	Average house hold size	Percentage of farmers to total population			
				Large	Small	Marginal	Landless
1.Northern	572	168	3.4	3.6	33.8	18.8	43.8
2.Central	782	214	3.7	9.7	40.0	12.9	37.4
3.Coastal	857	130	6.6	4.9	34.4	21.5	39.2
<b>Average</b>	<b>737</b>	<b>171</b>	<b>5.0</b>	<b>6.1</b>	<b>36.0</b>	<b>17.4</b>	<b>40.1</b>

This indicates that the average population size in the sampled villages was lowest in the Northern Zone and highest in the Coastal Zone. With regard to the number of households per village, the Central Zone had the highest number while the Coastal Zone the lowest. This implies that the Coastal Zone has a much larger household size than that of the other zones.

The farmers have also been classified on the basis of the size of their holding. A farmer having more than 10 hectares of area in his possession is classified as a large farmer, those with 1 to 10 hectare as small farmers and less than 1 hectare as marginal farmers. The proportion of large farmers varied from 3.6% to 9.7% with the lowest in the Northern Zone and the highest in the Central Zone. The proportion of the landless people varied between 37% and 44% with the highest in the Northern Zone and the lowest in the Central Zone. In fact the Northern and the Coastal Zone have bigger

proportions of landless and marginal farmers whereas the Central Zone has much higher proportions of large and small farmers.

The details of the livestock presented below in Table 6.2 show that the average number of livestock in sampled villages was highest in the Central Zone and lowest in the Coastal Zone, although the average number of livestock per household was similar for all zones at between 4 and 5. The average proportions of cattle and goat/sheep are found to be fairly uniform at about 59% and 29% respectively in all the zones with buffaloes, pigs and horses making up about 11% of the total.

**Table 6.2 Details of the average livestock population and their distribution in the sampled villages by agro-ecological zone.**

Zone	Total livestock	Livestock per household	Percentage of total livestock		
			Cattle	Goat/Sheep	Other
1. Northern	775	4.6	58.3	28.9	12.7
2. Central	965	4.5	60.4	29.0	10.6
3. Coastal	536	4.1	59.1	30.0	10.8
<b>Average</b>	<b>759</b>	<b>4.4</b>	<b>59.2</b>	<b>29.3</b>	<b>11.4</b>

Details of the land areas and the percentage of their uses under agriculture, forestry, grazing and wastelands in sampled villages is given below in Table 6.3. This indicates that the average geographical area of the sampled villages was highest in the Central Zone which was two and half times that of the lowest in the Coastal Zone. The proportion of the forest land was by far the highest in the Northern Zone and lowest in the Coastal Zone. The reverse was the case with regard to the area under agriculture, the latter having the largest proportion of agricultural land. The grazing and wasteland were fairly uniform in the three zones with averages of 5% and 41% respectively.

From the comparative descriptions of village profile among three zones, it is evident that the Northern Zone having highest percentage of forest area supports the highest percentage of landless poor. In contrast to this is the Coastal Zone where much larger villages are supported by the biggest proportion of agricultural land, but the lowest proportion of forest and livestock.

**Table 6.3 Details of land area and their distribution in various uses in the sampled villages by agro-ecological zone.**

Zone	Total land (ha)	Percentage of the total land			
		Agriculture	Forest	Grazing	Waste*
1. Northern	339	40.2	42.7	3.7	40.1
2. Central	509	37.7	27.1	5.4	42.9
3. Coastal	206	54.1	25.1	4.9	41.3
<b>Average</b>	<b>351</b>	<b>44.0</b>	<b>31.8</b>	<b>4.6</b>	<b>41.4</b>

Note: \* includes from all types of lands.

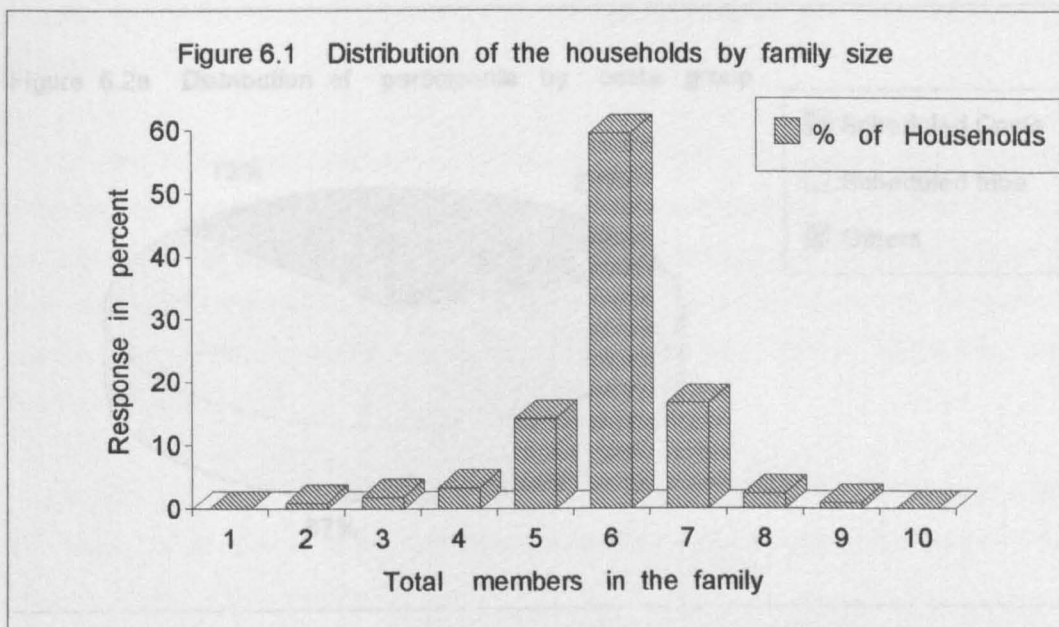
## 6.2 Results of the main questionnaire

As stated in Chapter 5, the main questionnaire was divided into six sections. The results of the responses of the participants from three agro-ecological zones under each section are presented and discussed below.

### 6.2.1 Participant's socio-economic profile (q. no. 1 to 6)

Questions in this section were designed to capture the social and economic profile of the participants involved in the FFRP and agriculture projects. Socio-economic variables included in this group were family size, caste, literacy, occupation, nature of employment and income profile of the participants. This information has been utilised in studying the determinants of profitability in the agroforestry and forestry projects and is dealt with in Chapter 9.

The information with regard to the average number of members (adult male, adult female and children) in a family was gathered through the first question of the this section. Figure 6.1 below presents the distribution of households according to the total members in a family. Six members were found in the maximum number of the households.



An average family consisted of 2 adults and 4 children in all the agro-ecological zones. The maximum number of members found in a family was 9 and minimum of 2 with more than 90% of households having between 5 and 7 members. The average size of a family ascertained in this question has been used in estimating the basic needs income for an average family for Orissa in the basic needs evaluation in chapter 8.

Caste is an important social element in Orissa. As discussed in chapter 1, the scheduled castes and the scheduled tribes are the two deprived caste groups in Orissa. The distribution of participants between different caste groups presented below in Figure 6.2a indicates that the majority of the participants belonged to the scheduled caste and scheduled tribes groups with two thirds of them from the later group. Only 13% come from the other groups such as the backward class and the elite class, for example, rajputra, brahmins and Kayastha.

The caste distribution of the participants in the three agro-ecological zones shown below in Figure 6.2b suggests that the highest percentage of scheduled tribes were found in the Northern Zone and lowest in the Central Zone.

Figure 6.2a Distribution of participants by caste group

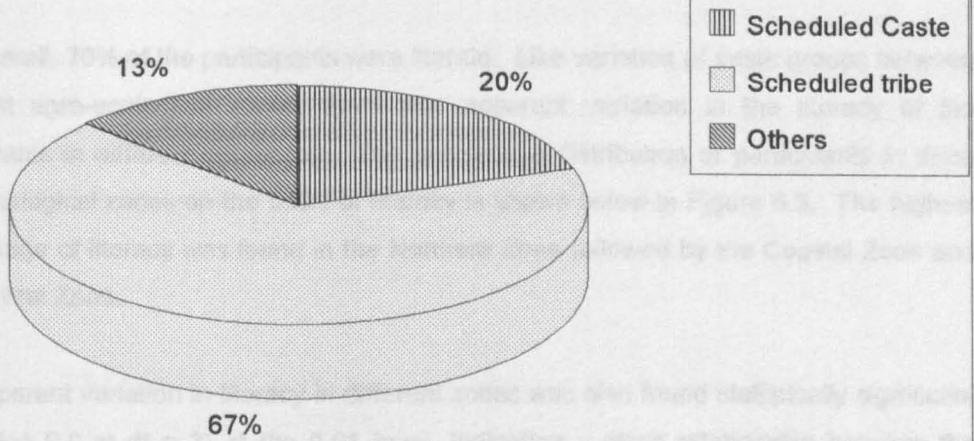
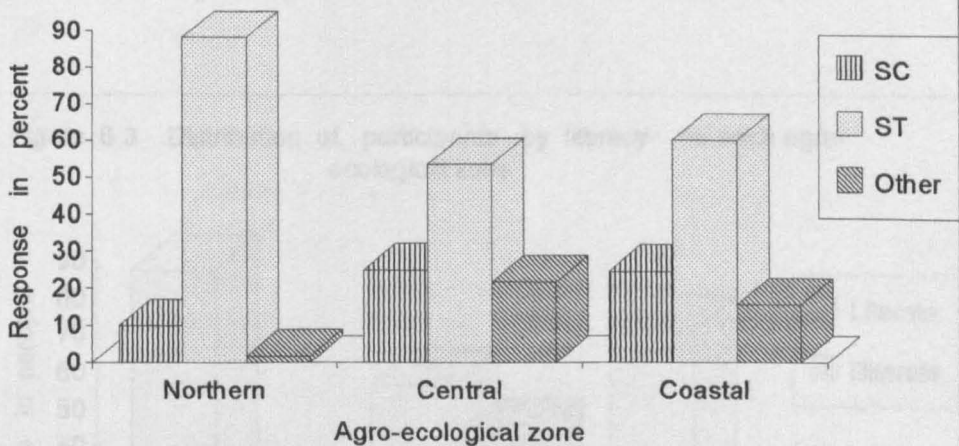


Figure 6.2b Distribution of participants by caste group for each agro-ecological zone



The apparent variation in the caste groups of the participants in different zones was tested statistically by using the chi-square ( $\chi^2$ ) test which was found highly significant ( $\chi^2$  value 20.61 at  $df = 4$ ) at the 0.01 level. This implies that the agro-ecological zones and the caste groups are closely related.

The above descriptions of caste groups of the participants indicate that the Northern Zone which is dominated by the scheduled tribe communities is comparatively backward in comparison to the other two zones. This is based on the argument (as discussed in

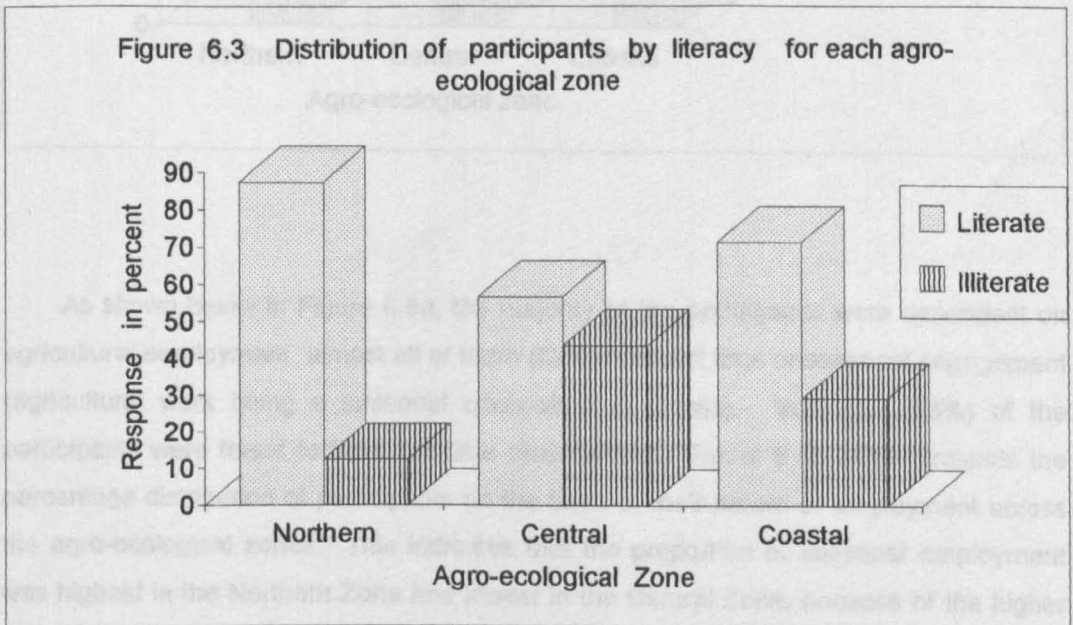


chapter 1) that the tribal dominated states are usually socio-economically backward in India.

Overall, 70% of the participants were literate. Like variation of caste groups between different agro-ecological zones, there was apparent variation in the literacy of the participants in different zones too. The percentage distribution of participants in three agro-ecological zones on the basis of literacy is shown below in Figure 6.3. The highest percentage of literacy was found in the Northern Zone followed by the Coastal Zone and the Central Zone.

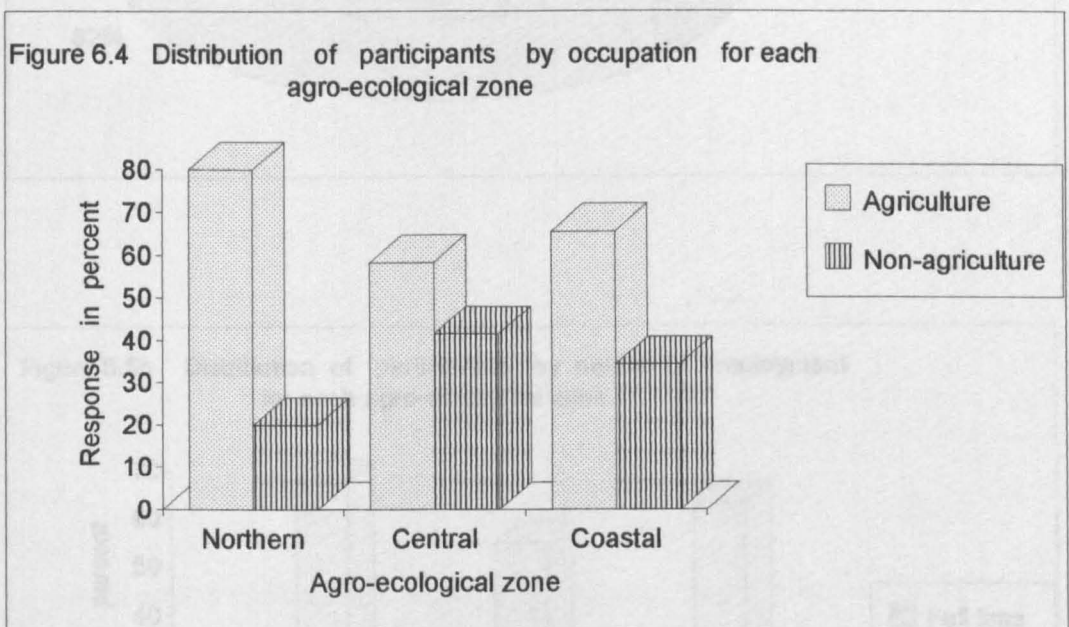
Apparent variation in literacy in different zones was also found statistically significant ( $\chi^2$  value 9.0 at  $df = 2$ ) at the 0.01 level, indicating a close relationship between the agro-ecological zones and the literacy.

The variation in literacy between different caste groups was also found highly significant ( $\chi^2$  value 17.4 at  $df = 2$ ) at the 0.01 level indicating a close relationship between caste groups and literacy.



Wages from agricultural work (i.e. working for someone else) were found to be the main source of livelihood for nearly two thirds of the participants. The remainder were dependent on non-agricultural employment. An apparent variation in the occupations of

the participants in three agro-ecological zones is presented below in Figure 6.4. This indicates that the percentage of participants whose livelihood were dependent on agricultural employment was maximum in the Northern Zone and the minimum in the Central Zone. The apparent variation in occupation of the participants in different zones was also found statistically significant ( $\chi^2$  value 6.7 at  $df = 2$ ) at the 0.05 level, which again implies that the occupation of the participants and agro-ecological zones are related.



As shown below in Figure 6.5a, the majority of the participants were dependent on agricultural employment, almost all of them (87%) had part time or seasonal engagement (agricultural work being a seasonal occupation in Orissa). Very few (13%) of the participants were found to have full-time employment. Figure 6.5b below presents the percentage distribution of participants on the basis of their nature of employment across the agro-ecological zones. This indicates that the proportion of seasonal employment was highest in the Northern Zone and lowest in the Central Zone, because of the higher proportion of participants dependent on the agricultural employment in the former zone.

Figure 6.5a Distribution of participants by nature of employment

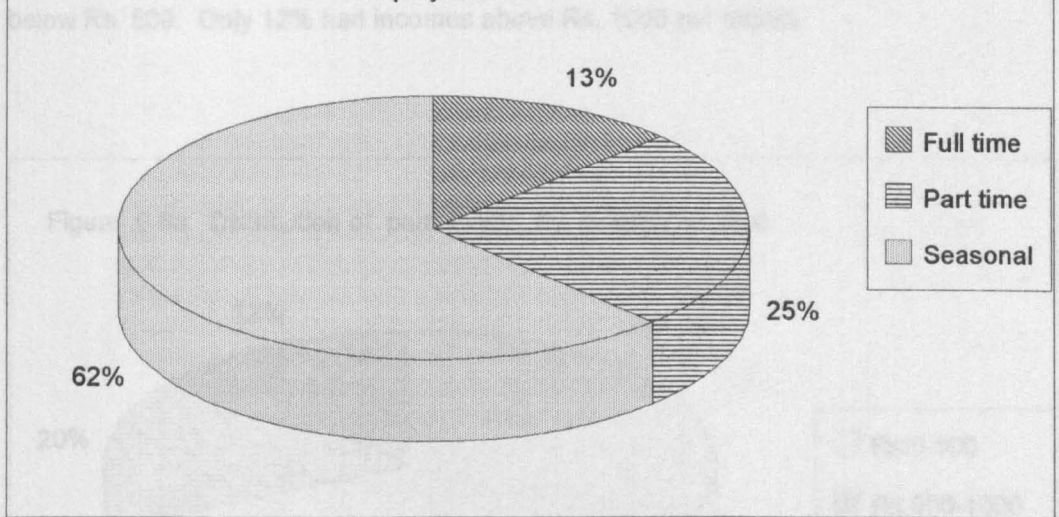
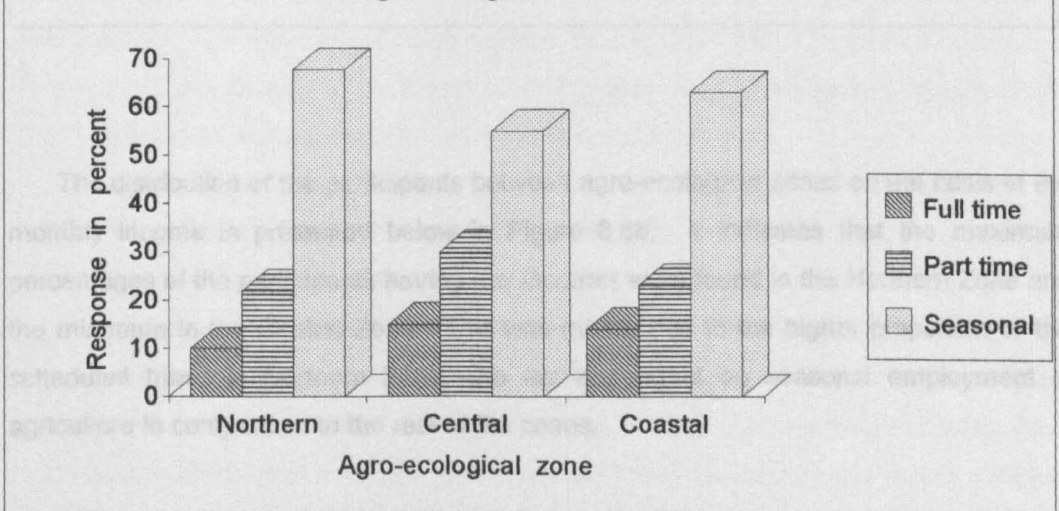


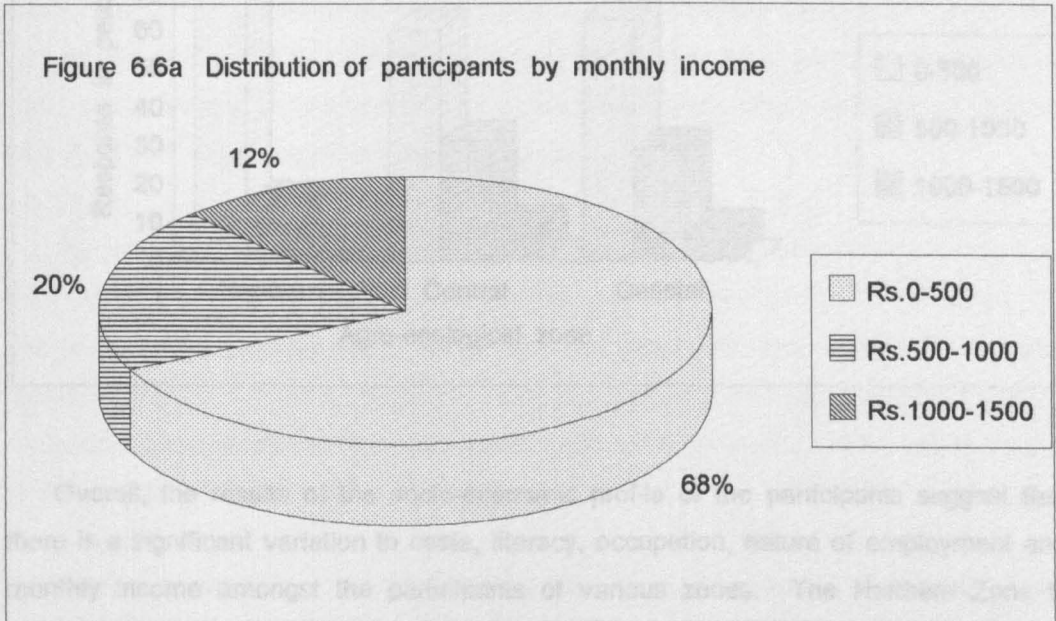
Figure 6.5b Distribution of participants by nature of employment for each agro-ecological zone



The monthly income of the participants was found to vary from a minimum of Rs. 50 to a maximum of Rs. 1500. Accordingly the participants were classified into three income groups namely (a) lower income group (monthly income ranging from Rs.0- 500), (b) medium income group (Rs. 500 -1000) and (c) higher income group (Rs.1000 -1500).



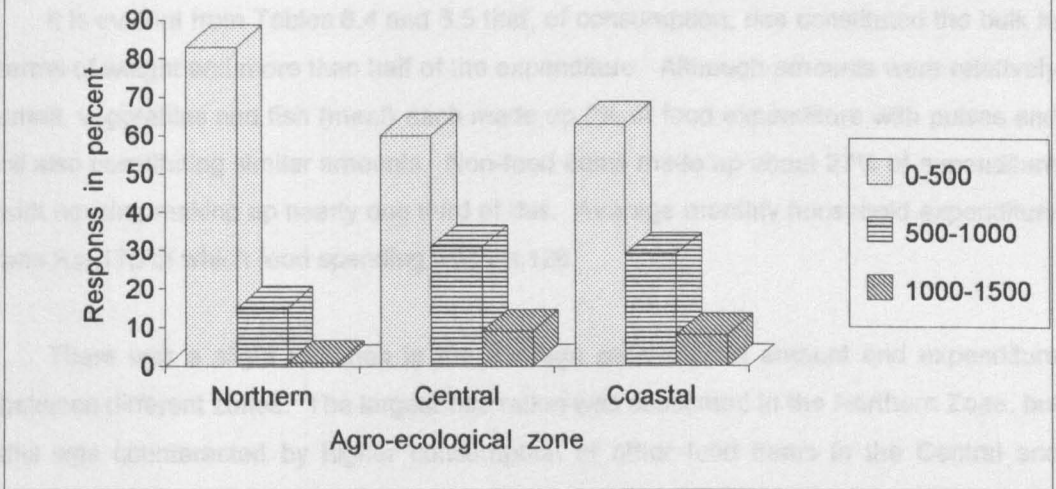
The responses with regard to the monthly income of the family presented below in Figure 6.6a indicate that a little less than two-thirds of the participants had incomes below Rs. 500. Only 12% had incomes above Rs. 1000 per month.



The distribution of the participants between agro-ecological zones on the basis of the monthly income is presented below in Figure 6.6b. It indicates that the maximum percentages of the participants having low incomes were found in the Northern Zone and the minimum in the Central Zone. This was mainly due to the higher proportion of the scheduled tribes in Northern Zone who are dependent on seasonal employment in agriculture in comparison to the rest of the zones.

Again variation in income of participants in different zones was found to be statistically significant according to the chi-square value (9.6 at  $df = 4$ ) at the 0.05 level. This again implies that there is a close relationship between the agro-ecological zones and income of the participants.

Figure 6.6b Distribution of participants by monthly income for each agro-ecological zone



Overall, the results of the socio-economic profile of the participants suggest that there is a significant variation in caste, literacy, occupation, nature of employment and monthly income amongst the participants of various zones. The Northern Zone is dominated by the participants of scheduled tribe groups with the highest degree of literacy and low income derived mainly from the seasonal employment from agriculture. This is followed by the Coastal Zone and the Central Zone.

### 6.2.2 Participant's basic consumption needs (q. no. 7 to 11)

The purpose of this section was to gather information with regard to the consumption of basic needs goods (food as well as non-food) and services by the participants of the three projects to carry out the basic needs analysis. The per capita consumption (both food and non-food) were collected through q. no 7 to 9. Information on goods obtained from the non-monetised sector, such as free firewood from the forest and cow dung from common land and pathways were also quantified and evaluated in terms of the foregone value of time and efforts spend on their collection. The market costs of goods were also collected to estimate consumption expenditure.

The information gathered on food and non-food consumption was compiled and the average per capita monthly consumption and expenditure were computed for different zones. Table 6.4 below, gives the details of the comparative picture of per capita per day consumption amounts both overall and within the agro-ecological zones. A similar

comparison for average per capita monthly consumption expenditure is shown below in Table 6.5.

It is evident from Tables 6.4 and 6.5 that, of consumption, rice constituted the bulk in terms of weight and more than half of the expenditure. Although amounts were relatively small, vegetables and fish (meat) each made up 9% of food expenditure with pulses and oil also constituting similar amounts. Non-food items made up about 27% of expenditure with housing making up nearly one third of this. Average monthly household expenditure was Rs. 173 of which food spending was Rs.126.

There was a slight variation in the average consumption amount and expenditure between different zones. The largest rice ration was consumed in the Northern Zone, but this was counteracted by higher consumption of other food items in the Central and Coastal Zone. In fact the total spending was much lower in Northern Zone than Coastal or Central Zone. Such variation was possibly due to the variation in the monthly income of the participants in different zones.

**Table 6.4 Average per capita per day basic consumption in the three agro-ecological zones of Orissa.**

Food items	Average per capita per day consumption in agro-ecological zones			Average of three zones
	Northern	Central	Coastal	
	Gm/day	Gm/day	Gm/day	
<b>A. Food</b>				
i. Cereal				
a. Rice	534	505	522	520
b. Wheat	26	35	28	30
ii. Pulses	24	37	30	30
iii. Vegetables	95	105	100	100
iv. Milk	25	35	30	30
v. Fish / Meat	17	23	20	20
vi. Edible oil	8	12	10	10
vii. Sugar	25	33	32	30

Source : Based on the questionnaire survey

**Table 6.5 Average per capita monthly basic needs consumption expenditure in three agro-ecological zones of Orissa.**

(figures in rupees at 1992-93 prices)

Food and non-food items	Average per capita monthly consumption expenditure in agro-ecological zones			Average of three zones
	Northern	Central	Coastal	
	Rs.	Rs.	Rs.	Rs.
<b>A. Food</b>				
i. Cereal				
a. Rice	66.21	62.62	64.91	64.58
b. Wheat	3.30	4.83	4.20	4.14
ii. Pulses	6.52	10.21	8.11	8.28
iii. Vegetables	9.97	11.65	11.50	11.04
iv. Milk	3.95	5.83	5.23	4.97
v. Fish / Meat	9.35	12.10	11.77	11.04
vi. Edible oil	6.52	9.94	8.48	8.28
vii. Sugar	4.62	6.57	6.21	5.80
viii. Other	6.30	8.56	7.62	7.50
<b>Total (food)</b>	<b>116.74</b>	<b>132.31</b>	<b>127.83</b>	<b>125.63</b>
<b>B. Non-food</b>				
i. Clothing	7.55	9.35	8.15	8.35
ii. Fuel	6.75	8.33	7.42	7.50
iii. Housing	14.15	15.60	15.25	15.00
iii. Light	8.40	9.60	9.00	9.00
iv. Exigencies	7.30	7.65	7.55	7.50
<b>Total (non-food)</b>	<b>44.15</b>	<b>50.55</b>	<b>47.37</b>	<b>47.35</b>
<b>Food+non-food</b>	<b>160.89</b>	<b>182.86</b>	<b>175.20</b>	<b>172.98</b>

Source: Based on the questionnaire survey

The overall average figures for consumption amount and expenditure with certain adjustment have directly been used for basic needs analysis which is dealt with in detail in Appendix 8.1.

As regards the expenditure on medical services and education (q. nos. 10 and 11), almost all of the participants (95%) responded that they were fully dependent on

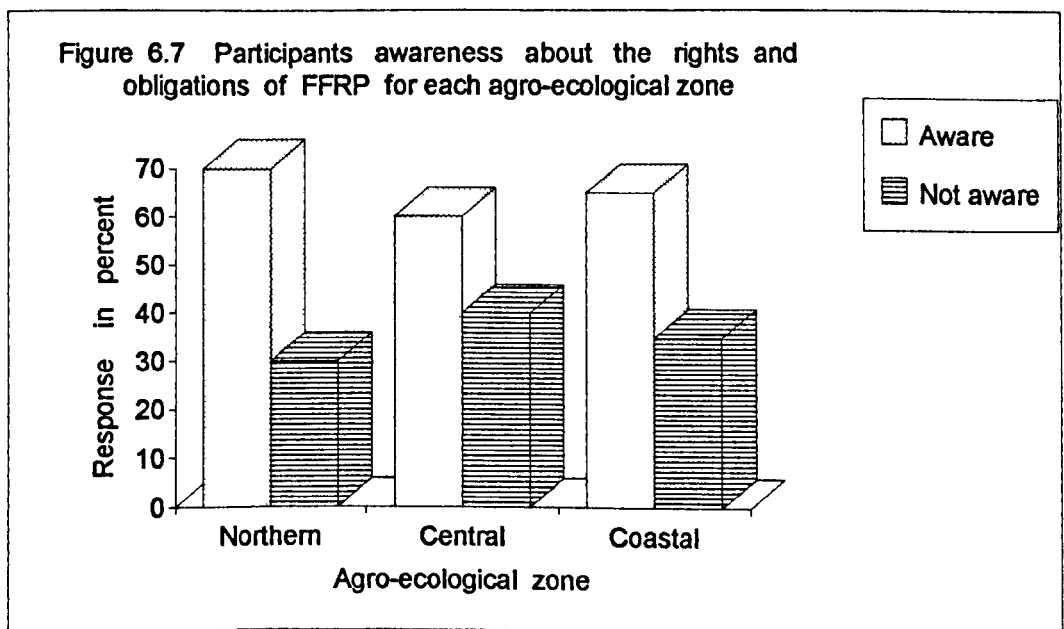
government hospitals and schools for the free medical treatment and free education respectively. This pattern of responses was common in all the zones.

### 6.2.3 Participant's knowledge and awareness about the FFRP (q. no. 12 to 14)

Questions under this section were framed to capture the knowledge and awareness of the participants with regards to their knowledge about the purpose of raising the FFRP, rights and obligation of the FFRP, types of land used and the uses of the land prior to the FFRP.

As many as 90% of the participants believed that the purpose of raising FFRP was to fulfil the basic needs for food, fuel, fodder and small timber followed by the generation of additional income. The rest were ignorant about its purpose. Nearly two thirds of the participants were aware about the entitlements of the FFRP (such as share in intermediate and final products) since the beginning of the project.

An apparent variation in responses with regards to the knowledge and awareness about the rights and obligations of the FFRP amongst the participants of different agro-ecological zones is presented below in Figure 6.7. It suggests that awareness was highest in the Northern Zone and lowest in the Central Zone.





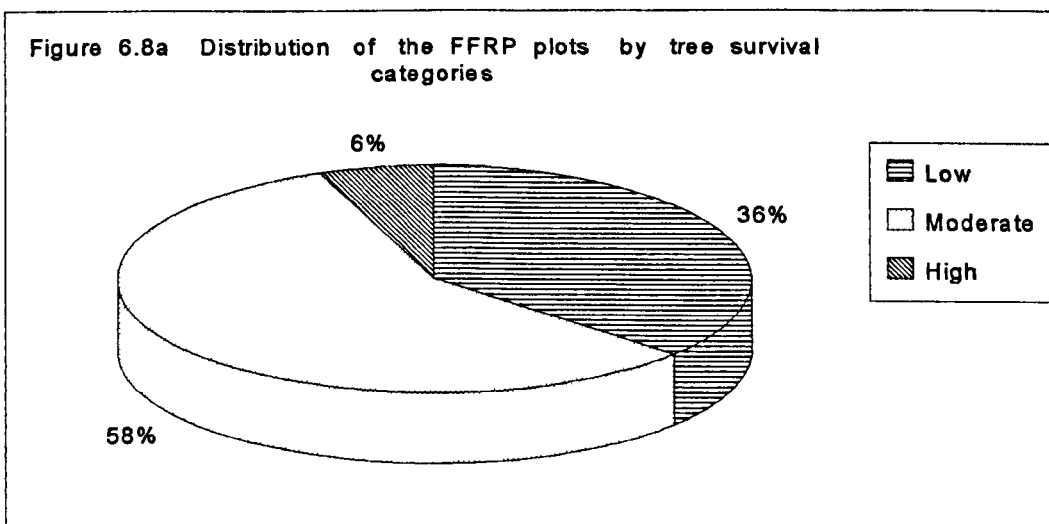
The apparent variation in the level of awareness between zones was also found to be statistically significant ( $\chi^2$  value 21.2 at  $df = 2$ ) at the 0.01 level indicating a strong relation between the agro-ecological zones and the knowledge and awareness of the participants.

On asking about the uses of land prior to the agroforestry, forestry and agriculture projects, nearly two thirds of the participants responded that the land was lying as barren and degraded waste land without any use, while one third stated that it was used for grazing purposes. This particular information was used in estimating the social opportunity cost of land in the basic needs evaluation. There was little variation in opinions on the above use of the land amongst the participants of the different agro-ecological zones.

#### 6.2.4 Participant's involvement in the FFRP (q. no. 15 to 17)

Participant's involvement in any project is a very important aspect in making the programme a success. To investigate the effort and interest shown by the participants in the agroforestry, forestry and agriculture projects, a set of questions was designed. An attempt through these questions was to gauge the survival percentage of trees and the possible reasons for this.

A summary of the responses with regard to the average survival percentage of trees (q.no. 15) in the agroforestry and forestry projects is presented below in Figure 6.8a.



This indicates that there were only a few plots (6%) where the survival rate was high (> 50% survival). However, more than half of the plots had the moderate survival (25-50% survival) and a little more than one third (36%) of the plots had a low rate of survival (< 25% survival).

The survival percentage of trees in agroforestry and forestry projects was also found to vary between the different zones as shown below in Figures 6.8b and 6.8c respectively.

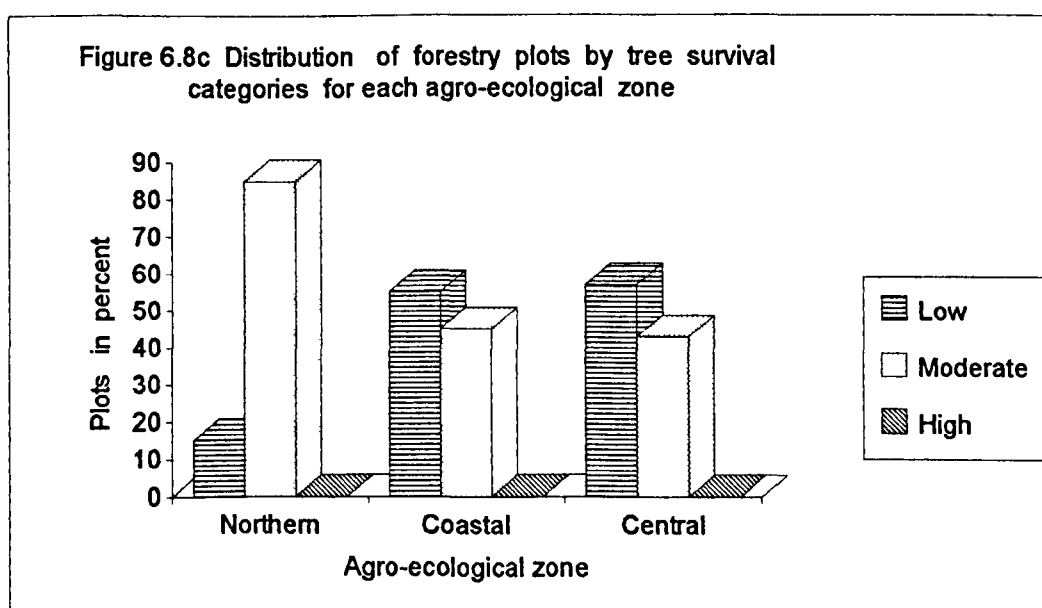
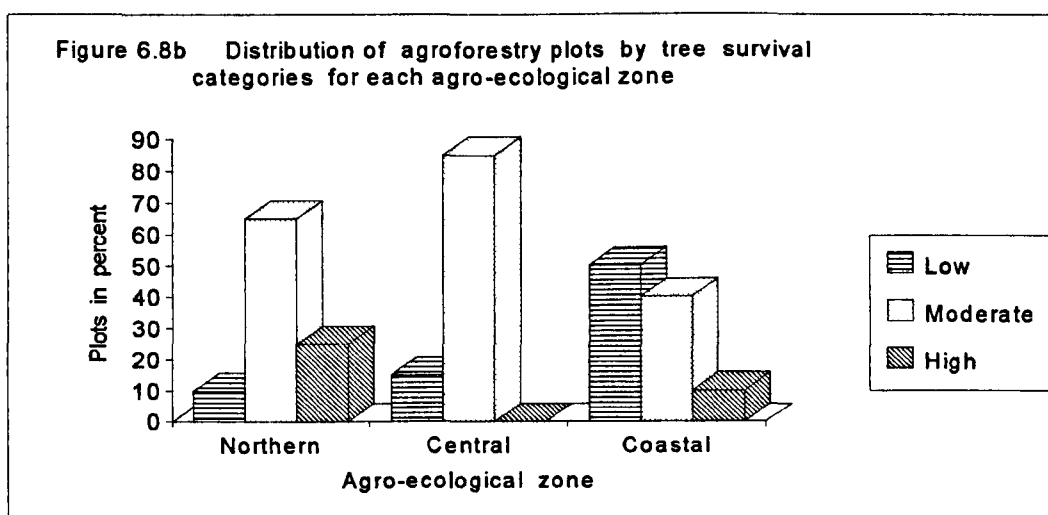


Figure 6.8b which presents the responses of the agroforestry project suggests that the Northern Zone had the maximum percent of plots under the high survival categories followed by the Coastal Zone. The Central Zone did not have a single plot under the high survival category, but did have the highest moderate survival percentage. The percentage under the low survival category was found greatest in the Coastal Zone and least in the Northern Zone.

In the forestry project, for which responses are presented in Figure 6.8c, not a single plot was within the high survival category. The plots under moderate survival category were highest in number in the Northern Zone and with the Central and Coastal Zone both exhibiting the greatest low survival percentages

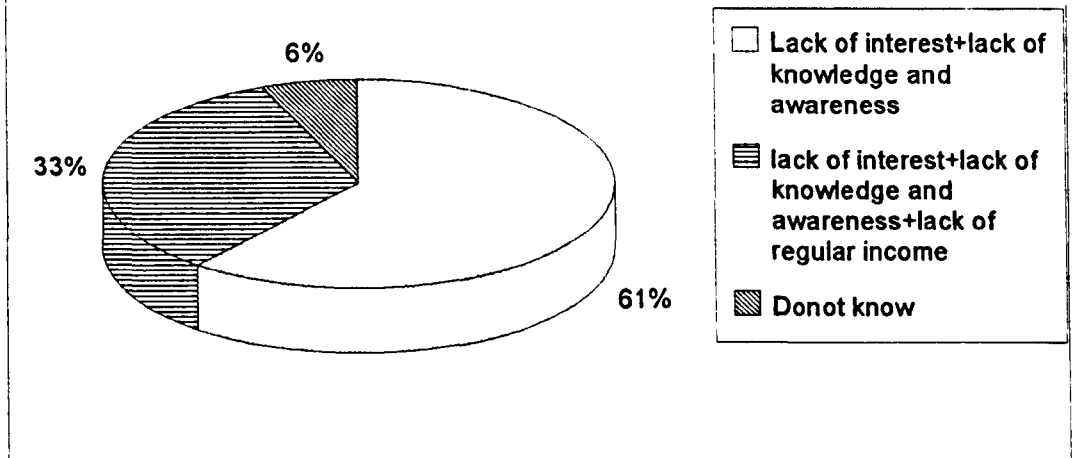
A comparison of the responses presented in Figures 6.8b and 6.8c suggests that agroforestry had a higher proportion of plots under high and moderate survival categories than forestry, but the pattern between zones differed for the two projects.

The varying levels of survival between zones and projects were found highly significant ( $\chi^2$  value 21.7 at  $df = 4$ ) between zones and ( $\chi^2$  value 10.5 at  $df = 2$ ) at the 0.01 level.

After obtaining the survival percentages of trees in agroforestry and forestry projects in different zones, efforts were made to find out the reasons for low, moderate and high survival. A summary of the socio-economic and agro-climatic reasons for the low survival percentage of trees was compiled and is presented below in Figures 6.9a and 6.9b respectively.

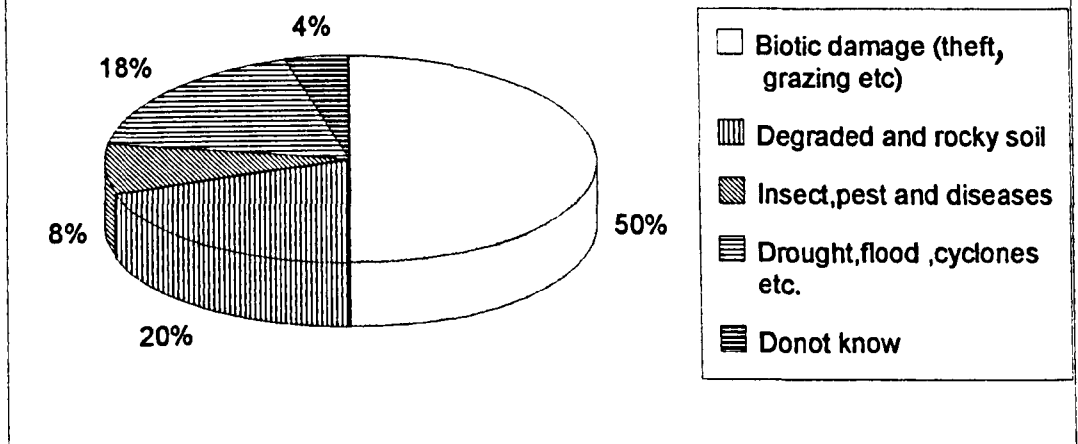
Figure 6.9a suggests that a more than half of the participants of agroforestry and forestry projects were of the opinion that the lack of knowledge and awareness accompanied by the inadequate effort and interest shown in the protection of the trees were the major socio-economic causes of poor survival in agroforestry. In addition to these, nearly one third of the participants from the forestry project gave lack of regular income as the reason for the low survival. This was based on the argument that the lack of regular income causes the participants to visit the farm less frequently which results in poor protection and finally the low survival of the trees. In contrast to this is the case in the agroforestry where visits to the plots become frequent due to regular income from the agricultural products plots which commenced close to the beginning of the project .

**Figure 6.9a** Distribution of responses on socio-economic reasons for the low survival of trees in FFRP

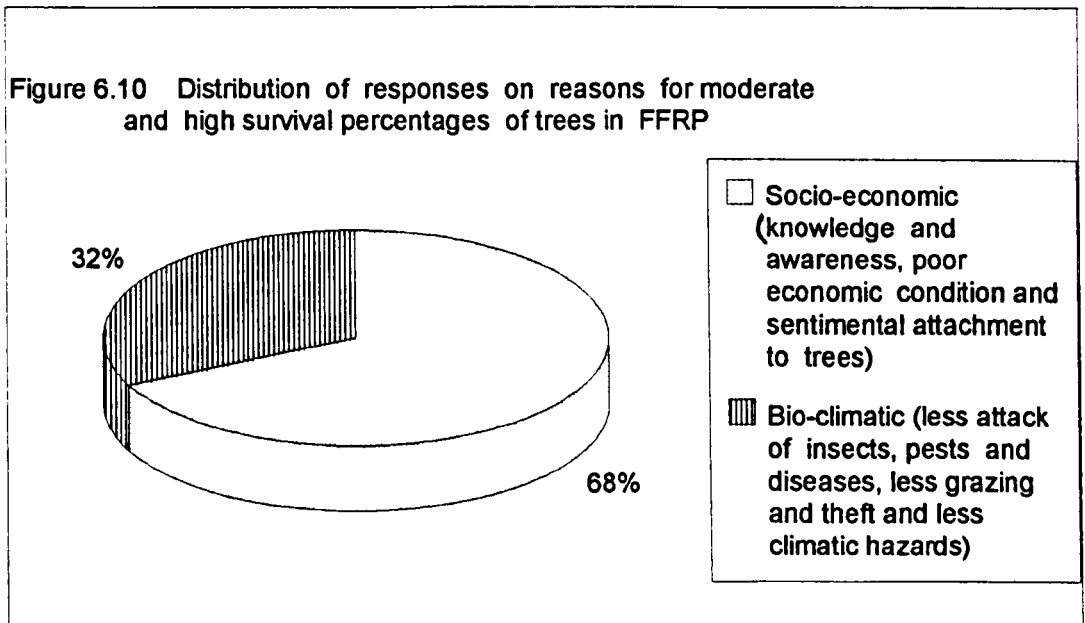


Responses with regard to the bio-climatic reasons for low survival of trees presented in Figure 6.9b suggest that the damage due to bio-climatic factors such as poor and degraded soil, natural hazards (drought, flood and cyclones) and the attack of insects, pests and diseases were the reasons for low survival. Yet half of the mortality was due to the biotic damage such as theft and grazing.

**Figure 6.9b** Distribution of responses on bio-climatic reasons for the low survival of trees in FFRP



Results of the responses with regard to the reasons for moderate and high survival are presented below in Figure 6.10.



More than two thirds of the participants were of the opinion that sentimental attachment to the trees accompanied by knowledge and awareness about project and poor economic conditions created the interest and enthusiasm amongst the participants which resulted in the better protection of the trees. The other one third of the participants thought that a lower prevalence of insects, pests and diseases accompanied by less biotic and climatic damage were the reasons for moderate and high survival of trees.

### 6.2.5 Benefits from the FFRP (q. no. 18 to 27)

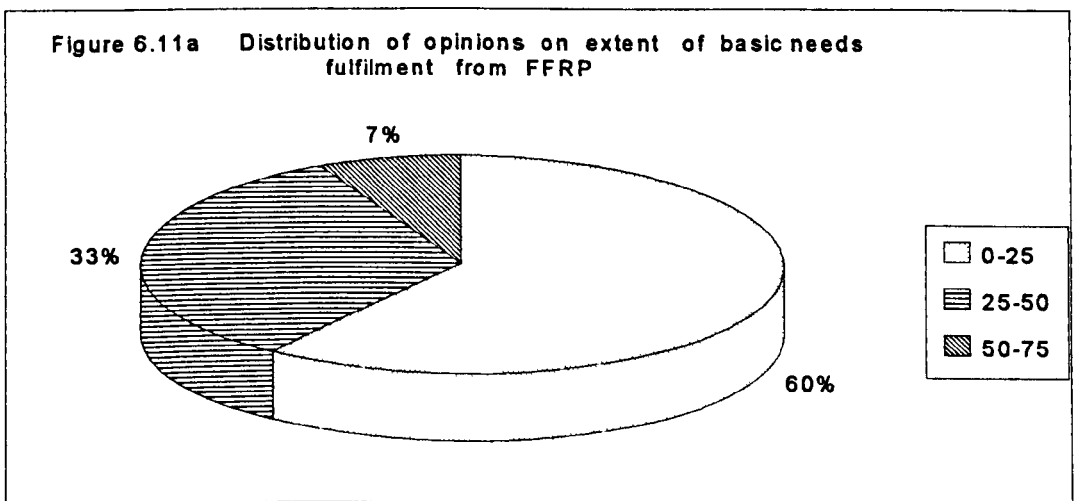
Although the agroforestry and forestry had reached its 9<sup>th</sup> year of establishment, no effort has so far been made to assess the actual benefits derived from the projects. Although the detailed quantitative information with regard to the benefits from the FFRP were gathered (Annexure 5.2), general opinions of the participants with regard to the benefits generated from the projects were captured through q. no. 18 to 27.

All the participants of the agroforestry and agriculture projects reported that they had derived the agricultural products from their plots. The majority of the participants (92%) used the agricultural products for their own consumption while the rest used them partly

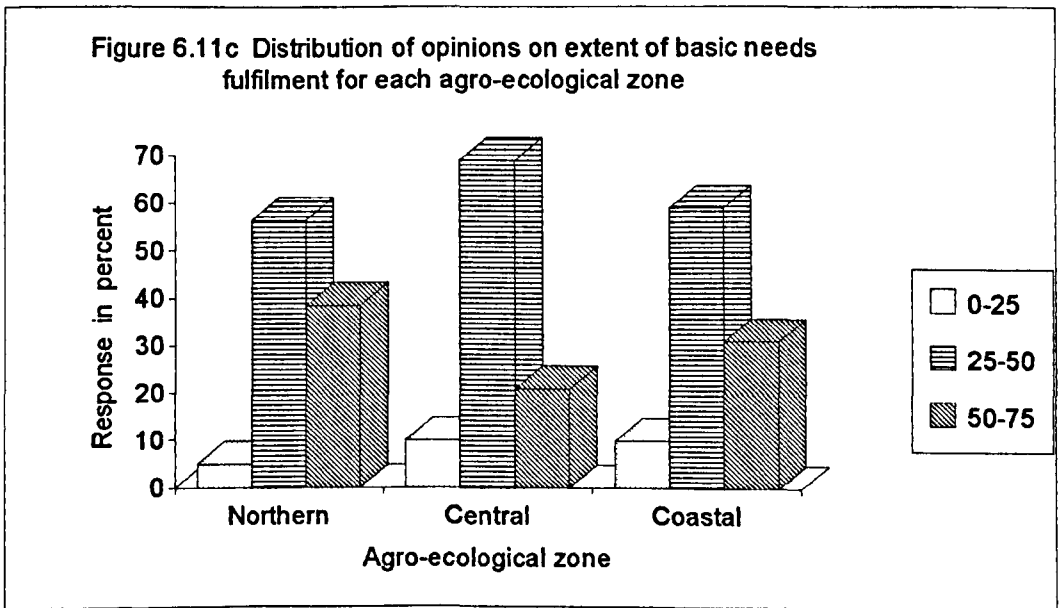
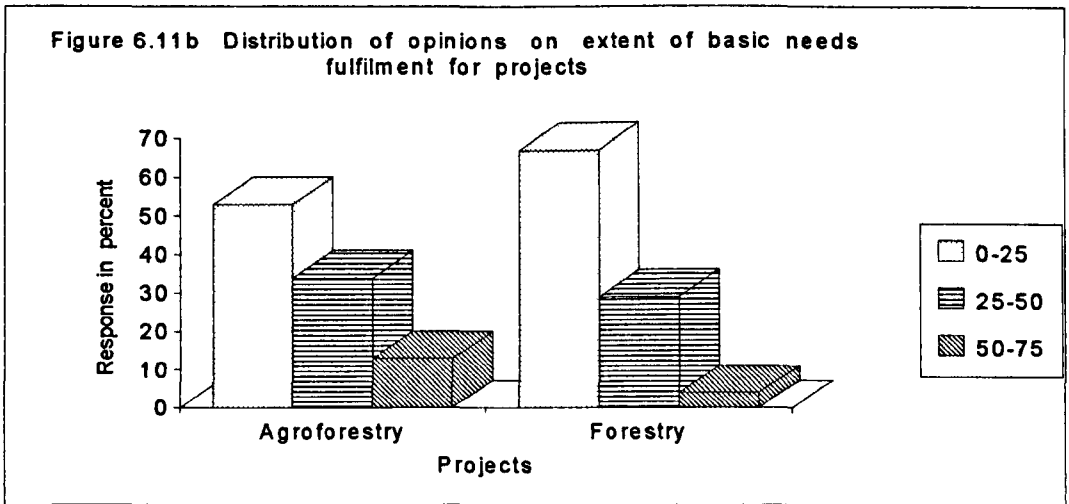
for consumption and partly for sale. The revenues generated from the sale of the products were re-utilised for basic needs satisfaction. Amongst the participants of the agroforestry and forestry projects nearly 94% received intermediate products such as dry leaves, grasses, twigs and branches, leaf fodder, bamboo and poles from various species before the final harvest of the main species. The remainder did not receive any such benefits due to the complete wash out of their plots as a result of natural hazards. Some 95% of the participants, who received intermediate products used them for their own consumption and the remainder sold them for cash income.

It was difficult to find out the possible benefits from the participants with regard to the final products likely to be harvested in the future. This was due to non-harvesting of any of the plots (except one plot in the Coastal Zone) under the agroforestry and forestry projects. On asking the reasons for non-harvesting, the majority of the participants reported that the non-issue of the legal document referred to as tree patta and the lack of price negotiation were the two main reasons. This means that the participants were in need of help with regard to the negotiation of prices as well as the permission to fell the standing trees.

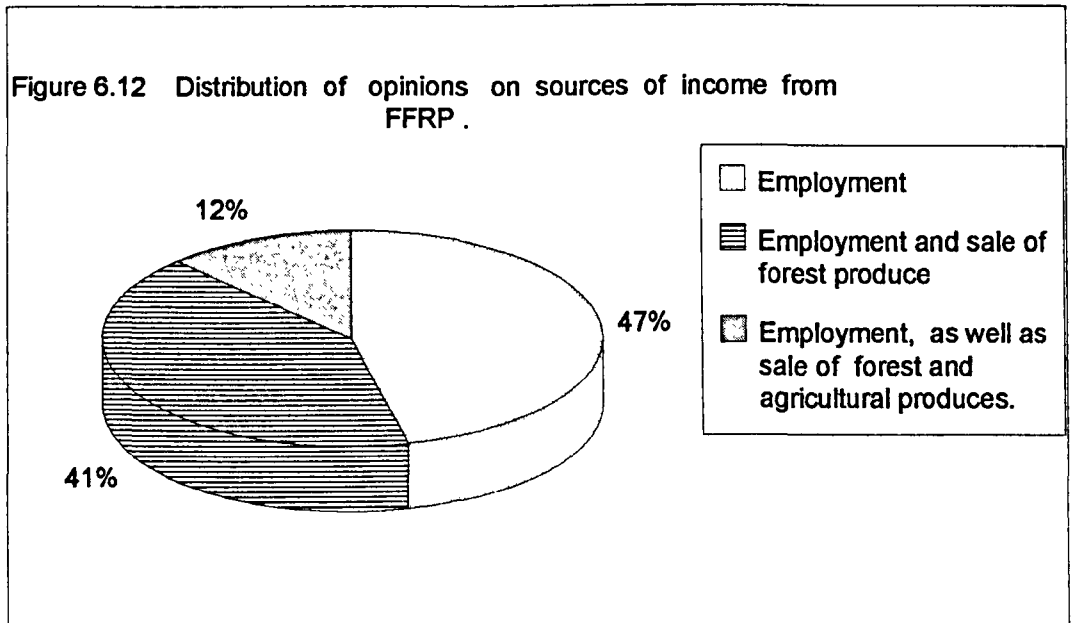
On the basis of the outputs generated and utilised by the participants, effort was made to discover the extent of basic needs fulfilment. Figure 6.11a presents the average of the responses with regard to the extent of basic needs fulfilment from the FFRP. The majority of the participants (60%) were of the opinion that the extent of basic needs fulfilment was below 25% and one third replied that the fulfilment was between 25 - 50%. Only a few (7%) told that the fulfilment was above 50% but within 75%.



The participants whose plots were completely washed-out gave the only negative responses. The percentages of responses with regard to the extent of the basic needs fulfilment between the agroforestry and forestry are presented below in Figure 6.11b which suggests that a higher percentage of basic needs fulfilment was found in the case of agroforestry. Responses for the three agro-ecological zones are shown below in Figure 6.11c which indicates that the percentage of basic needs fulfilment was highest in the Northern Zone and lowest in the Central Zone.



In addition to that of basic needs fulfilment, the information with regard to cash income generated through the agroforestry and forestry projects was also gathered. Nearly 94% of the participants responded that agroforestry and forestry had helped in raising the income of their family. The responses with regard to the various ways of increasing the income are presented below in Figure 6.12.



This suggests that some 47% of the participants were of the opinion that the employment generated in the FFRP was the main source of income. The remainder responded that, apart from the employment the sale of the forest and agricultural products also contributed in generation of the cash income .

Summarising the results of this section it can be concluded that more than 90% of the participants received both agricultural and intermediate forest products from forestry. Nearly three quarters of them used these products for their own basic consumption needs. The generation of employment was the main source of income in the opinion of the most of the participants.

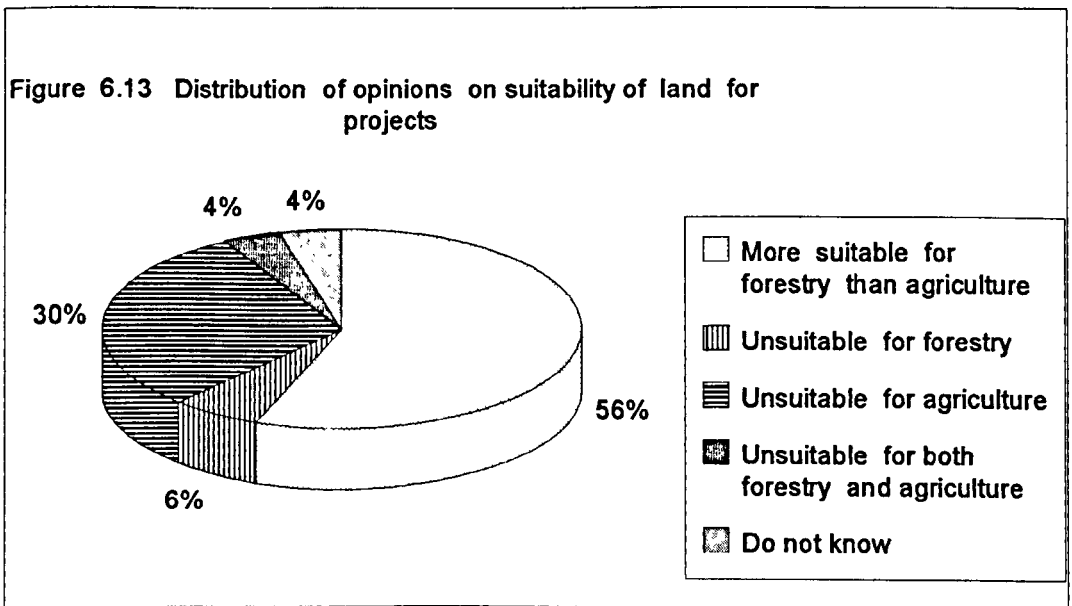
### 6.2.6 Participant's attitudes and opinions towards the FFRP (q. no. 28 to 35)

The main purpose of incorporating this section was to find the attitudes, opinions and perceptions of participants towards the FFRP. Most of the questions were designed to



capture the free and unbiased suggestions and opinions of the participants. A few closed type questions were also included to avoid too much complexity during the analysis. The responses in the form of suggestions and opinions such as quality of land and adequacy of marketing facilities were thought to be helpful in concluding the reasons for success and failure of the project. The results of the responses received through the questions of this section are summarised below.

As discussed earlier, the main idea behind the agroforestry and forestry projects was to meet the basic needs of the participants by utilising the government unused and degraded wasteland. Thus the land allotted to all the participants was supposed to be of almost the same quality. The responses with regard to the suitability of land for projects presented below in Figure 9.13 suggest that the land allotted was overwhelmingly more suitable for the forestry project. In fact, in more than one third of responses, the land was not considered suitable for agriculture and further 56% considered it more suitable for forestry than agriculture.

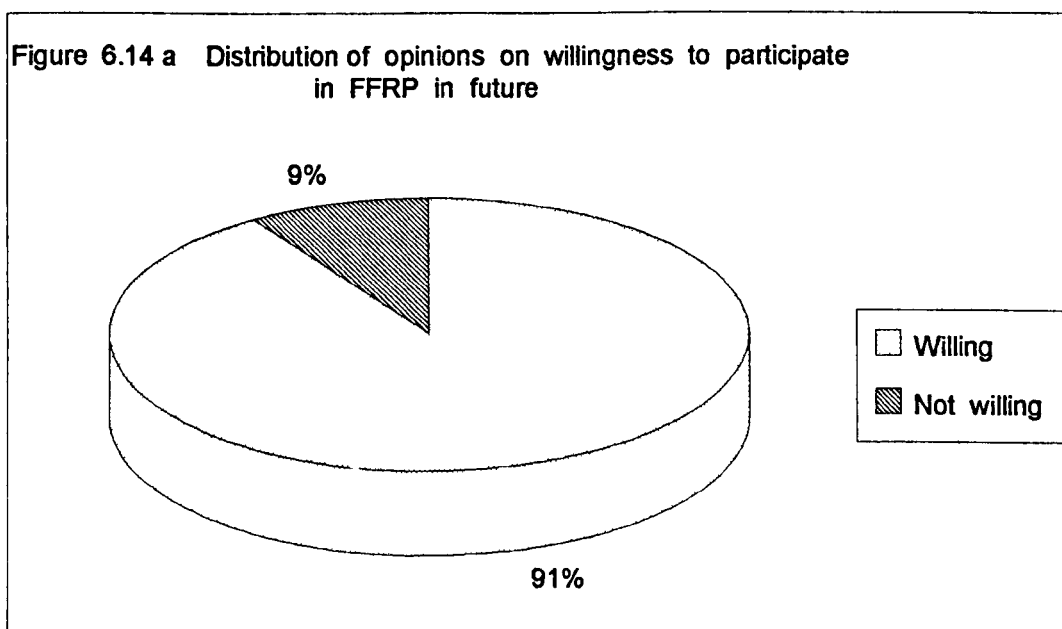


However, there was no apparent variation in the opinions on the suitability of land between the participants of the different agro-ecological zones and projects.

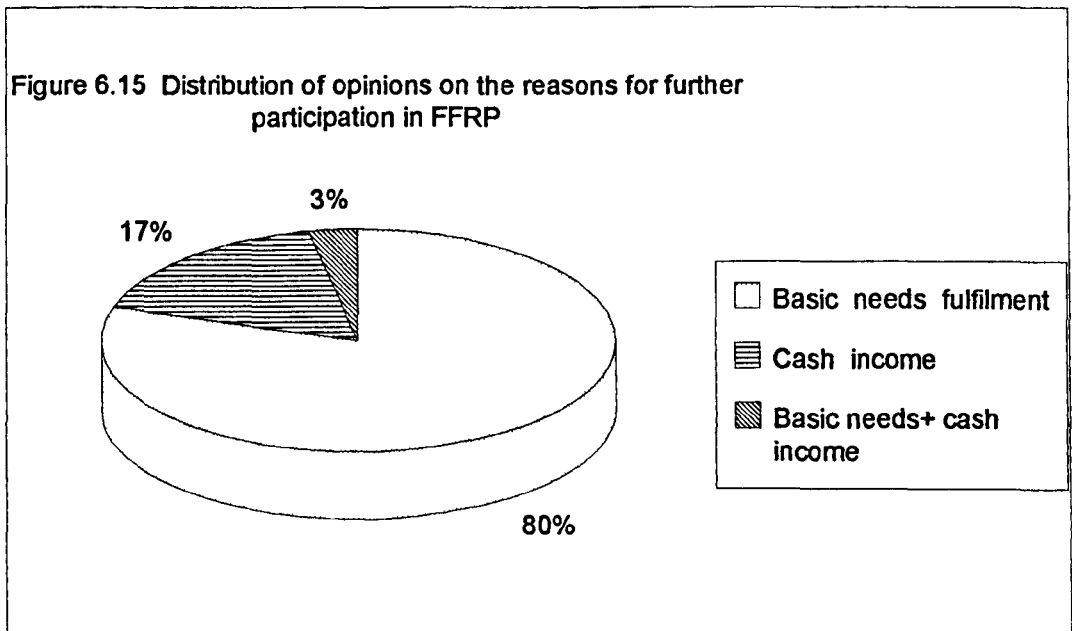
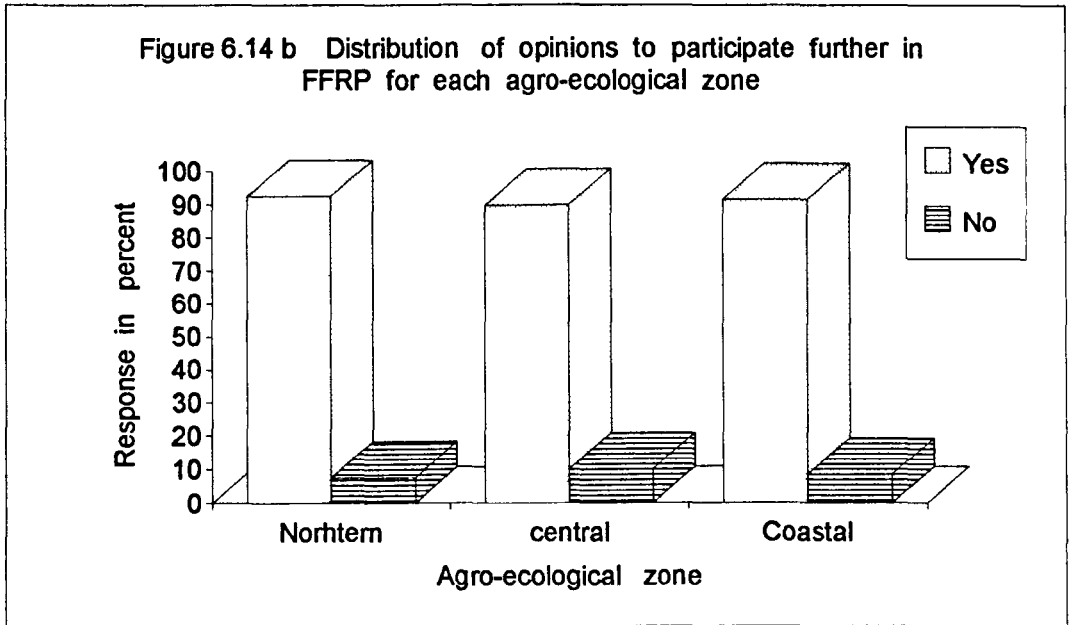
Suitability of the species planted under the FFRP was another important aspect where a majority (94%) of participants felt that the species planted were suitable.

Marketing facilities play an important role in the quick disposal of produce. On seeking the opinions on the adequacy of marketing, a majority of the participants (94%) expressed their dissatisfaction. Almost all of the participants expressed their preference for the formation of a village co-operative marketing society for quick disposal of the agricultural and forest products.

Opinions with regard to the willingness to further participate in agroforestry and forestry projects is shown below in Figure 6.14a, which suggests that the majority (91%) of the participants were willing to further participate in agroforestry and forestry. Only a few of the participants, whose plots were completely washed out, expressed their unwillingness to participate in future. However, the extent of willingness showed little variation between zones (Figure 6.14b).

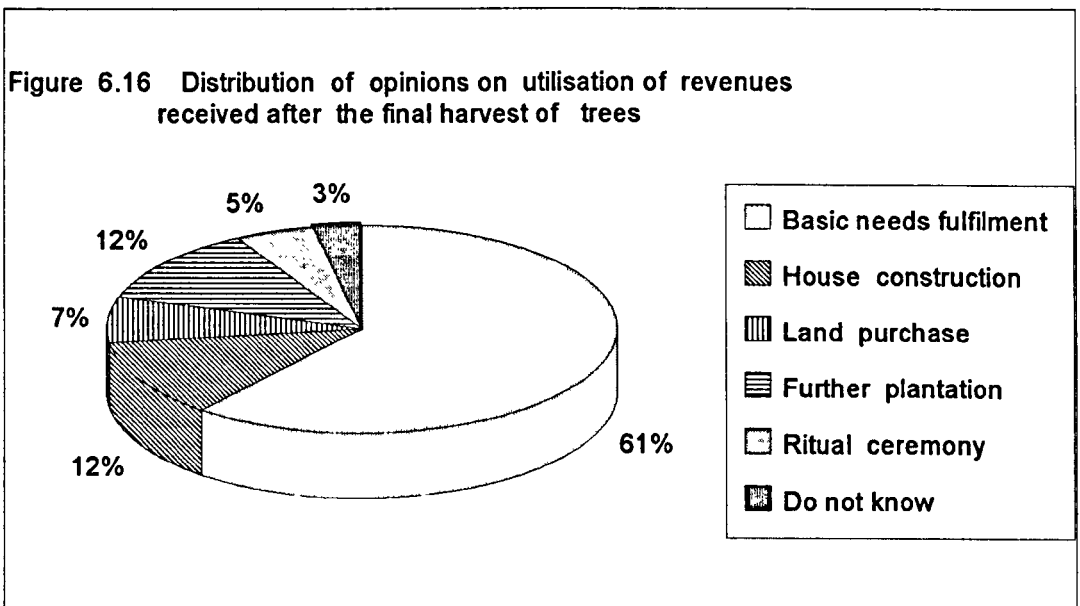


On asking the reasons for further participation, more than three quarters of the participants cited its contribution in basic needs fulfilment while a few (17%) assigned the reason as income generation. The rest of the participants were interested to participate in future on the grounds of both the basic needs fulfilment and for cash income (Figure 6.15).



The last but one question was related to the ultimate utilisation of the revenue received from the final harvest of the trees. The purpose of setting this question was to know the utility of a handsome amount of money likely to be received by participants after the harvesting of standing trees. The pattern of the responses is presented below in Figure 6.16.

Figure 6.16 Distribution of opinions on utilisation of revenues received after the final harvest of trees

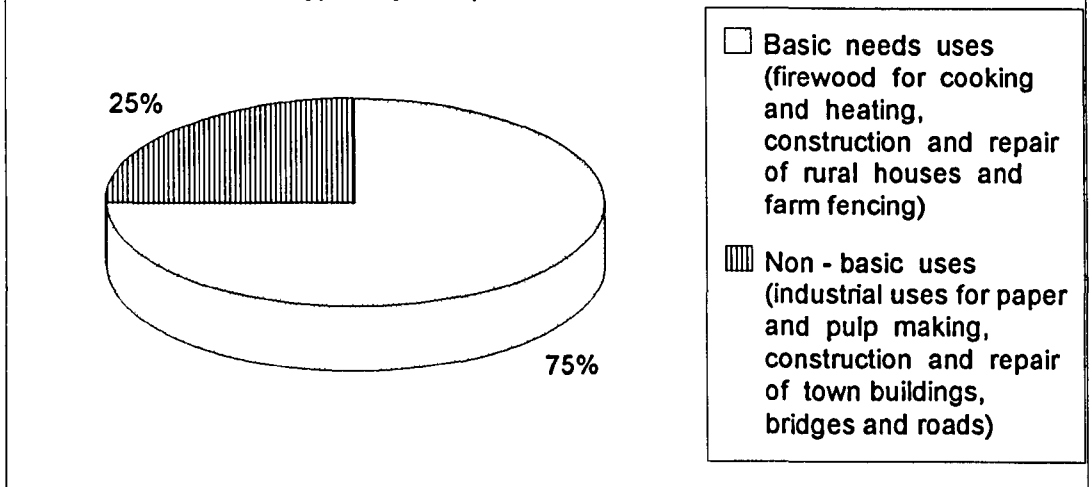


A majority of the participants (61%) planned to utilise the revenue on basic needs fulfilment. The remainder (36%) planned to invest in house construction, further plantation, purchase of land and in ritual ceremony and 3% of the participants had no plan at that time. This implies that the basic purpose of the FFRP plantation to fulfil the basic needs of the beneficiaries involved is being addressed by the project.

The last question (q.no. 35) was put to the respondents to find out the possible utilities of the main tree species (i.e. Eucalyptus hybrid) of the FFRP after its final harvest. The purpose of framing this question was to know the end use pattern of the species to estimate the basic needs conversion factor for basic needs evaluation. The average of the responses gathered through this question is presented below in Figure 6.17.

The majority of the participants (95%) responded that three quarters of the total timber would be utilised for basic needs uses such as firewood for cooking, construction and repair of rural houses and farm and household fencing in rural areas. However, one quarters would be utilised in non-basic uses such as paper and pulp making in industries, construction and repair of town buildings, roads and bridges. This implies that the utility of Eucalyptus hybrid in Orissa in basic needs fulfilment is relatively high. This information was partly used in estimating the social value of Eucalyptus hybrid in terms of basic needs fulfilment which is dealt with in detail in Appendix 8.2.

Figure 6.17 Distribution of opinions on the uses of the timber of Eucalyptus hybrid species



## Summary

From the above stated results, it is clear that, amongst the three agro-ecological zones, the Northern Zone, which is dominated by scheduled tribes and has the highest percentage of forest area, supports the highest percentage of landless people. In contrast to this is the Coastal Zone where much larger villages are supported by the lowest proportion of forest and livestock, but the biggest proportion of agricultural land. The socio-economic profiles of the participants suggest that there is significant variation in caste, literacy, occupation, nature of employment and monthly income amongst the participants of three agro-ecological zones.

The total per capita consumption expenditure is much lower in the Northern Zone than the Coastal and Central Zone. The survival percentages of trees in agroforestry and forestry projects were found highest in the Northern Zone in which the participants were found more literate, aware and alert in protecting the trees in comparison to the participants of the Coastal and Central Zone. The majority of the participants were of the opinion that FFRP was helpful in fulfilling their basic needs to a certain extent and this was the reason that the majority of them were willing to participate in FFRP in future.

The majority of the participants were of the opinion that lack of knowledge, awareness and inadequate effort shown in the protection of trees were the major socio-economic causes of the poor survival of trees. Amongst the agro-climatic factors, nearly

were not considered suitable for agriculture crops at all, although it was considered relatively more suitable for forestry project.

Most of the results of this chapter have been used in the next three chapters (Chapters 7, 8 and 9) in considering the results of financial and basic needs evaluation of the projects as well as to identify the socio-economic factors determining the profitability in agroforestry and forestry projects.

## **Chapter 7**

### **Financial Evaluation of Land Use Projects**

A conceptual framework for the financial evaluation was discussed in Chapter 3. Using the methodology outlined there, the computation for the financial costs and benefits for 210 plots (70 each from agroforestry, forestry and agriculture) have been carried out. The computations are based mainly on the primary data gathered through the field survey. This chapter describes and discusses the procedures and results of the financial evaluation. A brief description of the projects undertaken for the study is given in section 1 while section 2 describes the actual computation for the financial evaluation. A summary of the results after computation are presented and described in section 3. Lastly, the possible reasons for variations in the financial profitability amongst the individual plots, zones and projects are examined and discussed in section 4.

#### **7.1 A brief description of the projects**

As discussed earlier, this study covers the three land use projects namely agroforestry, forestry and agriculture of the government of Orissa. These projects are individual based and are practised on the government's unused and degraded waste land. The landless rural poor are selected as the beneficiaries and are allotted 0.5 hectare of land free of cost to undertake the practices. The details of these projects are described in Chapter 2.

The necessary inputs such as seeds and seedlings, fertilisers, polythene bags, insecticides and the costs of labour employed for various works such as soil preparation, weeding and other plantation operations are provided by the project. The beneficiaries in turn are provided with the usufructory rights to use the benefits of the projects .

This study covers the evaluation for a 9 year period of the project's life starting between 1985 and 1993. The reasons for covering this particular period are explained in Chapter 5.<sup>1</sup> It was not possible to undertake an evaluation of all the plots covered under all the projects for the study due mainly to the constraints in time and resources. Hence, a 20% (210 plots) sample was randomly selected. The details of the procedure followed

in sampling have already been discussed in Chapter 5. The next section describes the details of the computations for financial evaluation.

## **7.2 Computation for the financial evaluation**

The main purposes of the financial evaluation are first to assess the financial profitability of the individual plots or farms and second to examine their comparative financial performance. Using the data collected through the primary and secondary sources and following the steps outlined in Chapter 3, the computation for the financial evaluation of the 210 plots covered under the three projects in the three agro-ecological zones of Orissa was undertaken. The procedures and results are described below.

### **7.2.1 Identification of inputs and outputs**

The individual details of the inputs and outputs involved in each plot under each project were identified from both the field survey as well as from the official records of the government departments. The lists of the important inputs and outputs identified are presented below in Table 7.1. The inputs involved in the project were of two types namely (a) the direct inputs and (b) the indirect inputs. The direct inputs included the land, labour, seeds of agricultural and forestry crops, seedlings, polythene bags, fertilisers, insecticides and tools and equipment. The indirect inputs on the other hand were of two main types namely (a) the establishment and (b) the overhead costs of the projects. The inputs under establishment included the inputs involved in payment of the salaries and allowances of the permanent staff, and maintenance of offices, motor vehicles and buildings of the projects. The inputs under overhead charges included the inputs involved in research and training, monitoring and evaluation as well as the protection of the activities involved in the projects.

The identification of the outputs in financial evaluation is confined only to the direct outputs (FAO, 1991). The direct outputs obtained from the projects were of two types namely (a) agricultural products and (b) forestry products. The former comprises the food grain crops such as paddy, maize, black gram, green gram, red gram, horse gram, sesamum and groundnut as well as vegetables and fruit crops such as ladies finger, dioscorea, and pineapple.



**Table 7.1 List of inputs and outputs identified in the agroforestry, forestry and agriculture projects by agro-ecological zone.**

Zone	Projects	Lists of inputs and outputs			
		Inputs		Direct outputs	
		Direct	Indirect	Agricultural products	Forestry products
1. Northern	i. Agroforestry	a. Land b. Labour c. Seeds d. Seedlings e. Polythene bags f. Fertiliser g. Insecticides h. Tools and equipment	i. Establishment a. Staff salary b. Office maintenance c. Motor vehicle maintenance d. Buildings maintenance  ii. Over head a. Research b. Training c. Monitoring and evaluation d. Protection	Food grain crops Common name      Botanical name a. Paddy              Oryza sativa b. Maize              Zea mays c. Black gram        Phaseolus mungo d. Red gram          Cajanus cajan e. Niger                Guizotia abyssinica f. Sesamum            Sesamum indicum	i. Intermediate products a. Grasses b. Twigs and branches c. Leaf fodder d. Dry leaves e. Poles of various species such as Eucalyptus, Cassia and Acacia f. Bamboo ii. Final products a. Firewood after harvesting b. Lops and tops after harvesting
	ii. Forestry	Same as in agroforestry	Same as in agroforestry	nil	Same as in agroforestry
	iii. Agriculture	Same as in agroforestry except polythene bags and seedlings	No indirect costs	Same as agroforestry	nil
2. Central	i. Agroforestry	Same as in Northern zone	Same as in Northern zone	i. Food grain crops a. Paddy              Oryza sativa b. Red gram          Cajanus cajan c. Black gram        Phaseolus mungo d. Groundnut        Arachis hypogea e. Sesamum            Sesamum indicum	Same as in Northern Zone
	ii. Forestry	Same as in agroforestry	Same as in agroforestry	nil	Same as in Northern Zone
	iii. Agriculture	Same as in Northern Zone	No indirect cost	same as in agroforestry of this zone	nil
3. Coastal	i. Agroforestry	same as in Northern zone	Same as in Northern zone	i. Food grain crops a. Paddy              Oryza sativa b. Red gram          Cajanus cajan c. Black gram        Phaseolus mungo d. Horse gram        Dichous biflorus e. Sesamum            Sesamum indicum ii. Fruits and vegetables crops a. Pine apple        Ananas comosus b. Yam                Dioscorea alata c. Lady's finger      Hibiscus esculentus	Same as in Northern zone
	ii. Forestry	Same as in Northern Zone	Same as in Northern Zone	nil	Same as in Northern zone
	iii. Agriculture	Same as in Northern Zone	No indirect cost	Same as in agroforestry of this zone	nil

Source: Questionnaire survey and from the official records of the Forest and Agriculture Department of the Government of Orissa (OFD,1993; Das,1993).

The trees from the agroforestry and forestry projects provided a variety of products. These were of two main categories: first the intermediate products and second the final products.<sup>2</sup> The intermediate products consisted the grasses, dry leaves, twigs, fodder, bamboo and small timber from various species. These products were mainly used as fuel for cooking and heating, timber for house and farm fencing and fodder for livestock.

The intermediate products were derived a few years after the inception of the plantation. Although these products were of immense value for the poor people, no effort had so far been made to quantify and evaluate such products. The present study attempts to quantify and evaluate such products.

### **7.2.2 Quantification of inputs and outputs**

The annual quantity of each direct input used in an individual agroforestry and forestry plot was found similar because of the fixed input norm prescribed by the government. The details of the annual requirements of various inputs incurred in agroforestry and forestry are given below in Table 7.2. These norms did not include the inputs required for harvesting of the standing trees and for meeting the indirect expenses. Thus these two inputs were estimated separately.

The input requirements for the agriculture project were not readily available like agroforestry and forestry projects and hence they were gathered directly through interviews with the individual beneficiaries.

The annual quantities of each of the outputs (except the final products from the final harvest of the eucalyptus trees) were gathered directly from the individual beneficiaries of the projects. The quantities of the final products were estimated on the basis of the estimated yield of timber and firewood with the help of the information concerning the growth and survival percentages of the trees. This aspect has already been discussed in detail in Chapter 5. Although it is not possible to present the quantities of each output under each plot here, average quantities of the intermediate and final products of the projects in three agro-ecological zones are presented below in Table 7.3.

### **7.2.3 Valuation of inputs and outputs**

Market prices were taken as the basis for the valuation of inputs and outputs in the financial evaluation. Annual market prices for the individual inputs and outputs were

**Table 7.2 Annual requirements of inputs in the agroforestry and forestry projects.**

Plantation year	Types of inputs	Units per hectare	
		Agroforestry	Forestry
Pre-planting year	1. Labour (man days)	210	261
	2. Material		
	a. fertiliser (kgs.)	nil	nil
	b. insecticides (kgs.)	nil	nil
	c. tools and implement	LS <sup>+</sup>	LS
Planting year (first year)	1. Labour (man days)	210	184
	2. Material		
	a. fertiliser (kgs.)	300	250
	b. insecticides (kgs.)	35	25
	c. tools and implement	LS	LS
Post-planting year (second year)	1. Labour (man days)	135	110
	2. Material		
	a. fertiliser (kgs.)	200	150
	b. insecticides (kgs.)	9	5
	c. tools and implement	LS	LS
Post-planting year (Third year)	1. Labour (man days)	75	50
	2. Material		
	a. fertiliser (kgs.)	40	nil
	b. insecticides (kgs.)	5	nil
	c. tools and implement	LS	LS
<b>Total</b>	<b>1. Labour (man days)</b>	<b>630</b>	<b>605</b>
	<b>2. Material</b>		
	<b>a. fertiliser (kgs.)</b>	<b>540</b>	<b>400</b>
	<b>b. insecticides (kgs.)</b>	<b>49</b>	<b>30</b>
	<b>c. tools and implement</b>	<b>LS</b>	<b>LS</b>

Note : LS<sup>+</sup> indicates the lumpsum amount i.e. it is difficult to give the physical quantities of the machinery inputs and hence a lumpsum annual amount is prescribed.

Source: Compiled from the records of the Social Forestry Project, Orissa (OFD, 1989a, 1989b and 1993)

collected through both official sources and the field survey. Annexure 7.1 presents the annual unit prices of the various inputs and outputs involved in the projects. Multiplying

these prices by the annual quantities of inputs and outputs, the financial valuation of inputs (except harvesting and indirect inputs) and outputs (except the final products) were carried out. The estimation of harvesting costs, indirect costs and the valuation of final products of the projects were undertaken as described below.

**Table 7.3 Average quantities of forestry outputs from agroforestry and forestry projects for the project period.**

Products	Units	Projects	
		Agroforestry	Forestry
<b>(a) Intermediate products</b>			
i. Dry leaves	Q <sup>+</sup> /ha	15.2	15.3
ii. Grasses	Q/ha	11.7	11.6
iii. Twigs and branches	Q/ha	8.6	10.5
iv. Poles	Number	40	44
v. Bamboo	Number	34	33
<b>(b) Final products</b>			
i. Timber	cu.m <sup>++</sup> /ha	70.0	59.1
ii. Firewood	cu.m/ha	128.2	123.0

Note: i. <sup>+</sup> is quintal (equal to 100 kgs), <sup>++</sup> is cubic metre.

- ii. Average quantities of individual agricultural outputs were not possible to present in the Table 7.3 due to complexity of the outputs, hence the average values of all agricultural outputs both from agroforestry and agriculture projects are shown in Annexures 7.6 and 7.8.

### 7.2.3.1 Estimation of the harvesting costs

About 95 % of the harvesting costs of trees comprise the costs of labour involved in different operations such as felling of trees, logging into suitable marketable pieces and transportation to the disposal point. The costs of tools and equipment make up the remainder. During the field survey it was found that the Eucalyptus hybrid was the only species standing in the field for harvesting. Based on the procedure described in chapter 5<sup>3</sup>, the timber and firewood yield from the Eucalyptus hybrid were estimated for each individual plot. The average harvesting costs of Eucalyptus were collected from the Forest Department of Orissa (Singh, 1994). Using this rate (Rs. 75 per cubic metre) the harvesting costs for the estimated firewood of Eucalyptus hybrid for each plot were carried out.

### **7.2.3.2 Estimation of the indirect costs**

It was difficult to estimate the exact indirect costs for each individual plot. Hence an average percentage of indirect costs involved in agroforestry and forestry projects were used as an average estimate for the individual plot also. This average figure was estimated on the basis of the proportion of the expenditure incurred in the agroforestry and forestry to the total expenditure incurred in the Social Forestry Project of Orissa. The total indirect costs involved in the Social Forestry Project of Orissa were established through the official records (OFD, 1993) of the project (Annexure 7.2). Based on these two sets of information as well as the information gathered through personal communication with the officials of the Social Forestry Project (Bose, 1994; Mahapatra, 1994), an average estimate of 5% as the indirect cost each for agroforestry and forestry was considered as an appropriate. This estimate happened to be far less than the 30%, which is the indirect cost of the whole Social Forestry Project of Orissa. The reason of this is, its small share in the total expenditure incurred in the whole Social Forestry project. The estimated 5% as indirect cost for agroforestry and forestry was further divided into two parts: the 4% on the establishment charges and 1% on the overhead charges (OFD, 1993).

### **7.2.3.3 Valuation of the final products**

The stumpage prices of timber and firewood were compiled from the open market auction rates of the Orissa Forest Development Corporation for the year 1992-93. According to this rate the wood prices for the Eucalyptus hybrid (of girth class less than 90 cm as applicable in the present study) was Rs. 1166 per cubic metre and that of firewood was Rs. 50 per 100kgs (OFDC, 1994). Using this information the financial valuation of the final products of the agroforestry and forestry projects have been carried out.

The valuation of the inputs and outputs involved in the agriculture project were carried out using the information gathered from the field survey as well as through the official records of the Agriculture Department (Das and Sarangi, 1994; GOO, 1991). The indirect costs have not been considered in the agriculture for the reason that there was no direct supervision by project management and the beneficiaries themselves were responsible for maintaining the practice.

Annexures 7.3, 7.4 and 7.5 give the details of the financial costs and Annexures 7.6, 7.7 and 7.8 the financial benefits involved in the agroforestry, forestry and agriculture projects respectively. A break up of an average revenue generated from the intermediate and final products of the three projects is given in Annexure 7.18.

### 7.2.3.1 Adjustment for inflation

The market values of the inputs and outputs computed above refer to different periods of time. In order to make them comparable, these values need to be converted to equivalent values at a particular period of time. This was achieved by multiplying the market values of the annual costs and benefits by the inflating factors of the respective years with the base year shifted at 1992-93 to give the real values. The converted values were called the real values which took into account the price rises (inflation) over the period. The wholesale price index of India for all the commodities was used to compute the inflating factor. Table 7.4 below gives the wholesale price index and inflating factors with respect to the base year of 1992-93.

### 7.2.4 Choosing a suitable discount rate

Although the inflation adjusted market rate of interest represents the real interest rate for discounting in financial evaluation, in a developing economy like that of India, it is difficult to get a single market rate of interest. According to a recent study (Khan, 1993) the commonly used market rate of interest in Indian conditions varied between 10 and 20% between 1985 and 1993. Similarly the inflation rate during the period had ranged between 5 and 12%. Considering the nominal market rate of interest during the project periods as 15% and inflation rate as 7%, the real rate of interest has been calculated applying the formula:

$$r = (1+i)/(1+f) - 1$$

where  $r$  is the discount rate,

$i$  is nominal market interest rate and

$f$  is the rate of inflation.

Thus:

$$r = (1+.15)/(1+.07) - 1$$

$$= 1.15/1.07 - 1$$

$$= 0.075 \text{ or } 7.5\%$$

However, the market rates is often subsidised in the Third World and the rate of interest is not necessarily the opportunity cost of capital, rather it can be expected to be lower than the opportunity cost of capital. Hence, the above two reasons suggest that higher rates of interest can be used. Thus a discount rate of 10% has been chosen for the calculation of the net present value (NPV) and benefit-cost ratio (BCR). However, to test the results, a sensitivity analysis has also been carried out using discount rates ranging from 5% to 15%.

**Table 7.4 Index numbers of wholesale prices (India) for all commodities and inflating factors.**

Financial year	Base year 1981-82	Base year 1992-93 <sup>+</sup>	Inflating factors
1981-82	100.0		
1982-83	104.0	45.8	2.18
1983-84	112.8	49.2	2.03
1984-85	120.1	52.7	1.90
1985-86	125.4	54.7	1.82
1986-87	132.7	57.9	1.72
1987-88	143.6	62.7	1.59
1988-89	154.3	67.3	1.48
1989-90	165.7	72.3	1.38
1990-91	182.7	79.7	1.25
1991-92	204.1	89.1	1.22
1992-93	229.1	100.0	1.00
1993-94	247.9	108.2	0.92

Note : + compiled figure.

Source: Compiled from GOI (1991) and IFS (1993).

### 7.2.5 The selection of decision criteria

NPV, IRR and BCR have been used to examine the net financial profitability of agroforestry, forestry and agriculture projects. However, the IRR has not been used in the

case of agriculture because it effectively constituted a series of separate one year investments with no initial investments<sup>4</sup> followed by a series of benefits. The reasons for selecting these particular decision criteria are discussed in detail in Chapter 3.

## **7.2.6 Computation of the financial NPV, IRR and BCR**

Following the various steps described above, the real annual costs and benefits were computed for the 210 plots. Then the annual cash-flows were prepared for each individual plot. Finally, the NPV, IRR and BCR have been computed using a standard spreadsheet package<sup>5</sup>. Separate spreadsheets have been developed for each of the three agro-ecological zones each covering all the three projects. The details of the spreadsheet construction are explained in Appendix 7.1. The analyses included under each spreadsheet show the values of the annual real costs and benefits, net cash-flows and the values of NPV, IRR and BCR. Since the spreadsheets are very large in size, a print out of one spreadsheet (Northern Zone, for example) is provided in the pouch at the covering end of the thesis. Nevertheless, in order to provide a means of comparing the financial NPV, IRR and BCR of the individual plots, a summary table for each of the projects under each agro-ecological zone has been compiled and is presented in Annexures 7.9-7.17. The next section presents and describes a summary of the financial results.

## **7.3 Results of the financial evaluation**

### **7.3.1 The financial NPV**

The mean of the financial NPV's of all the projects under three agro-ecological zones at 10% discount rate compiled from Annexures 7.9 - 7.17 are presented below in Table 7.5.

Evidently the variation in the NPV's amongst the projects and agro-ecological zones is quite conspicuous. Overall, the NPV is highest in agroforestry followed by forestry and agriculture. The average NPV of the forestry and agriculture projects are 77% and 17% respectively that of the agroforestry.

Comparing the NPV's amongst the projects across the agro-ecological zones, agroforestry ranks first followed by forestry and agriculture across all the agro-ecological zones. The NPV's in forestry relative to those in agroforestry range from 70% in the



Central Zone to 84% in the Northern Zone and in agriculture relative to agroforestry from 10% in the Northern Zone to 33% in the Central Zone.

A similar comparison of NPV's amongst the agro-ecological zones shows that the NPV's of all the projects are highest in the Northern Zone followed by the Coastal Zone and the Central Zone except for agriculture where the Central Zone ranks highest and the Northern Zone lowest. The NPV's of the agroforestry project in the Coastal and the Central Zone are 69% and 54% respectively of that in the Northern Zone, whereas for the forestry projects these are 60 % and 45%. The NPV's of the agriculture project in the Coastal and Northern Zones are 61% and 54 % of that in the Central Zone.

**Table 7.5 Mean financial NPV's of three projects at 10% discount rate.**

(figures in Rs./ha at 1992-93 prices)

Zone	NPV's of projects		
	Agroforestry	Forestry	Agriculture
1. Northern	26836	22582	2575
2. Central	14364	10125	4731
3. Coastal	18465	13508	2870
<b>Orissa (average)</b>	<b>19888</b>	<b>15405</b>	<b>3392</b>

In summary agroforestry amongst the projects and the Northern Zone amongst the zones show the best financial performance in terms of per hectare NPV (except agriculture). The gap in financial profitability between agroforestry and agriculture across all the agro-ecological zones is much wider than between agroforestry and forestry.

Another look at the financial NPV's of the individual plots within projects and agro-ecological zones presented in Annexures 7.9 - 7.17 also indicates a wide variation in NPV's between individual plots. Table 7.6 below presents a summary of the variation in NPV's amongst the projects in three agro-ecological zones.

Evidently the variation, particularly in agroforestry and forestry projects in each zone is very wide and seems to depend very much on survival of the trees. The factors affecting this are discussed in Chapter 9.

Overall results of the financial NPV's at 10% discount rate based on the percentage of plots having a positive NPV are presented below in Table 7.7

**Table 7.6 Range of variation in financial NPV in the projects at 10% D.R.**

(figures in Rs./ha at 1992-93 prices)

Zone	Range of NPV 's		
	Agroforestry	Forestry	Agriculture
1. Northern	-5760 to 19138	-6067 to 14092	107 to 2629
2. Central	-5600 to 10104	-6067 to 7755	1304 to 4294
3. Coastal	-5068 to 16581	-6067 to 13330	- 120 to 2870

Source: Compiled from Annexures 7.9 - 7.17.

**Table 7.7 The percentage of plots with positive NPV at 10% D.R.**

(figures in %)

Zone	Percentage of plots with positive NPV			Average
	Agroforestry	Forestry	Agriculture	
1. Northern	90	95	100	95
2. Central	85	90	100	92
3. Coastal	90	87	97	91
<b>Orissa (average)</b>	<b>88</b>	<b>91</b>	<b>99</b>	<b>93</b>

Nearly 93% of the plots (including all projects) have positive NPV's. The plots having negative NPV's were the plots washed out by floods and cyclones or severely damaged by insect. Of those that were not washed out, all were viable at a 10% discount rate.

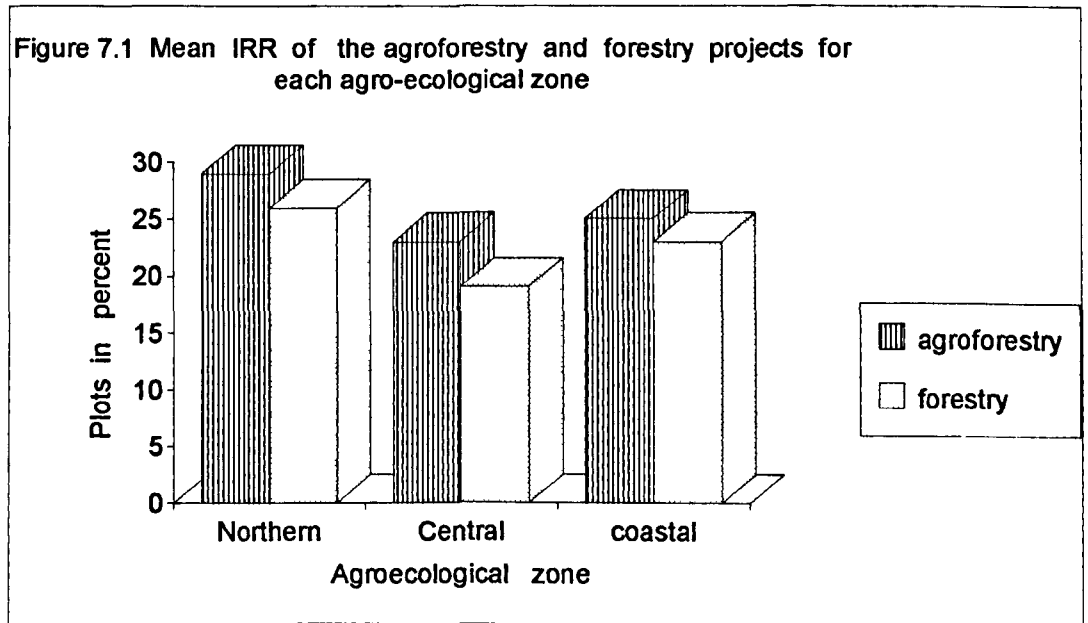
### 7.3.2 The financial IRR

The overall mean financial IRR by projects and agro-ecological zones presented below in Table 7.8 and Figure 7.1 give a similar picture to that of the NPV. When IRR's are compared in terms of their excess over the discount rate, percentage differences are

the same as for the NPV's. All IRR's show profitability when compared to the discount rate and agroforestry and the Northern Zone have the highest IRR amongst the projects and zones respectively. In the absence of the agriculture project there is no wide variation in IRR's amongst the projects and zones and the IRR's of the individual plots given in Annexures 7.9 -7.17, also show little variation amongst the individual plots.

**Table 7.8 Mean of the financial IRR in different projects.**

Zone	Mean IRR's of projects	
	Agroforestry	Forestry
1. Northern	29%	26%
2. Central	23%	19%
3. Coastal	25%	23%
<b>Average (Orissa)</b>	<b>26%</b>	<b>23%</b>



**7.3.3 The financial BCR**

The results of the financial BCR presented below in Table 7.9 also give a similar picture again. If percentage difference are compared, after subtracting 1 (the break-even level) the pattern is similar to that of NPV's except that forestry results approach much more closely to those of agroforestry. In fact, in the Northern Zone, the forestry has a

higher BCR than agroforestry illustrating the unreliability of the BCR as a decision criterion already discussed in Chapter 3.

**Table 7.9 Mean financial BCR of different projects at 10% discount rate.**

Zone	BCR of projects		
	Agroforestry	Forestry	Agriculture
1. Northern	2.47	2.56	1.12
2. Central	1.86	1.75	1.25
3. Coastal	2.06	1.98	1.17
<b>Average (Orissa)</b>	<b>2.13</b>	<b>2.09</b>	<b>1.18</b>

#### 7.4 The analysis of the financial results

The financial results presented and described in the earlier sections indicate that there is a conspicuous variation in the profitability between the projects as well as between the zones. The variation in results between agroforestry and forestry is not only due to the addition of an agricultural crop, but also due to greater variation in the survival percentage of trees at the time of yield estimation despite the greater initial tree density in the forestry project and to the greater volume per tree. A summary of the results presented in Annexures 7.9 - 7.17 indicates a wide variation in the survival percentage of trees from one plot to another. The average figures for the survival percentage of trees in zones and projects given below in Table 7.10 indicate that the agroforestry plots tend to have higher percentage of survival than the forestry in all zones. This aspect has been dealt with in detail in Chapter 9.

**Table 7.10 Mean survival percentage of trees in the projects.**

(figures in %)

Zone	Mean survival percentage of trees in projects	
	Agroforestry	Forestry
1. Northern	42	32
2. Central	27	23
3. Coastal	33	25
<b>Average (Orissa)</b>	<b>34</b>	<b>27</b>

The higher survival percentage appears to be due to active participation and more interest shown by beneficiaries in the agroforestry projects. The recurrent accrual of agricultural benefits from agroforestry plots during first three years encourages beneficiaries to pay regular visits to the agroforestry plots which in turn leads to better protection and achieves a higher survival of trees. Table 7.11 given below presents the comparative picture of the mean annual revenue generated both from agroforestry and forestry projects. It is obvious that the accrual of benefits from agroforestry project during first three years are much higher than forestry mainly due to revenue generated from the presence of agricultural crops. Further evidence for this is reviewed in chapter 9.

**Table 7.11 Mean annual revenue from the agroforestry and forestry projects.**

( figures in Rs/ha/year at 1992-93 prices)

Plantation Year	Mean annual revenues from projects			
	Agroforestry			Forestry
	Agricultural crops	Forestry crops	Total	
1	3022	0	3022	12
2	2158	49	2207	53
3	1457	113	1570	96
4	0	324	324	359
5	0	572	572	760
6	0	444	444	599
7	0	277	277	264
8	0	142	142	28
9	0	80863	80863	72835
<b>Total</b>	<b>6637</b>	<b>82784</b>	<b>89421</b>	<b>75006</b>

Source: Based on the questionnaire survey.

Another reason for the higher NPV and IRR in agroforestry plots appears to be due to better out turn from trees, which ultimately results from their better growth and this resulted in greater volume per tree than forestry. A comparative picture of the annual growth and yield of trees in agroforestry and forestry projects presented below in Table 7.12 illustrates this statement.

**Table 7.12 Mean annual growth and yield of trees in the agroforestry and forestry projects.**

Plantation year	Growth				Yield	
	Tree height (m)		Tree diameter (cm)		Volume /tree (m <sup>3</sup> )	
	Agroforestry	Forestry	Agroforestry	Forestry	Agroforestry	Forestry
1	1.2	1.2	0.6	0.6	0.000	0.000
2	2.5	2.4	1.0	0.8	0.000	0.000
3	4.5	4.2	2.3	2.1	0.001	0.000
4	7.1	6.7	4.4	4.3	0.004	0.004
5	9.9	9.6	6.5	6.1	0.013	0.011
6	12.1	11.8	9.2	8.8	0.032	0.028
7	13.3	13.1	10.4	10.0	0.045	0.041
8	13.9	13.7	10.9	10.4	0.051	0.046
9	14.1	13.9	11.0	10.6	0.054	0.049

Source: Based on questionnaire survey.

Better growth of trees in agroforestry plots appears to be due to the availability of double nutritional benefits (from both agricultural and forestry operation) and the wider spacing between trees i.e. two rows of trees at a spacing of 1m x 1m separated by an alley of 4m width, which results in a lesser number of trees (4000 trees/ha) in comparison to close spacing of 2m x 2m (5000 trees/ha) in forestry plantation. Reduced numbers of trees help in better light, water and nutrient capture (Thomas et al., 1989), which results in better tree growth and better tree growth in turn helps in higher yield of timber and other forest benefits.

The lowest financial NPV in agriculture amongst the three projects (Table 7.5) is possibly due to the use of the degraded land with poor fertility which resulted in a poor yield of the agriculture crops. The higher profitability in agroforestry and forestry where a similar type of lands was used appears to be due to the utilisation of eucalyptus trees which can thrive well even in degraded soil of poor fertility (Chaturvedi, 1983). Hence, it is the tree component which has scaled up the financial profitability in agroforestry and forestry leaving agriculture far behind in terms of per unit profitability.

Reasons for the variation in NPV and IRR between different zones appears to be due to the variation in the biotic, climatic and edaphic as well as socio-economic factors. The

climatological information given in Chapter 1 suggests that the Northern Zone had the higher average annual rainfall in comparison to the other two zones. Furthermore, although the lands selected for all the projects in all the zones are of a similar nature, fertility varies slightly from one zone to another. The fertility of the soils in the Central and Coastal Zone is higher than that in the Northern Zone (Das and Sarangi, 1994 ; ORG, 1993).

Besides the climatic and edaphic factors, the interference of the human and livestock populations (also known as biotic factors) have important effects in maintaining the survival percentage of trees. Results of the questionnaire survey show that more than half of the mortality is due to biotic interference in almost all the agro-ecological zones and this is highest in the Central Zone followed by the Coastal Zone and the Northern Zone.

A variation in the socio-economic factors such as caste and literacy, knowledge and awareness about the project, level of poverty, occupational pattern of the beneficiaries and the price structure as well as the marketing infrastructure available in different zones may also be responsible for variation in the financial profitability from one zone to another. The factors determining variation in profitability are discussed in detail in Chapter 9.

#### **7.4.1 The sensitivity analysis**

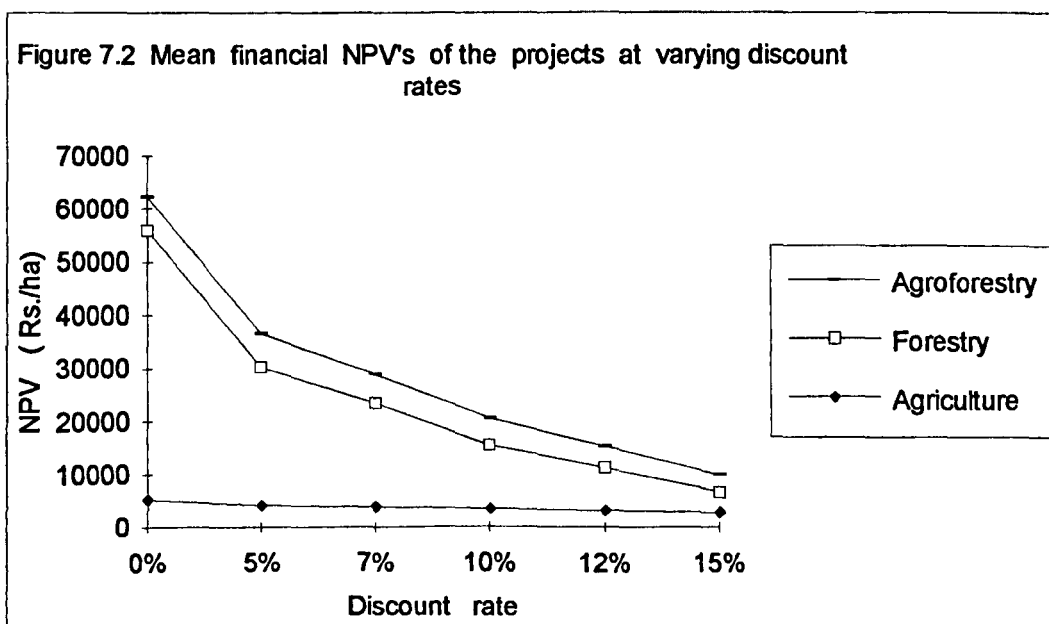
In order to test the effects on profitability at various discount rates, a sensitivity analysis was carried out and its results are presented below in Table 7.13 and Figure 7.2. It indicates that with a decrease in discount rates there is increase in NPV in zones as well as in projects, which one would expect. Even at 15% discount rate the NPV's in all projects and agro-ecological zones are found positive.

With the change in discount rates, however the ranking of the projects with regard to their financial profitability remains unchanged as compared to what exists at 10% discount rate. For example, in Table 7.13 and Figure 7.2, at 5% discount rate forestry and agriculture give NPV's of 83% and 11.3% that of the agroforestry. This changes to 67% and 28% respectively at 15% discount rate, but the ranking remains unchanged at both the discount rates. Similar is the case with agriculture where the NPV changes from 11.3% of agroforestry at a 5% discount rate to 28% of agroforestry at a 15% discount rate.

**Table 7.13 Mean financial NPV's of projects at various discount rates.**

(figures in Rs./ha at 1992-93 prices)

Discount rates	NPV's of the projects		
	Agroforestry	Forestry	Agriculture
0%	62250	55876	5147
5%	36594	30269	4150
7%	28837	23357	3823
10%	20555	15405	3392
12%	15301	11344	3140
15%	9979	6642	2806



#### 7.4.2 Past evaluation : a comparison

Only a few systematic studies based on actual field data have so far been undertaken to evaluate the financial profitability of agroforestry, forestry and agriculture together (Swinkles and Scherr, 1991). Choosing NPV as the decision criterion in evaluation of land use practices by many workers (Harou, 1983; Joseph, 1986; Kurtz et al., 1989; Reiche et al., 1988; Shah, 1988; Duldulao, 1985; Hosier, 1987 and 1989; Reddy



et al.,1985; Sekar et al., 1990; Srinivasan et al.,1990; Srivastava et al., 1979; Sharma, 1990; Khan, 1993; Search India, 1991; Arnold et al., 1987; Desmond at al., 1992 and ORG, 1991) indicates that the NPV for agroforestry plots exceeds all traditional monocultures as well as forestry farming. However none of the studies include the indirect cost in their analyses<sup>6</sup>. In the present study the indirect costs have been included in the costs of agroforestry and forestry projects and the performance of both the projects appears very robust across a range of site conditions. The results obtained from the present study (based on direct as well as non-direct cost) are therefore not strictly comparable to the previous studies, but do show a similar pattern of results i.e. agroforestry performs better than the monoculture (forestry or agriculture).

## Summary

The financial evaluation of agroforestry, forestry and agriculture projects practised on the unused and degraded waste land in Orissa suggests that the lands diverted for the projects have shown promising results through the tree planting. It is obvious from the financial evaluation of 210 plots that more than 90% of these lands appear to be capable of producing marketable products in sufficient quantities to make the projects financially viable. However, in terms of the quantum of profitability per hectare, agroforestry and forestry projects are found much more promising than agriculture. This is because more than 90% of the net profitability in agroforestry and forestry was due to the returns from the trees. The net profitability in the case of agriculture is found to be low, due to the unsuitability of the land for agricultural production. The financial profitability in the case of agroforestry is found somewhat higher than forestry due to higher survival of trees, greater growth as well as the presence of agricultural crops. The zonal variation in profitability where the Northern Zone gives better results, except in the case of agriculture, appears to be due to variation in agro-climatic and socio-economic conditions.

Having assessed financial profitability in this chapter, the next chapter examines and discusses the impacts of these three projects in terms of basic needs fulfilment.

## Notes:

- 1 The reason for taking 9 years study of the projects is explained in para 5.1 of Chapter 5.

- 2 A brief description of the intermediate and final products of the projects is given in para 5.3.2.2.1 of Chapter 5.
- 3 Methodology for the estimation of yield is described in para 5.3.2.2.1 (d) of Chapter 5.
- 4 To calculate the NPV and BCR for agriculture project, net benefits in each of the nine years have been used.
- 5 The Borland (Quattro pro v 4.0) package has been used for the computation of financial evaluation.
- 6 A recent study on *ex-post* evaluation of village woodlots in Gujarat state of India includes the indirect cost (36%) in plantation and harvesting activities.

## Chapter 8

### Basic Needs Evaluation of Land Use Projects

The theoretical framework for basic needs evaluation outlined in Chapter 4 and the required parameters estimated and described in Appendices 8.1 - 8.4 have been applied in this chapter to assess the impact of the land use projects in terms of their basic needs fulfilment in Orissa. As with the financial evaluation undertaken in the previous chapter, the basic needs evaluation has not been undertaken at the levels of the individual plot within the various projects. Rather to keep the analysis within manageable limits, the basic needs evaluation has been carried out in terms of the average net annual basic needs impacts per hectare in each of the agro-ecological zones for each of the land use projects. In order to clarify the various aspects of evaluation in more detail, this chapter has been divided into two sections. Actual computation and results of basic needs evaluation are described and presented in section 1. The evaluation results are analysed and discussed in section 2 in order to ascertain the possible reasons for the variation in basic needs impacts between different agro-ecological zones and projects.

Details of the projects for which both financial and basic needs evaluation have been carried out are provided in Chapter 2<sup>1</sup> and Chapter 7. It is clear from these discussions that these projects aim primarily to meet the basic consumption requirements of the rural poor. The dominant tree species in the agroforestry and forestry projects is Eucalyptus hybrid with a rotation age of 9 years (OFD, 1989a). The Eucalyptus wood, harvested at the end of the rotation would constitute the main product. Prior to harvesting the beneficiaries also utilised intermediate products<sup>2</sup> in the form of dry leaves, grasses, twigs, branches, bamboo, poles and minor forest products. After harvesting, eucalyptus would be used in many ways as described in Appendix 8.2.<sup>3</sup> Details of the financial costs and benefits of the projects have already been described in Chapter 7. The break up of the annual expenditure on various inputs of the three projects is given in Annexures 7.3, 7.4 and 7.5 and that of annual benefits from outputs in Annexures 7.6, 7.7 and 7.8

#### 8.1 Computation and results of the basic needs evaluation

Chapter 4 explained that the objective of the basic needs evaluation is to assess the impact of projects in terms of the production of basic needs goods (goods effect) and the

generation of basic needs income (income effect). A project may have the ability to score well in both criteria. However, this may not necessarily be the case. It may well be that it can score highly in terms of the goods effect and poorly in terms of the income effect or vice versa. Moreover there are social costs and social values both in the production of basic needs goods and in the generation of basic needs income. For the goods effect and the income effect in turn, the social value is calculated and from this is subtracted the social cost to give the net goods and income effect. Finally the aggregation weights are used to combine the net goods and income effect to producing the aggregate measures of the basic needs impact.

The remainder of this chapter therefore begins by computing values for each of these parameters. The projects are then assessed for each parameters for Orissa as a whole and for each of the three agro-ecological zones under examination. A sensitivity analysis encompassing variation in the aggregation weights employed is undertaken before ranking the various projects according to performance. Finally the results are discussed.

Having identified the basic needs goods and estimated basic needs income needed to fulfil the basic needs of an average family in the project area (described in detail in Appendix 8.1), the following parameters are required in order to assess the impacts of the project in terms of both goods and income effect.

- a. The market value of the project's inputs and outputs.
- b. The social value of the project's goods in terms of basic needs fulfilment.
- c. The social value of the project's income in terms of basic needs fulfilment.
- d. The social cost of the project incurred in the production of basic needs goods and generation of basic needs income.
- e. Aggregation weights for net goods effect and net income effect.

The above parameters have been estimated in line with the refinements made to Nair's methodology explained in Chapter 4. Since their estimation is a lengthy process, this has been described and presented in separate appendices. The market valuation of inputs and outputs is dealt with in detail in Chapter 7. The estimation of basic needs conversion factor (BNCF) for social valuation of goods (in terms of basic needs fulfilment) is described in Appendix 8.2. The social valuation of project's income (in terms of basic needs fulfilment) is described and presented in Appendix 8.3. Appendix 8.4 describes the social costing of the projects incurred in the production of basic needs goods and

generation of basic needs income. Finally, the estimation of aggregation weights for the net goods effect (goods balance sheet) and net income effect (income balance sheet) of the project is described in a later section of this chapter (see para 8.2.5).

Using the estimated value of the above parameters the actual computations for the basic needs evaluation are carried out. The selection of the best alternative is decided by the following criterion.<sup>4</sup>

$$\text{BNV} = \frac{[ b_g (\text{GE} - \text{Sc}_g) + b_i (\text{IE} - \text{Sc}_i ) ]}{N}$$

where BNV is the net annual aggregated value of the basic needs impact;

GE is the goods effect ;

IE is the income effect ;

$b_g$  is the aggregation weight for the net goods effect ;

$b_i$  is the aggregation weight for the net income effect ;

$\text{Sc}_g$  is the social cost of the project incurred in the production of basic needs goods ;

$\text{Sc}_i$  is the social cost of the project incurred in the generation of basic needs income and

N is the project life.

Thus, as discussed above, a number of steps are followed for the calculation of the basic needs impact. The results of each of these stages are discussed below.

### 8.1.1 Goods effect of the projects

The goods effect measures the impact of a project on the production of basic needs goods. It is estimated by multiplying the market value of goods by their basic needs conversion factors. Thus:

$$\text{GE} = \sum Q_g \cdot P_g \times \text{BNCF}_g$$

where GE is the goods effect ;

$Q_g$  is the quantity of the g th good ;

$P_g$  is market price of the g th good and

$BNCF_g$  is the basic needs conversion factor of the  $g$  th good.

The average market value of goods produced in the projects and their BNCF's values are given below in Table 8.1.

It is clear from Table 8.1 that on average, the goods produced from forestry and agriculture were valued at 82% and 39 % respectively of those produced by agroforestry. Comparing the projects, the total market value of goods produced is highest in agroforestry followed by forestry and agriculture, both on average for Orissa as a whole and within each of the agro-ecological zones.

A similar comparison amongst the agro-ecological zones indicate that in terms of the market value of goods the Northern Zone ranks first, followed by the Coastal Zone and the Central Zone for the agroforestry and forestry projects. By contrast the values of goods generated by agriculture in the Central Zone edges ahead of that generated in the Northern and the Coastal Zone.

Table 8.1 also shows that the contribution of forestry outputs in the total market value of the project is substantially higher than that of agriculture in the agroforestry project and of that the bulk is produced by timber production. In fact the second most important forest product in terms of the value of goods, namely firewood, constitutes nearly as much as agriculture in all zones. The share of forestry output ranges from 90% to 94% and that of timber from 80% to 86% to the total market values of the outputs in three zones.

Because the utilisation pattern of the goods and the consumption pattern of the beneficiaries involved in all the three projects across the three agro-ecological zones is broadly similar (OFD,1993), the social value of the goods produced in terms of basic needs fulfilment is also similar. Consequently the basic needs conversion factor are also assumed to be identical.

Multiplying the above market values of goods by the values of their corresponding BNCF's (Table 8.1), the total goods effect (the social value of goods in terms of basic needs fulfilment) of each project has been computed and the results are presented below in Table 8.2.

**Table 8.1 Market value of goods and their BNCf's in the projects.**

(figures in Rs./ha at 1992-93 prices)

Zone	Goods	Market values of goods of projects			BNCf of good
		Agroforestry	Forestry	Agriculture	
<b>1. Northern</b>	a. Agricultural outputs	6678	nil	36354	1.0
	b. Forestry outputs				
	i. Intermediate	2113	2313	nil	1.0
	ii. Timber	93723	86355	nil	0.73
	iii. Firewood	6275	6027	nil	1.0
	Total (forestry)	102110	94695	nil	
	<b>Northern Zone (total)</b>	<b>108789</b>	<b>94695</b>	<b>36354</b>	
<b>2. Central</b>	a. Agricultural outputs	7421	nil	37212	1.0
	b. Forestry outputs				
	i. Intermediate	1784	2036	nil	1.0
	ii. Timber	58941	53366	nil	0.73
	iii. Firewood	5511	5055	nil	1.0
	Total (forestry)	66236	60457	nil	
	<b>Central Zone (total)</b>	<b>73658</b>	<b>60457</b>	<b>37212</b>	
<b>3. Coastal</b>	a. Agricultural outputs	6215	nil	32002	1.0
	b. Forestry outputs				
	i. Intermediate	1865	2164	nil	1.0
	ii. Timber	72408	62173	nil	0.73
	iii. Firewood	5733	5530	nil	1.0
	Total (forestry)	80005	69866	nil	
	<b>Coastal Zone (total)</b>	<b>86220</b>	<b>69867</b>	<b>32002</b>	
<b>Orissa (average)</b>	a. Agricultural outputs	6772	nil	35189	1.0
	b. Forestry outputs				
	i. Intermediate	1921	2171	nil	1.0
	ii. Timber	75024	67298	nil	0.73
	iii. Firewood	5839	5537	nil	1.0
	Total (forestry)	82784	72996	nil	
	<b>Orissa (average)</b>	<b>89555</b>	<b>75006</b>	<b>35189</b>	

Source : Market values compiled from Annexures 7.3-7.5 and BNCf's from Appendix 8.2.

**Table 8.2 Goods effect of the projects.**

(figures in Rs./ha at 1992-93 prices)

Zone	Goods effects of projects		
	Agroforestry	Forestry	Agriculture
1. Northern	83484	71379	36354
2. Central	57743	46048	37212
3. Coastal	66670	53080	32002
<b>Orissa (Average)</b>	<b>69299</b>	<b>56836</b>	<b>35189</b>

Source: Computed from Table 8.1

Taking Orissa as a whole the goods effect generated by the forestry project is 82% of that generated by the agroforestry project; being highest in the Northern Zone at 86% and lowest in the Central Zone at 80%. The average goods effect generated in the agriculture project is only 51% of the agroforestry project. It is highest in the Central Zone and lowest in the Northern Zone at 64% and 44% respectively.

Comparing Tables 8.2 and 8.1 it is also apparent that the superior goods effect of agroforestry relative to forestry is due to the higher contribution of forestry outputs particularly in the form of timber as well as an additional marginal contribution from the agricultural outputs. The poor goods effect in agriculture is due not only to the absence of forestry output, but also the poor performance of agriculture relative to that of forestry on these degraded soils.

The reasons for the higher output from the forestry components in the agroforestry project appear to be due to a higher survival rate of trees. The possible reasons for this were discussed in Chapter 6<sup>5</sup> and will be dealt with further in Chapter 9.

### **8.1.2 Social costs of the projects incurred in the production of basic needs goods**

As discussed in chapter 4, the social costs of a project incurred in the production of basic needs goods are estimated in terms of the foregone production of basic needs goods.<sup>6</sup> Based on this principle, the social costs of each input used in the projects have



been estimated and described in Appendix 8.4. From these estimates the social costs of each project have been compiled and are presented below in Table 8.3.

**Table 8.3 Social cost of projects incurred in the production of basic needs goods.** (figures in Rs./ha at 1992-93 prices)

Zone	Social costs of projects		
	Agroforestry	Forestry	Agriculture
1. Northern	14023	11427	17464
2. Central	12215	10059	15769
3. Coastal	12981	10425	14343
<b>Orissa (average)</b>	<b>13073</b>	<b>10637</b>	<b>15858</b>

Source : Compiled from Appendix 8.2.

Table 8.3 shows that amongst the projects, the social costs are highest in agriculture followed by agroforestry and forestry in both average and across each of the agro-ecological zones. On average the social costs incurred in agroforestry and forestry are 82% and 67% respectively of those incurred in agriculture. The social costs in agroforestry relative to those in agriculture ranges from 77% - 90% across zones, and in forestry relative to agriculture these ranges from 63% - 72%.

Amongst the agro-ecological zones, the social cost of projects incurred in production of goods is highest in the Northern Zone followed by the Coastal Zone and the Central Zone across all projects except for agriculture, where the ranking of the Coastal and the Central Zone is interchanged.

The higher social cost in agriculture is due to the higher social opportunity cost of resources used in the project and this in turn is due to the higher loss in production of basic needs goods due to the withdrawal of resources in the project. The financial cost of resources involved in agriculture is also higher in comparison to agroforestry and forestry. Similarly the higher social costs in agroforestry in comparison to forestry are also due to the higher financial costs in the former.

### 8.1.3 Net goods effect (goods balance sheet) of the projects

The difference between goods effect and social costs of projects in terms of production of basic needs goods measures the net goods effect. These have been computed from Tables 8.2 and 8.3 for each project and are presented below in Table 8.4.

**Table 8.4 Net goods effect of the projects.**

(figures in Rs./ha 1992-93 prices)

Zone	Net goods effect of the projects		
	Agroforestry	Forestry	Agriculture
1. Northern	69461	59952	18891
2. Central	45528	35989	21443
3. Coastal	53689	42655	17659
<b>Orissa (average)</b>	<b>56226</b>	<b>46199</b>	<b>19331</b>

Source : Computed from Tables 8.2 and 8.3

On average, forestry and agriculture projects lag behind agroforestry by 18% and 66% respectively in the generation of the net goods effect. Amongst the projects, agroforestry ranks first followed by forestry and agriculture across all the agro-ecological zones.

Amongst the agro-ecological zones, the rankings are the same as for the goods effect (Table 8.2) with the Northern Zone ranking highest, except in case of agriculture where it is supplanted by the Central Zone. In fact in the Northern Zone the forestry project gives net goods effect 29% ahead of its nearest rival (Coastal Zone) and 23% ahead in case of agroforestry. However for agriculture the Northern Zone figure is 12% below that of its nearest rival the Central Zone.

#### 8.1.4 Income effect (or social value of income) of the projects

The Income effect measures the generation of basic needs income from the outputs and inputs of the project. Thus,

$$IE = BNI_o + BNI_i$$

where IE is income effect;

$BNI_o$  is basic needs income generated from the sale of outputs of the project and

$BNI_i$  is the basic needs income generated from the inputs of the project.

Based on the concept of basic needs income explained in Chapter 4, the basic needs income generated from each output and input of the project has been estimated and described in Appendix 8.3. Using these estimates the total basic needs income generated from all outputs and inputs of each project is computed and described as below.

#### 8.1.4.1 Basic needs income from outputs of the projects

The income effect from the output of a project is assessed in terms of basic needs income generated from the sale of the output. This is estimated by multiplying the net benefit of the project by the value of the average BNCF estimated for all the outputs of the project as a whole. Appendix 8.3 describes the procedure for the estimation of the average BNCF of the outputs involved in the projects. To arrive at the basic needs income, it is necessary to calculate the total output benefits, the total costs of production and the net output benefits. Total outputs benefits (at market prices) were given in Table 8.1 and discussed above. Table 8.5 below gives the total costs of production. Both sets of data (output benefits and cost of production) have already been used within the financial evaluation of the projects (in Chapter 7).

**Table 8.5 Total costs of the projects.**

( figures in Rs./ha at 1992-93 prices)

Zone	Agroforestry	Forestry	Agriculture
1. Northern	25672	20552	32996
2. Central	22826	18272	29668
3. Coastal	24158	18880	26905
<b>Orissa (average)</b>	<b>24219</b>	<b>19235</b>	<b>29856</b>

Source: Compiled from Annexures 7.3-7.5.

It is clear from Table 8.5 that in terms of the costs of production of goods in Orissa as a whole, agriculture project shows the highest levels throughout with agroforestry and forestry reaching 81% and 64% respectively. At the zonal level, costs are highest in the Northern Zone for all projects and lowest in the Central Zone except for the agriculture project where the Coastal Zone has the highest costs. Although the other projects incur higher input costs in particular years in other years they incur no costs at all, whereas

agriculture incurs relatively high cost in every year. Therefore the overall costs of inputs in agriculture is much higher than in agroforestry and forestry.

The net benefits of the projects are then calculated by subtracting the total output values of projects from Table 8.1 and that of costs from Table 8.5 and are presented below in Table 8.6.

**Table 8.6 Net output benefits of the projects.**

(figures in Rs./ha at 1992-93 prices)

Zone	Agroforestry	Forestry	Agriculture
1. Northern	83117	74143	3358
2. Central	50832	42186	7544
3. Coastal	62062	50986	5097
<b>Orissa (average)</b>	<b>65337</b>	<b>55772</b>	<b>5333</b>

Source: Compiled from Tables 8.1 and 8.5

Obviously, the net benefits from the outputs of the projects, on average is highest in agroforestry followed by forestry and agriculture across the agro-ecological zones. This is due to the highest revenues realised from the highest production of timber and firewood in the agroforestry project. Amongst the agro-ecological zones, the net benefits of outputs generated by projects is highest in the Northern Zone followed by the Coastal Zone and the Central Zone in all the projects except agriculture where the ranking is reversed. Within agriculture the higher profitability in the Central Zone in comparison to the other zones is due to its relatively better soil conditions (discussed in Chapter 1), which have a more pronounced effect on the crops than the species of trees adopted here.

The net output benefits of the projects are next adjusted to cover basic needs fulfilment only. This adjustment is made by using a common BNCf, whose estimation is described in Appendix 8.3. According to the estimation described in Appendix 8.3, 100% of the net output benefits derived from the projects are assumed to be utilised for basic consumption needs.<sup>7</sup> Thus using an average BNCf of 1 for all outputs as a whole, the net income effect of outputs has been computed and is shown below in Table 8.7.

**Table 8.7 Net income effect from outputs of the projects.**

(figures in Rs./ha at 1992-93 prices)

Zone	Net income effect from outputs of the projects		
	Agroforestry	Forestry	Agriculture
1. Northern	83117	74143	3358
2. Central	50832	42186	7544
3. Coastal	62062	50986	5097
<b>Orissa (average)</b>	<b>65337</b>	<b>55772</b>	<b>5333</b>

It is apparent from Table 8.7 that the ranking of projects in terms of the generation of net income effect from the outputs both in Orissa as a whole and across the agro-ecological zones is same as for the net benefits (in Table 8.6). Overall, the net income effect from forestry and agriculture constitute 85% and 8% respectively of those from agroforestry. This is due to the highest revenue realised from the highest production of timber and firewood in the agroforestry project.

#### 8.1.4.2 Basic needs income from inputs of the projects

Based on the methodology discussed in Chapter 4, the basic needs income generated from each input involved in the projects<sup>9</sup> has been estimated and described in Appendix 8.3. From these estimates the total basic needs income generated in each project has been compiled and is presented below in Table 8.8.

This indicates that agriculture, amongst the projects generates the highest income followed by agroforestry and forestry both in average terms and across the zones. On average the income from inputs in agroforestry and forestry is 82% and 67% respectively of that of agriculture. Agriculture shows the highest income due to higher inputs over the whole life time of the projects and involvement of more local factors of production as discussed earlier. Agroforestry in turn generates slightly higher input income than forestry because of incurring higher input costs.

Amongst the agro-ecological zones, the basic needs income generated by the projects is highest in the Northern Zone and lowest in the Central Zone except for agriculture where the Coastal Zone ranks at the lowest.

**Table 8.8 Basic needs income from inputs of the projects.**

(figures in Rs./ha at 1992-93 prices)

Zone	Basic needs income from inputs of the projects		
	Agroforestry	Forestry	Agriculture
1. Northern	21966	17935	27422
2. Central	18943	15696	24766
3. Coastal	20171	16294	22515
<b>Orissa (average)</b>	<b>20360</b>	<b>16641</b>	<b>24901</b>

Source : Compiled from Appendix 8.3.

#### 8.1.4.3 Social costs of projects incurred in the generation of basic needs income

The social cost of a project incurred in the generation of basic needs income is estimated in terms of the foregone generation of basic needs income.<sup>10</sup> Based on this principle, the social cost of each input involved in each of the projects has been computed and is described and presented in Appendix 8.4. From these estimates the total social costs of each project are compiled and shown below in Table 8.9.

Table 8.9 shows that both overall and on a zonal basis, the social cost of the agriculture project is highest followed by the agroforestry and forestry projects. On average the costs in agroforestry and forestry are 81% and 66% respectively of those in agriculture. This is due to the higher expenses in agriculture in comparison to agroforestry and forestry. Amongst zones, the Northern Zone ranks substantially ahead of the other zones in all the projects.

#### 8.1.4.4 Net income effect from inputs of the projects

The net income effect from inputs of the projects has been compiled from Tables 8.8 and 8.9 and is presented below in Table 8.10. The results follow the same pattern as the earlier tables (i.e. Tables 8.8 and 8.9) with agriculture again ranking above agroforestry and forestry. Overall, agroforestry exhibits a net income effect of some 83% of that in agriculture and forestry about 69%.

Similarly amongst the zones, the Northern Zone again ranks at the top and the Central Zone at the bottom, except in the case of agriculture where the Coastal Zone remains at the bottom.

**Table 8.9 Social cost of projects in the generation of basic needs income.**

(figures in Rs./ha at 1992-93 prices)

Zone	Social costs of projects in the generation of basic needs income		
	Agroforestry	Forestry	Agriculture
1. Northern	14023	11427	17464
2. Central	12215	10059	17769
3. Coastal	12981	10425	14443
<b>Orissa (average)</b>	<b>13073</b>	<b>10637</b>	<b>15858</b>

**Table 8.10 Net income effect from inputs of the projects.**

(figures in Rs./ha at 1992-93 prices)

Zone	Net income effects from inputs of the projects		
	Agroforestry	Forestry	Agriculture
1. Northern	7943	6507	9958
2. Central	6728	5637	8997
3. Coastal	7190	5869	8172
<b>Orissa (average)</b>	<b>7287</b>	<b>6004</b>	<b>9042</b>

Source: Computed from Tables 8.6 and 8.7

#### 8.1.4.5 Net income effect of projects (both from outputs and inputs)

Finally, the net income effect of the projects has been computed by adding the net income effects of both output and inputs and is presented below in Table 8.11.

**Table 8.11 Net income effect of the projects.**

(figures in Rs./ha at 1992-93 prices)

Zone	Net income effects of the projects		
	Agroforestry	Forestry	Agriculture
1. Northern	91060	80650	13317
2. Central	57559	47822	16541
3. Coastal	69252	56855	13269
<b>Orissa (average)</b>	<b>72624</b>	<b>61776</b>	<b>14375</b>

Source: Compiled from Tables 8.7 and 8.10.

Table 8.11 indicates that the highest net income effects are generated by agroforestry followed relatively closely by forestry (85% of agroforestry) and with agriculture (20% of agroforestry) lagging well behind in each agro-ecological zone. Similarly amongst the agro-ecological zones the net income effect is highest in the Northern Zone followed by the Coastal Zone and the Central Zone across all the projects except for agriculture for which the Central Zone provides the highest net income effect. In fact in the forestry project, income effect in the Northern Zone is 42% above that of the nearest rival the Coastal Zone, and also 42% above that for agroforestry, whereas for agriculture it is 19% behind that of the Central Zone.

Comparing the net income effect (Table 8.11) with that of the net goods effect (Table 8.4) it is found that the ranking of both projects and agro-ecological zones are similar in both cases. In other words, amongst the projects, both the net goods effect and income effect are found highest in agroforestry followed by forestry and agriculture across all the agro-ecological zones. Similarly, both the effects are highest in the Northern Zone followed by Coastal Zone and Central Zone in both agroforestry and forestry whereas agriculture shows the highest net goods and income effect in the Central Zone and the lowest in the Coastal Zone.

### 8.1.5 Ranking of the projects in terms of basic needs impact

The steps followed so far have produced the net goods effect and net income effect which give the net effects of projects in terms of the production of basic needs goods and the generation of basic needs income respectively. Since the income required to meet



the basic needs of an average family in Orissa has been estimated in annual terms (see Appendix 8.1), both of these effects need to be estimated on an annual basis. The life of the project under study covers a period of 9 years so these two impacts should be divided by 9 to give the net annual per hectare basic needs impact. Table 8.12 below presents the net annual goods effect and income effect of the three projects.

Although these two effects themselves give a clear picture of the actual impact of the three land use projects, to select the best project it is necessary to aggregate these two effects (Nair, 1981).

The Socio-economic background of Orissa indicates that more than 85% of the its population reside in the rural villages and nearly half of the total population falls under the category of people who are below the poverty line. An inadequate supply of goods for basic needs consumption and a high level of both unemployment and underemployment exist side by side. The land use pattern existing in the state shows that the majority of the farmers are dependent on subsistence oriented production where, it is difficult to demarcate between production and consumption activities. In other words, the economy of a type which is almost closed, scarcity of basic needs goods exists coupled with a predominance of unemployment and underemployment.

Given the above socio-economic situation, the generation of employment as well as production of the basic needs goods are both of equal importance. Unequal treatment may lead a greater imbalance in society. Equity demands an equal weightage to both aspects of the problem. The appropriateness of using the equal aggregation weight for both net goods effect and net income effects has been tested using the information collected through the questionnaire survey.

As discussed in Chapter 4, the weights for aggregation can be derived by the project evaluator taking into account the state of basic goods supply and basic needs income generation in the area concerned.<sup>11</sup>

According to Nair:

$$bg = \frac{g - 1}{(g - 1) + (i - 1)} \quad \text{and} \quad (8.1)$$

$$i = \frac{i - 1}{(i - 1) + (g - 1)} \quad (8.2)$$

where  $bg$  is the aggregation weight for net goods effect;  
 $bi$  is the aggregation weight for net income effect;  
 $g$  is basic needs supply co-efficient and  
 $i$  is basic needs income co-efficient.

Furthermore:

$$g = R / S$$

where  $R$  is the requirement of basic needs goods in a given region or area and  
 $S$  is the supply of basic needs goods in a given region or area.

The required information was collected within the questionnaire survey. The value of  $R$  and  $S$  were computed to give Rs. 9000 and Rs. 4509 respectively, details of which are given in Appendices 8.1 and 8.5 (see the column net annual goods effect in spreadsheet 2) respectively. The value of  $g$  in terms of per family for whole Orissa is therefore computed as :

$$g = \frac{9000}{4509} \\ = 1.99$$

Similarly the basic needs income co-efficient is estimated from the total income needed to meet the basic needs within the area and the existing income of the beneficiaries involved in the three projects of Orissa.

$$i = \frac{y}{Y}$$

where  $n$  is number of household below poverty line ;

$y$  is basic needs income needed to fulfil the basic needs consumption and  
 $Y$  is existing income.

The required information was also collected within the questionnaire survey. The value of  $y$  and  $Y$  were computed to give Rs. 9000 and Rs. 5018 respectively, details of which are again given in Appendices 8.1 and 8.5 (see the column net annual income effect in spreadsheet 2) respectively. The value of  $i$  in terms of per family per hectare for whole Orissa is therefore computed as :

$$i = \frac{9000}{5009} \\ = 1.80$$

Substituting these values for  $g$  and  $i$  in expressions (8.1) and (8.2) we obtain the following:

$$\text{weights for net goods effect} = \frac{2.00 - 1}{(2.00 - 1) + (1.80 - 1)} = 0.55$$

$$\text{weight for net income effect} = \frac{1.80 - 1}{(1.80 - 1) + (2.00 - 1)} = 0.45$$

The computed weights closely match with the estimates for Orissa discussed above and in Chapter 4. These are rounded to 0.5 and 0.5 for net goods effect and net income effects respectively for the present study. However, a sensitivity analysis has also been carried out with a range of aggregation weights to see the changes in total basic needs impact generated from the projects.

The column 5 in Table 8.12 below gives the value of the aggregated annual basic needs impact of the projects at aggregation weights 0.5 and 0.5 for the net goods effect and net income effect respectively.

It is clear that in Orissa as a whole, the net per hectare annual basic needs profitability is highest in agroforestry followed by forestry and agriculture. In fact, the profitability in forestry and agriculture projects are 17% and 70% respectively below that of the agroforestry project. Agroforestry also ranks first followed by forestry and agriculture across all the zones. Comparing the zones in terms of the net annual aggregated basic needs impact generated by each of the projects, the Northern Zone ranks well above the Coastal Zone and the Central Zone in case of agroforestry and

forestry whereas in agriculture the Central Zone ranks above the Northern Zone and the Coastal Zone.

**Table 8.12 Net annual basic needs impact of the projects.**

(figures in Rs./ha at 1992-93 prices)

Zone	Land use projects	Net annual <sup>+</sup> good effect	Net annual <sup>++</sup> income effect	Net aggregated basic needs impact at 0.5 and 0.5 weights
1	2	3	4	5
1. Northern	i.. Agroforestry	7718	8918	8318
	ii. Forestry	6661	7811	7236
	iii. Agriculture	2099	1789	1944
2. Central	i.. Agroforestry	5059	5727	5393
	ii. Forestry	3999	4658	4328
	iii. Agriculture	2383	2110	2246
3. Coastal	i.. Agroforestry	5965	6830	6398
	ii. Forestry	4740	5528	5134
	iii. Agriculture	1962	1718	1840
<b>Orissa (average)</b>	<b>i. Agroforestry</b>	<b>6247</b>	<b>7158</b>	<b>6703</b>
	<b>ii. Forestry</b>	<b>5133</b>	<b>5999</b>	<b>5566</b>
	<b>iii. Agriculture</b>	<b>2148</b>	<b>1873</b>	<b>2010</b>

Source: + Compiled from Table 8. 4 ; ++ compiled from Table 8.11

### 8.1.6 Extent of basic needs fulfilment

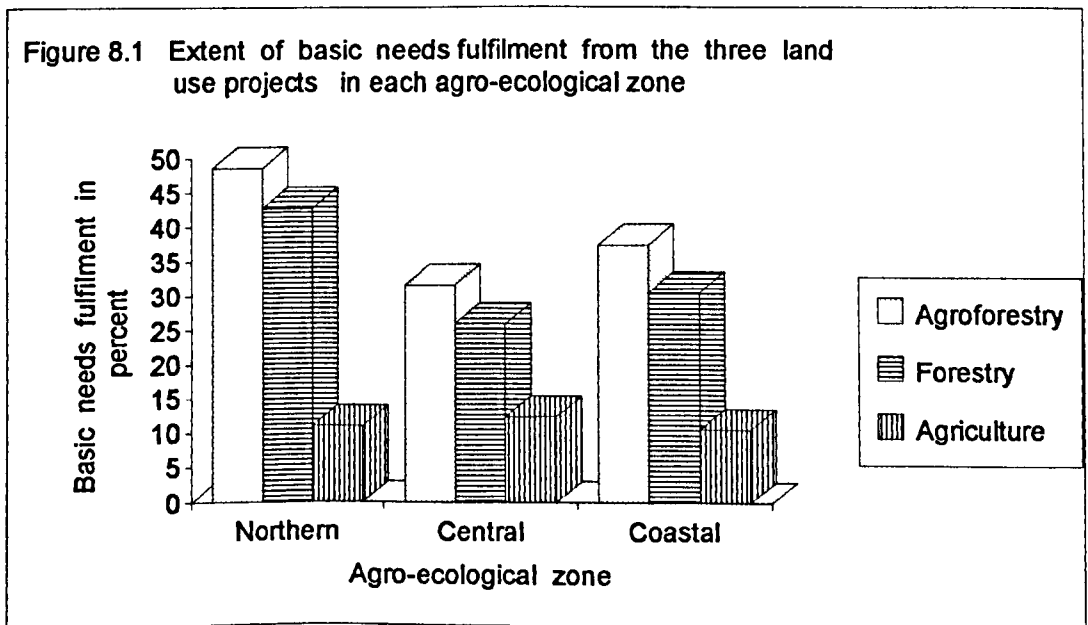
As discussed in Appendix 8.1, on average, a family having 6 members in Orissa, needs Rs. 9000 per annum to fulfil its basic needs. On the other hand, the results of the evaluation of the average net aggregated annual basic needs impact of land use projects for Orissa presented in Table 8.12 indicate that even the most favourable project, namely agroforestry, only generated an average benefit of Rs. 6703/ha. Furthermore, an individual household involved in any of the three projects was given only 0.5 hectare of land. This means that an average basic needs impact from an individual plot would be Rs. 3352 in agroforestry followed by forestry (Rs. 2783) and agriculture (Rs. 1005).

Table 8.13 and Figure 8.1 below present the extent of basic needs fulfilment of a family through the land use practice carried out on 0.5 hectare of land. They indicate that, on average, the extent of extra basic needs fulfilment in Orissa as a whole through the agroforestry, forestry and agriculture projects would be about 37%, 31% and 11% respectively. However, a wide variation is observed in the extent of basic needs fulfilment amongst the participants of different practices in different zones. The participants of agroforestry and forestry projects in the Northern Zone would be able to fulfil the highest basic needs to a greater extent than those of the Coastal and Central Zone. For agriculture all zones performed poorly, with an average extra basic needs fulfilment of only 11%.

**Table 8.13 Percentage basic needs fulfilment from the projects.**

(figures in %)

Zone	Agroforestry	Forestry	Agriculture
1. Northern	46.2	40.2	10.8
2. Central	30.0	24.0	12.5
3. Coastal	35.5	28.5	10.2
<b>Average(Orissa)</b>	<b>37.2</b>	<b>31.0</b>	<b>11.2</b>



The computation of the basic needs evaluation of the three projects has been carried out using a standard spreadsheet package and a separate spreadsheet has been developed showing the details of the computation for the three projects under each agro-ecological zones. The details of the spreadsheet construction are explained in Appendix 8.5

### 8.1.7 Sensitivity analysis of effects of varying aggregation weights

In order to test the basic needs impacts of projects due to variation in the aggregation weights for the net goods and net income effects, a sensitivity analysis was carried out whose results are presented below in Table 8.14. The bold and underlined figures show the results for the actual weights used based on the primary data. In a completely open economy the weights would tend towards the upper extreme with a zero weight for the net goods effect. Conversely, the more the closed economy, the more the weights would move in favour of the net goods effect, although the lower extreme would be a highly unlikely position.

Table 8.14 indicates that with an increase in the aggregation weight for the net goods effect, the net basic needs impact and percentage basic needs fulfilment decrease for all projects. The reverse is the case with the aggregation weights for the net income effect. However there is no change in the ranking of the projects with an increase or decrease in the aggregation weights in the present context. In other words, the agroforestry project always ranks at the top and the agriculture project at the bottom in terms of the net basic needs impact irrespective of the aggregation weights.

**Table 8.14 Net mean annual basic needs impacts at varying aggregation weights.**  
( figures in Rs./ha at 1992-93 prices)

Aggregation weights		Net annual basic needs impacts of the projects		
Net goods effect (bg)	Net income effect (bi)	Agroforestry	Forestry	Agriculture
0.0	1.0	8069 (45%)	6864 (38%)	1597 (9%)
<u>0.5</u>	<u>0.5</u>	<u>6703 (37%)</u>	<u>5566 (31%)</u>	<u>2010 (11.2%)</u>
1.0	0.0	6247 (35%)	5133 (29%)	2148 (11.9%)

Note: Figures in brackets show the percentage basic needs fulfilment from the projects.

### 8.1.8 Comparison with the financial evaluation

Net per hectare annual basic needs profitability and net per hectare undiscounted financial profitability cannot be readily compared. This is because the latter is expressed on the basis of a project's lifetime, rather than an annual format and more crucially, they are calculated on an entirely different basis. The net present value (NPV) of a project can nevertheless be readily converted to an equivalent annual value (EAV) using an annuity formula (Gittinger, 1984; Bright, 1991) given below:

$$\text{EAV} = \text{NPV} \times \frac{(1+r)^n \times r}{(1+r)^n - 1} \quad (8.3)$$

where EAV is an equivalent annual value;

NPV is the net present value;

r is the discount rate and

n is the project's life.

Table 8.15 below presents a comparative picture of the financial equivalent annual value (EAV) and net annual basic needs value (BNV) of the three projects in the three agro-ecological zones.

**Table 8.15 Comparison of equivalent annual value (EAV) and net annual basic needs value (BNV) of the projects.**

(figures in Rs./ha/year at 1992-93 prices)

Zone	EAV and BNV of projects					
	Agroforestry		Forestry		Agriculture	
	EAV <sup>+</sup>	BNV <sup>++</sup>	EAV	BNV	EAV	BNV
1. Northern	4669	8318	3929	7236	448	1944
2. Central	2499	5393	1761	4328	823	2246
3. Coastal	3213	6398	2350	5134	499	1840
<b>Orissa (average)</b>	<b>3460</b>	<b>6703</b>	<b>2680</b>	<b>5566</b>	<b>590</b>	<b>2010</b>

Note: <sup>+</sup> compiled from Annexures 7.6, 7.7 and 7.8 ; <sup>++</sup> compiled from Table 8.10.

Because of the effects of not discounting and despite the effects of weighting by the BNCF, the BNV exceeds the EAV for all the projects and across all the zones. Whereas direct comparison of these figures is not appropriate, a comparison of rankings does provide some useful indications, as discussed in the next section.

In most cases the effect of the introduction of the basic needs evaluation is to maintain the rankings both between projects and between zones, but to marginally narrow the gap between components. However, in the case of the agriculture project not only is the gap between it and the other projects and between zones narrowed substantially, but zone rankings are also altered. Thus whereas the EAV puts the Central Zone above the Coastal Zone, the position is reversed in the basic needs evaluation. This worsening of the relative position of agriculture and the reversal of zonal rankings appears to be due to the effect of the relatively larger input costs in agriculture in general and the Northern Zone in particular.

## **8.2 An analysis and discussion of the results**

An analysis of the above results indicates that there is a wide variation in the net annual basic needs impact between the three projects and three agro-ecological zones. The prominence of agroforestry in terms of basic needs fulfilment is due to the incorporation of trees along with agricultural crops in comparison to forestry. Another reason is the higher survival rate of trees in agroforestry which may be due to more interest and effort taken by the participants as a result of which trees received more protection.<sup>12</sup> The greater interest and effort in agroforestry were possibly due to the regular cash flow generated by the agricultural crop in the first few years of the project.<sup>13</sup> Furthermore, trees in the agroforestry plots got double benefits of fertiliser and other inputs used on the trees and the agricultural crops, resulting in somewhat greater growth and yield in comparison to the forestry project.

The reasons for the poor basic needs impact of the agriculture project are a combination of lower revenue and higher costs in comparison to the forestry and agroforestry plots. The low agricultural production was due to the use of poor, degraded and rocky soil which was particularly unsuitable for agriculture.<sup>14</sup>

With regard to the variation in basic needs impact amongst the different zones, agro-ecological factors were probably primarily responsible. A more suitable agro-climatic situation in terms of rainfall and less natural hazards such as flood and drought in the



Northern Zone created more favourable conditions for the growth of trees in comparison to the Coastal Zone and the Central Zone.

Besides the agro-ecological factors, variation in socio-economic factors such as literacy, caste, monthly income and occupation of the participants in different zones appear to have also been responsible for variation in basic needs impact. Evaluation of the various socio-economic factors determining variation in performance in the agroforestry and forestry projects is dealt with in detail in Chapter 9.

In terms of basic needs fulfilment both agroforestry and forestry, especially in the Northern Zone, appear to meet a substantial proportion of the household basic requirements. However, the given basic needs level is a minimum and if the household is solely dependent on the project for its livelihood then even the agroforestry and forestry projects are disappointing. As far as agriculture is concerned only a small proportion of basic needs are met so this project can be deemed to be barely worthwhile.

Nevertheless, the measure of basic needs fulfilment, the net annual basic needs impact, is positive throughout, which suggests that all projects have brought about an improvement in the fulfilment of basic needs with respect to the situation without the project.

## **Summary**

Using the methodology outlined in Chapter 5 , basic needs evaluation has been carried out to elicit the basic needs impact of three land use projects from three agro-ecological zones of Orissa. The necessary parameters were estimated using the field data collected through a questionnaire survey. The results indicate that agroforestry generates the highest basic needs impact in all three zones followed by forestry and agriculture. The percentage basic needs fulfilment from 0.5 hectare of agroforestry, forestry and agricultural plots are generally found to be highest in the Northern Zone followed by the Coastal Zone and the Central Zone although for agriculture the Central Zone ranks highest.

Using the results of the financial and basic needs evaluations as well as the questionnaire survey, an attempt has been made in the next chapter to identify the factors determining profitability in agroforestry and forestry projects.

**Notes:**

- 1 See para 2.5 of Chapter 2 for detailed description of Forest Farming for Rural Poor (agroforestry and forestry) FFRP and Economic Rehabilitation of Rural Poor (ERRP) projects of Orissa.
- 2 See para 5.3.2.2.1 of Chapter 5 for the detailed description about the intermediate benefits.
- 3 See para 4.3.9 of Chapter 4 for criterion for selection of a project in basic needs evaluation.
- 4 See para 1.2.2 of Appendix 4.2 for various uses of Eucalyptus hybrid species in Orissa.
- 5 See para 6.2.4 of Chapter 6 for higher survival rate of trees in agroforestry.
- 6 See para 4.3.6 of Chapter 4 for the principles adopted in social costing of a project.
- 7 See paras 6.2.5 and 6.2.6 of Chapter 6 for the uses of the outputs of the projects.
- 8 See para 1.1.7 of Chapter 1 for soil conditions of different agro-ecological zones.
- 9 See para 4.3.5 of Chapter 4 for the estimation of basic needs income.
- 10 See para 4.3.6 of Chapter 4 for the estimation of social cost in the generation of basic needs income.
- 11 See para 4.3.8 of Chapter 4 for the estimation of aggregation weight for the net goods effect and net income effect.
- 12 See para 6.2.4 of Chapter 6 for the reasons of the high survival of trees in the agroforestry project.
- 13 See para 6.2.4 of Chapter 6 for the higher enthusiasm and effort in the agroforestry project.
- 14 See para 6.2.6 of Chapter 6 for unsuitability of land for the agriculture project.

## Chapter 9

### An Evaluation of Socio-economic Factors Determining the Profitability of Land Use Projects

The results of the financial and the basic needs analyses of the three land use projects discussed in Chapters 7 and 8 indicate that there is a wide variation in financial profitability and basic needs fulfilment amongst the different agro-ecological zones as well as the different land use projects. Notwithstanding the difference between the agro-ecological zones and the projects, the results of individual plots within the same agro-ecological zone and the same project reveal that there is also wide variation in the financial profitability amongst the individual plots (Annexures 7.6 - 7.17). This happens in spite of the similar technological inputs and policy package being adopted in all the plots. Such variation suggests that there are some variables other than technical, agro-ecological and policy factors which influence the performance of the individual participants. This chapter attempts to identify such variables from a theoretical standpoint and then to test their actual significance. Section 1 of this chapter establishes a theoretical framework in which the potential factors determining profitability in agroforestry and forestry are identified while section 2 tests the theory using the information collected through the questionnaire survey.

#### 9.1 Theoretical framework

The profitability of any project depends upon the extra revenues and the costs incurred. Thus :

$$\pi = \text{revenue} - \text{cost}$$

where  $\pi$  is the profitability expressed in this instance as the net present value (NPV)

This can be expanded to:

$$\pi = \sum_{g=1}^m Q_{og} \times P_{og} - \sum_{h=1}^n Q_{ih} \times P_{ih} \quad (9.1)$$

where  $Q_{og}$  is the quantity of output  $g$  for all outputs 1-m;

$P_{og}$  is the price of the output  $g$  for all outputs 1-m;

$Q_{ih}$  is the quantity of input  $h$  for all inputs 1-n and

$P_{ih}$  is the price of input  $h$  for all inputs 1-n.

If the  $Q_{ih}$ ,  $P_{ih}$  and  $P_{og}$  are common to all plots of the projects then:

$$\pi = f(Q_{og} \mid P_{og}, Q_{ih}, P_{ih}) \quad (9.2)$$

where the variables to the right of the bar are held constant (Lipsey, 1967).

Taking the example of forestry, the quantity of output produced in forestry itself depends on two variables: (a) the volume per tree and (b) the number of trees, which further depends on planting density and survival percentage of trees.

Since the contribution from agriculture in the agroforestry project, (as has been seen), is small, and because the profitability determinants could be expected to be the same as for forestry, the following framework will cover both agroforestry and forestry projects.

Thus the quantity of output produced in forestry per unit area would depend on the volume of individual tree, survival percentage of the trees and density of the trees. Hence:

$$Q_{og} = f(W, S_t, D) \quad (9.3)$$

where  $W$  is the average volume per tree;

$S_t$  is the survival percentage of trees and

$D$  is the planting density of the tree.

Because the plantation density is kept the same throughout the individual plots as project policy (OFD, 1993), expressions 9.2 and 9.3 can now be combined to give :

$$\pi = f(W, S_t \mid D, P_{og}, Q_{ih}, P_{ih}) \quad (9.4)$$

The next step is to outline the factors one would expect to determine the variables  $W$  and  $S_t$ .

In production economics the determination of output, by a combination of inputs is expressed in the form of a production function. This is defined as showing the transformation of inputs into outputs or as the relationship between physical inputs and physical outputs. It may be expressed as:

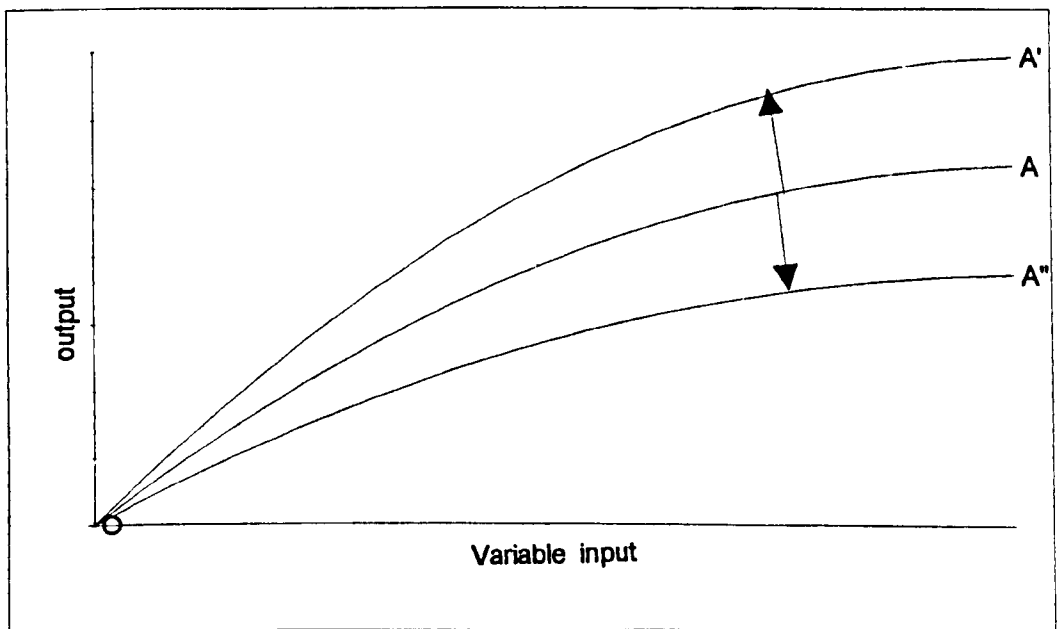
$$Q = f(i_1, i_2, \dots, i_n)$$

where  $Q$  is the physical quantity of certain products and

$i_1, i_2, \dots, i_n$  stand for physical quantities of various inputs needed to produce  $Q$ .

However, the inputs to the production process in agroforestry and forestry are not simply the physical inputs such as seeds, fertiliser, labour, insecticides and polythene bags, but also managerial and labour skills and effort as well as agro-climatic factors. Variation in the latter may shift the production curves above or below the normal production curve as shown below in Figure 9.1 .

**Figure 9.1 Production function effects of variation in managerial and labour skill and effort and agro-climatic factors**



Thus for any set of physical inputs with a single variable input we may have the production function  $OA$ . For those farmers with a high degree of managerial and labour skill and effort, the function might move to  $OA'$  and for those applying less, to  $OA''$ .

Similarly, for a favourable agro-climatic zone, the curve may move to OA and for a unfavourable one to OA\*.

In the present study all the physical inputs can be expected to be the same in all plots within each project according to the policy package. However, the managerial skills and labour inputs provided by the participants may differ, moreover agro-climatic variation may also occur. Therefore the two technical measures, namely the volume per tree and survival percentages of trees, determining the profitability of the individual plot are themselves determined thus:

$$W = f(M, L, A \mid D, Q_{ih}) \quad (9.5)$$

where M is the managerial skill and effort of the participants;

L is the labour skill and effort of the participants and

A is the agro-climatic factors such as soil, rainfall, temperature, topography, biotic interference (such as grazing, theft, insect and disease) and climatic hazards such as flood, drought and cyclones.

D and  $Q_{ih}$  are included since volume per site is also dependent on planting spacing and quantity of inputs at some extent.

Similarly, the survival percentage of trees is likely to be determined by the managerial and labour skills and effort and agro-climatic conditions. Thus:

$$S_t = f(M, L, A \mid D, Q_{ih}) \quad (9.6)$$

Unfortunately, the managerial and labour skill and effort are not directly measurable. Nevertheless, they are likely to be determined in part by the socio-economic characteristics of the farmers, such as caste, literacy, income, occupation and awareness. Consequently the latter can be used as proxy variables for the former. The following example illustrates the relationship between the socio-economic profile and the managerial and labour skill and effort of the participants particularly engaged in land use projects such as forestry in Indian context.

Amongst the caste groups, the scheduled caste is one of the deprived castes in Orissa who are economically backward (Chapter 1). Their livelihood depends mainly on labouring either in agricultural or forestry activities. A symbiotic relationship between

these tribes and forests is found to exist in many parts of Orissa (Sharma, 1993). As discussed in chapter 1, these tribes have a community based social structure which helps in conserving the forest by imposing restrictions on the use of forests. A common example is "totem" and "ancestral worship" in which certain trees are treated as sacred and are not allowed to be felled. Being economically backward and having affection and sentimental attachment to trees, these people are more alert and enthusiastic in accepting a forestry or forestry associated project in comparison to those who have an alternative source of income (OFD,1993) such as for example, the elite caste group such as rajputra and brahmins. In other words, there are some cultural factors supplemented with low income amongst these castes which influence or even compel them to adopt such practices more readily.

Literacy and awareness also influence an individual in knowing the merits and demerits of any activity. Literate and aware people can easily understand the various aspects of the land use activities communicated through a project official and can show a prompt reaction.

Occupation similarly plays an important role in generating interest and effort in adopting any activity. Usually, the low earning people, who often struggle for two daily meals, are found insecure and therefore alert to innovation in comparison to those whose incomes are above their consumption level and are therefore more relaxed.

In the light of the above discussions the managerial and labour skill and efforts can be expressed as determined thus:

$$M, L = f(E)$$

where E is the socio-economic factors. Thus expressions 9.5 and 9.6 can now be expressed as:

$$W, S_t = f(E, A | D, Q_{ih}) \quad (9.7)$$

Now although both W and  $S_t$  are expected to be the main determinants of profitability, in the present study, the variation in profitability (expressed in NPV) due to variation in volume per tree tended to be very small both in agroforestry and forestry. Annexure 9.1 gives the results of the regressions analyses which are summarised in the following regression equations.

a. In case of the agroforestry project :

$$\text{NPV} = -5283 + 42392 \times \text{Survival percentage of tree} \quad (9.8)$$

(43.6)                       $R^2 = 97\%$

$$\text{NPV} = -5977 + 307939 \times \text{Volume per tree} \quad (9.9)$$

(7.13)                       $R^2 = 42\%$

$$\text{NPV} = -5619 + 41692 \times \text{survival} + 11727 \times \text{volume per tree} \quad (9.10)$$

(32.4)    (0.84)               $R^2 = 97\%$

b. In case of the forestry project:

$$\text{NPV} = -5906 + 47835 \times \text{Survival percentage of tree} \quad (9.11)$$

(58.2)                       $R^2 = 98\%$

$$\text{NPV} = -7412 + 315763 \times \text{Volume per tree} \quad (9.12)$$

(6.8)                       $R^2 = 40\%$

$$\text{NPV} = -6519 + 46567 \times \text{survival percentage} + 21096 \times \text{volume per tree} \quad (9.13)$$

(45.6)    (1.8)                       $R^2 = 98\%$

where NPV is in rupees / 0.5 ha ;

$R^2$  shows the percentage of explained variation and  
t statistics are given in parentheses.

For both agroforestry and forestry, the regression equations (9.8 and 9.11) indicate that survival appear to a powerful determinant of NPV, giving  $R^2$  value 96% and 98% respectively. Volume per tree, however has much less of an influence, with  $R^2$  values of 42% and 40% (9.9 and 9.12) for agroforestry and forestry respectively. Furthermore, in the combined regression equations (9.10 and 9.13), the volume co-efficient is not significant at the 95% level, although this may be due to multicollinearity.

This suggests that it would be reasonable to focus on survival as the main determinant of variations in profitability.



The next section therefore, studies the extent to which the theoretical determinants of survival (and hence profitability) have an influence in the case of the agroforestry and forestry projects in Orissa.

## 9.2 Identification of factors affecting profitability in the agroforestry and forestry projects

### 9.2.1 Survival percentage of trees between agro-ecological zones

As discussed in Chapter 6, the main questionnaire relating to the participants of the agroforestry and forestry projects were further sub-grouped into three categories on the basis of the survival percentages of trees. The participants in whose plot survival ranged from 0 to 25% were classified as the low survival category ; those with 25 to 50% as the moderate survival category and those with more than 50% as the high survival category. The basis of classifying according to the survival percentage of trees was on the principles adopted by the Forest Department of Orissa (Singh 1994 and Kumar, 1994) and its purpose was to identify the relevant factors responsible for variation in survival percentage of trees. This was done on the assumption that the trees are the major contributor in the total income from the FFRP plot. Such grouping was not possible amongst the questionnaire of the agriculture project due to absence of trees in the plots.

The overall distribution of plots under different survival categories in agroforestry and forestry projects are presented below in Table 9.1. This indicates that the proportion of agroforestry plots within high and moderate survival categories is higher than that of forestry whereas the proportion of the plots under low survival is substantially lower. In fact, none of the plots in forestry are within the high survival category.

**Table 9.1 Average distribution of plots under survival categories in agroforestry and forestry projects.**

(figures in %)

Projects	Survival categories		
	Low	Moderate	High
Agroforestry	29	60	11
Forestry	44	56	0

The distribution of plots within different survival categories in both agroforestry and forestry are presented below in Figures 9.2 and 9.3 respectively.

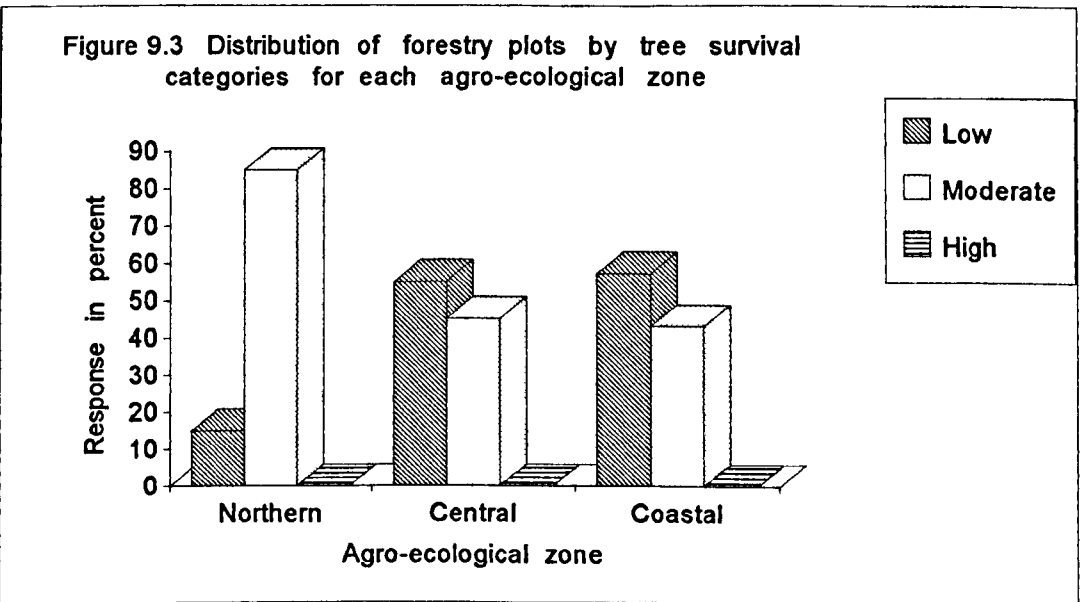
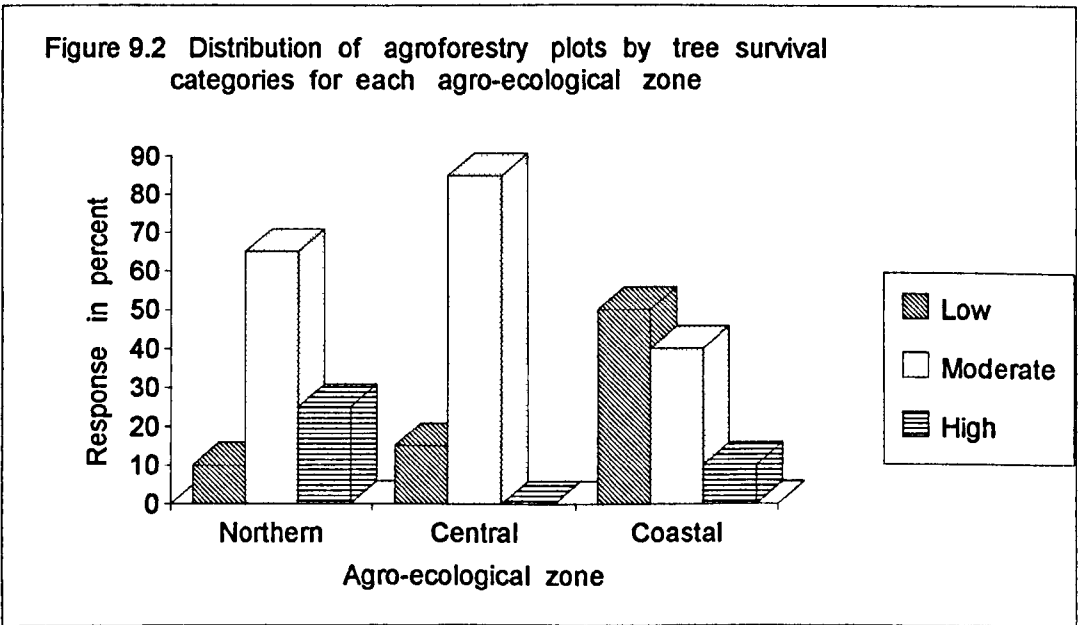


Figure 9.2 indicates that the Northern Zone has the greatest proportion of plots within the high and moderate survival categories. Although the Coastal Zone has the next highest proportion within the high survival category, it also has the highest proportion of low survival plots.

In forestry (Figure 9.3) again, the Northern Zone has highest proportion of plots within the moderate survival category followed by the Central Zone and the Coastal Zone. In fact, there is not even a single plot in forestry with high survival category in any of the zones. As far as the low survival category is concerned, the Coastal Zone ranked at the top and the Northern Zone at the bottom.

The differences in survival percentages between zones were found to be significant when the chi-squared ( $\chi^2$ ) test (21.7 at  $df = 4$ ) rejected the null hypothesis at 0.01 level.

### **9.2.2 Survival percentage of trees and socio-economic factors between and within zones**

The variation in survival percentage of trees with the variation in the socio-economic factors were examined from the responses gathered through the questionnaire survey. Chi-square tests then were carried out within and between zones to test the significance of variation for both agroforestry and forestry projects. The percentage variation in responses and the results of the chi-square tests are presented and described below.

The survival percentage of trees in different caste groups for agroforestry and forestry projects are shown below in Figures 9.4 and 9.5 respectively. These indicate that the participants from scheduled tribes tended to obtain high to moderate survival rates, whereas for the other two caste categories (i.e. scheduled caste and other caste group), low survival predominated in both agroforestry and forestry. However, in forestry there was no plot with high survival.

The apparent variations in survival between the caste groups of the participants were found to be significant at the 0.01 level within and between all zones.

Figure 9.4 Distribution of tree survival categories in the agroforestry project by caste group of participants

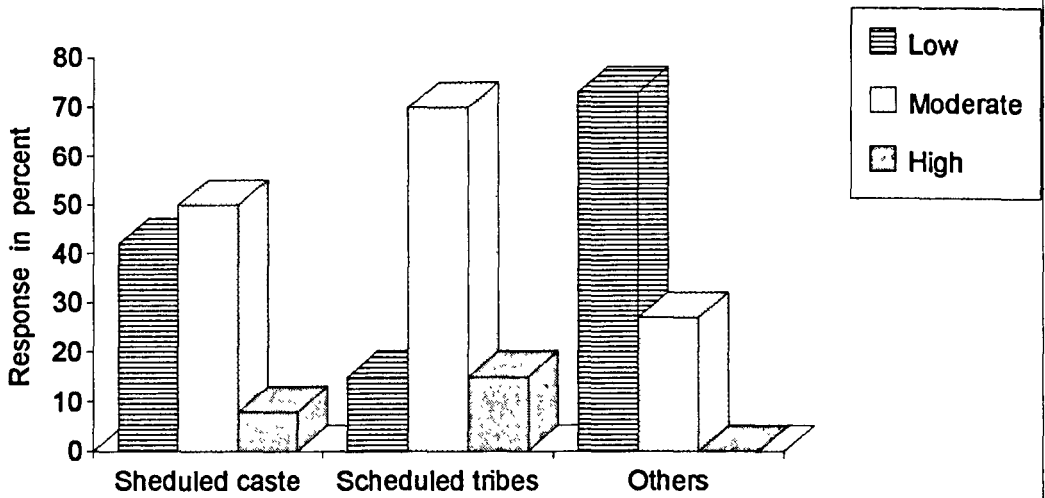
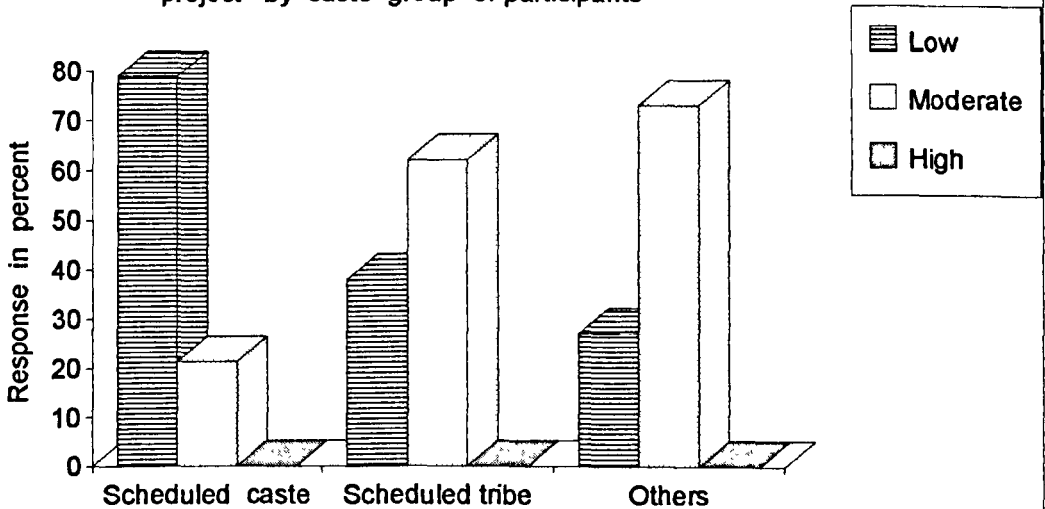


Figure 9.5 Distribution of tree survival categories in the forestry project by caste group of participants



A summary of the computed chi-square values showing the variation in survival percentage with variation in socio-economic factors between and within agro-ecological zones for agroforestry and forestry projects is presented below in Tables 9.2 and 9.3 respectively. These are based on the frequency table of the responses given in Annexure 6.1.

**Table 9.2 Computed chi-square ( $X^2$ ) value for socio-economic factors within and between zones in the agroforestry project.**

Socio-economic factors	$X^2$ value within zone			$X^2$ value between zone
	Northern	Central	Coastal	
1. Caste	<u>15.0</u> (df =2)	<u>10.6</u> (df =2)	4.0 (df =4)	<u>16.1</u> (df =4)
2. Literacy	<u>12.8</u> (df =2)	<u>5.3</u> (df =1)	<u>9.1</u> (df =1)	<u>17.9</u> (df =2)
3. Occupation	<u>12.8</u> (df =2)	0.7 (df =1)	<u>6.8</u> (df =2)	<u>9.9</u> (df =2)
4. Income	<u>13.6</u> (df =2)	2.6 (df =2)	1.0 (df =4)	5.9 (df =4)
5. Awareness	<u>12.6</u> (df =2)	1.0 (df =1)	<u>9.7</u> (df =2)	<u>11.4</u> (df =2)

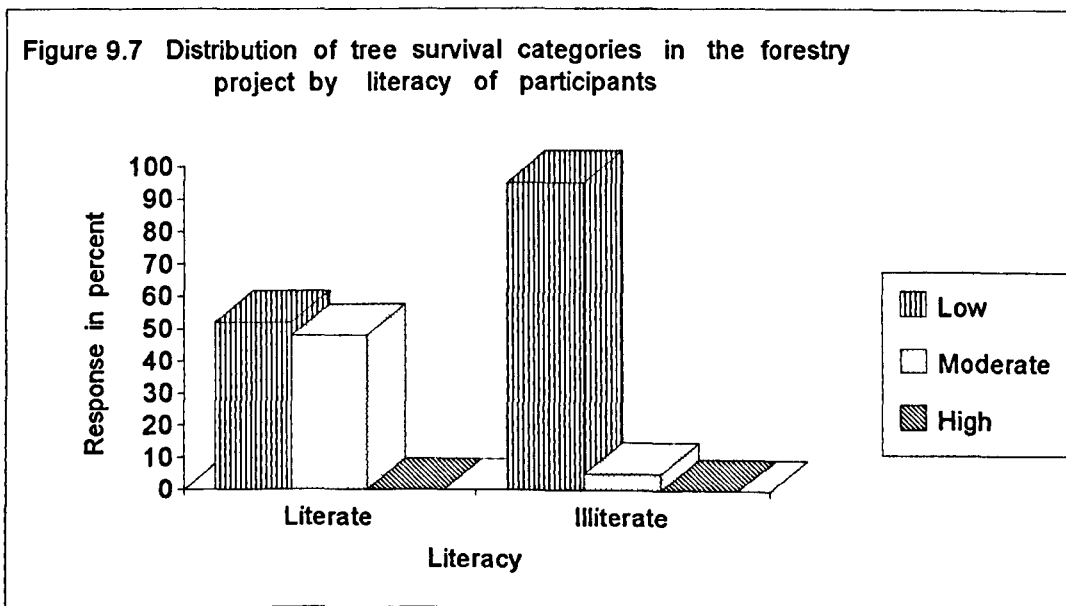
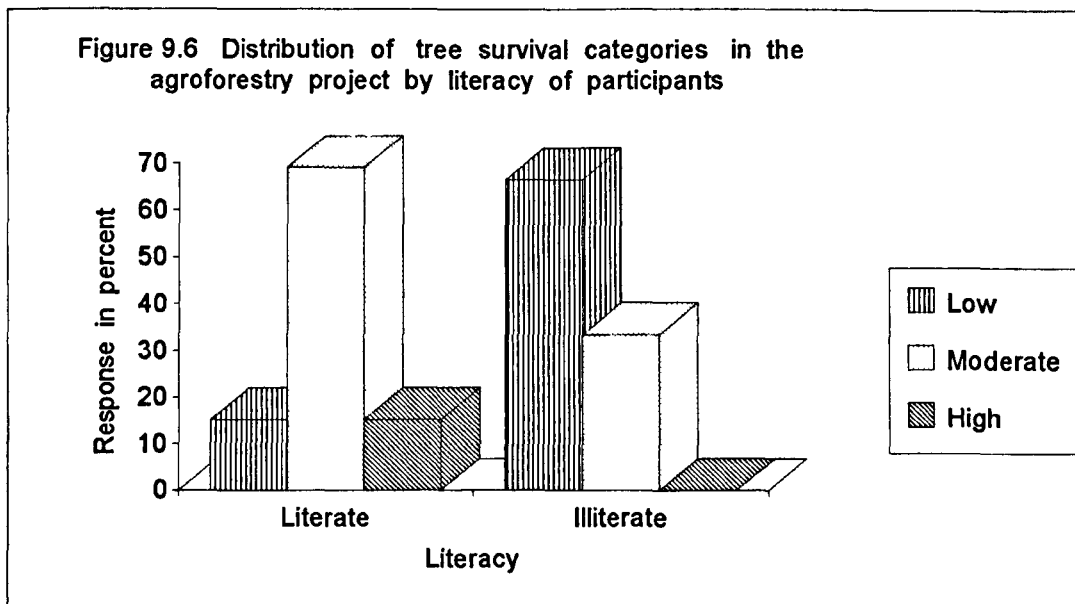
Note: df\* is the degree of freedom, underline values denote the significant values at at least .05 level

**Table 9.3 Computed chi-square ( $X^2$ ) values for socio-economic factors within and between zones in the forestry project.**

Socio-economic factors	$X^2$ value within zone			$X^2$ value between zone
	Northern	Central	Coastal	
1. Caste	<u>20.0</u> (df =2)	<u>9.3</u> (df =2)	<u>5.8</u> (df =2)	<u>8.7</u> (df =2)
2. Literacy	<u>14.0</u> (df =1)	<u>5.7</u> (df =1)	<u>4.6</u> (df =1)	<u>17.6</u> (df =2)
3. Occupation	<u>10.6</u> (df =1)	<u>7.2</u> (df =1)	<u>17.5</u> (df =1)	<u>35.3</u> (df =2)
4. Income	<u>7.1</u> (df =1)	0.7 (df =1)	0.4 (df =1)	<u>7.5</u> (df =2)
5. Awareness	<u>10.1</u> (df =1)	0.1 (df =1)	<u>13.3</u> (df =1)	<u>5.0</u> (df =1)

Note: df\* is the degree of freedom, underline values denote the significant values at at least .05 level

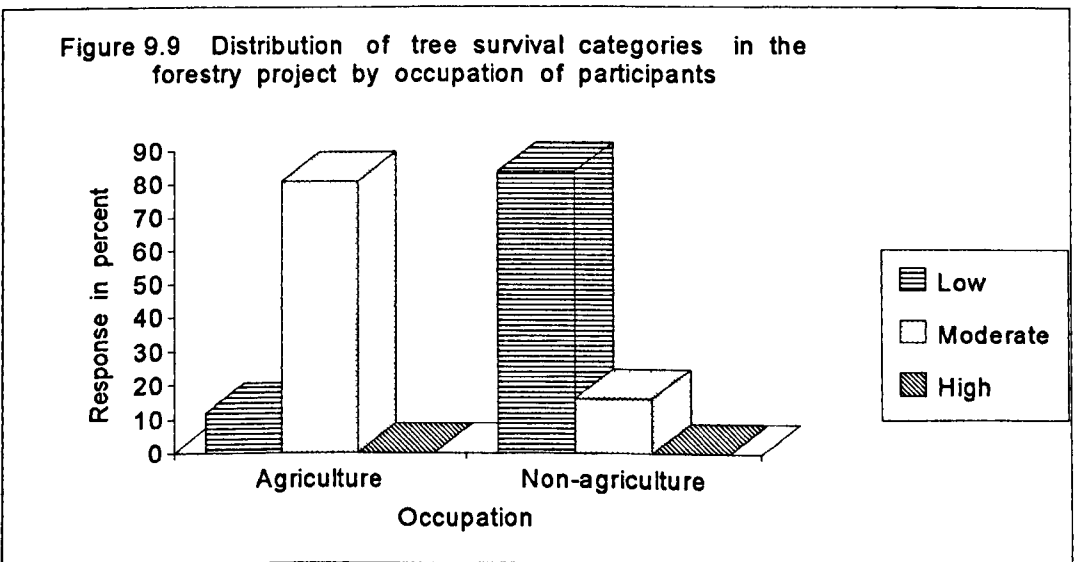
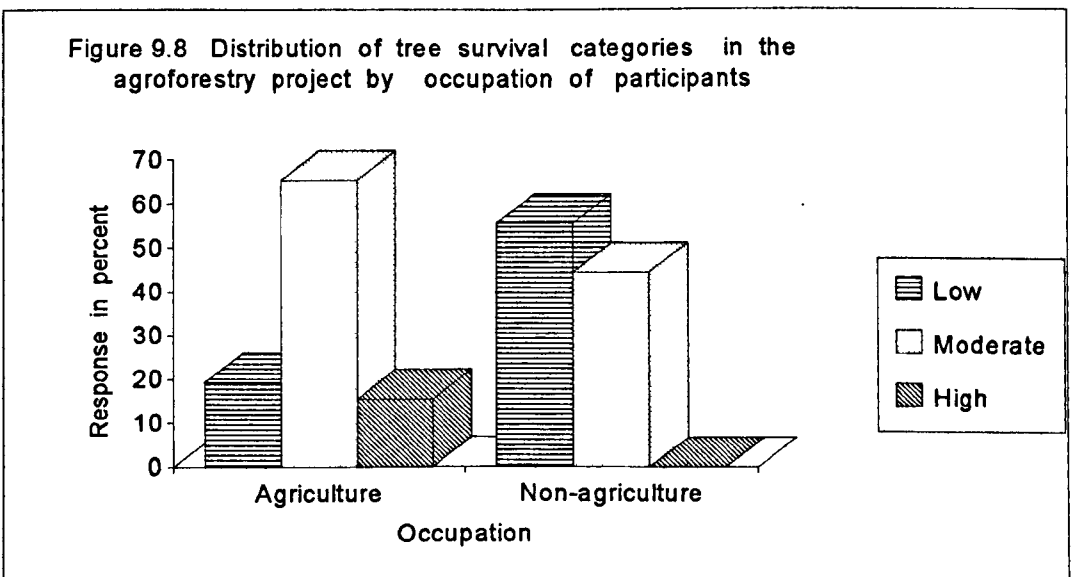
Like the variation in survival percentage with variation in the caste group of participants, an apparent variation in survival percentage with the literacy of the participants was also observed for both Orissa as a whole and within zone in both agroforestry and forestry as shown below in Figures 9.6 and 9.7 respectively.



These show that high and moderate survival rates were most common with the literate category whereas low survival was most frequent for illiterate participants.

Apparent variation in survival percentages of trees with literacy were found to be significant overall and within zone at 0.01 level in both agroforestry and forestry as shown in Tables 9.2 and 9.3.

In Chapter 6 it was reported that agricultural labouring was the main source of livelihood for nearly two thirds of the participants. A distinct variation in occupation was apparent amongst the participants in the different zones. Figures 9.8 and 9.9 below present the responses with regard to the survival percentages of trees and the occupation of the participants in agroforestry and forestry projects respectively.



The same pattern emerges with the previous tree variables. Survival tended to be much higher amongst those working in agriculture than those working elsewhere for both agroforestry and forestry. Again the variation in survival percentages of trees between occupations of participants were found statistically significant overall and within zone at 0.01 level as presented in Tables 9.2 and 9.3.

During the analysis of the questionnaire survey (in Chapter 6), it was seen that the income of the participants varied from a minimum of Rs. 500 to a maximum of Rs. 1500. The participants therefore, were classified into three income groups: a lower income group (monthly income ranging from Rs. (0 - 500), (b) a middle income group (Rs. 500-1000) and (c) an upper income group (Rs. 1000-1500).

The distribution of the survival percentages of trees according to the income of participants is shown below in Figures 9.10 and 9.11 for agroforestry and forestry respectively. These reveal that the proportion of the high survival rate was highest in lower income group, whereas for middle and upper income group survival tended to be low.

Variation in survival by income categories of participants was also found to be statistically significant particularly between zones in both agroforestry and forestry.

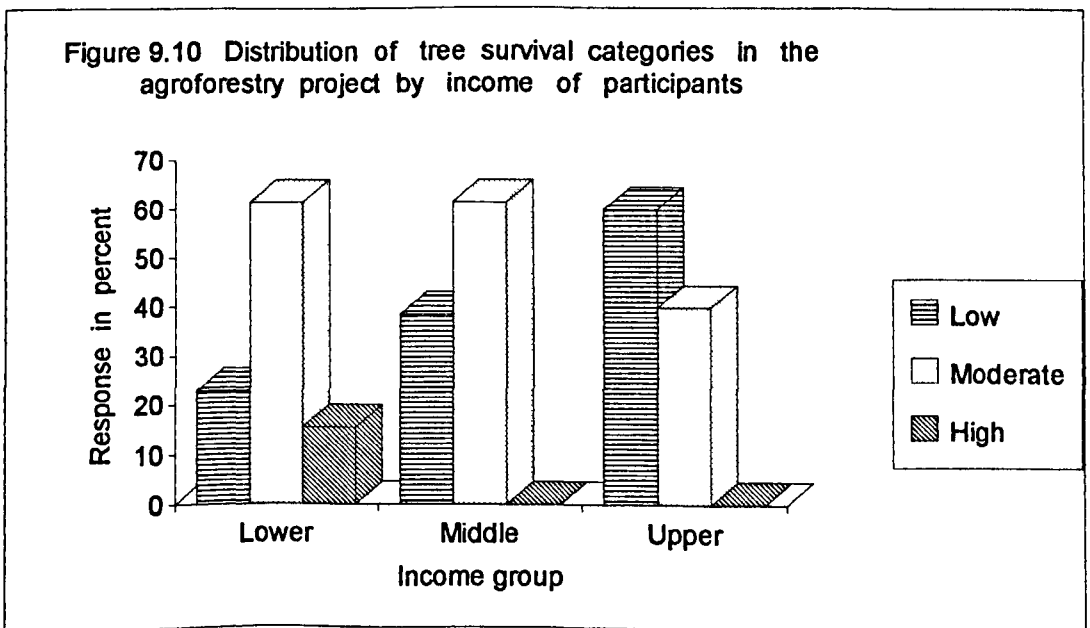
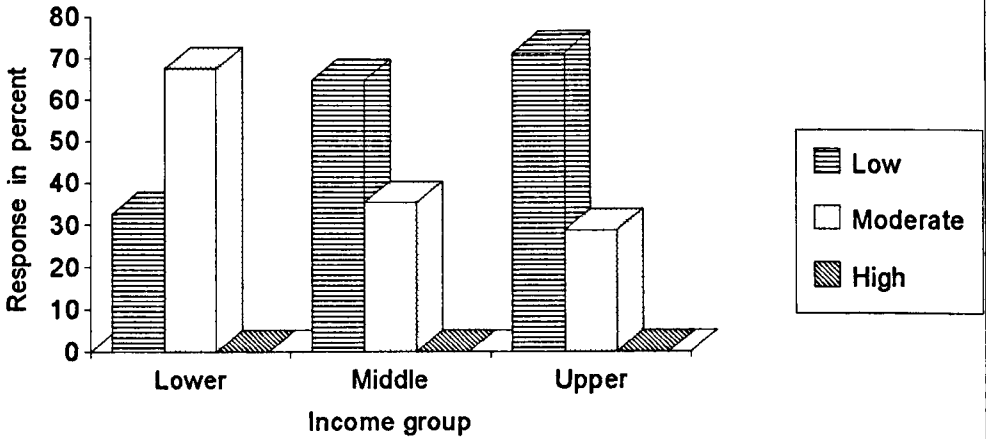




Figure 9.11 Distribution of tree survival categories in the forestry project by income of participants



As seen in Chapter 6, nearly two thirds of the participants were aware of the rights and obligations of the FFRP from the beginning of the project. However survival did seem to vary with awareness amongst the participants. A summary of the responses presented below in Figures 9.12 and 9.13 for agroforestry and forestry respectively shows that those aware about rights and obligations of FFRP enjoyed higher survival rates in comparison to those who did not show awareness.

Figure 9.12 Distribution of tree survival categories in the agroforestry project by knowledge and awareness of participants

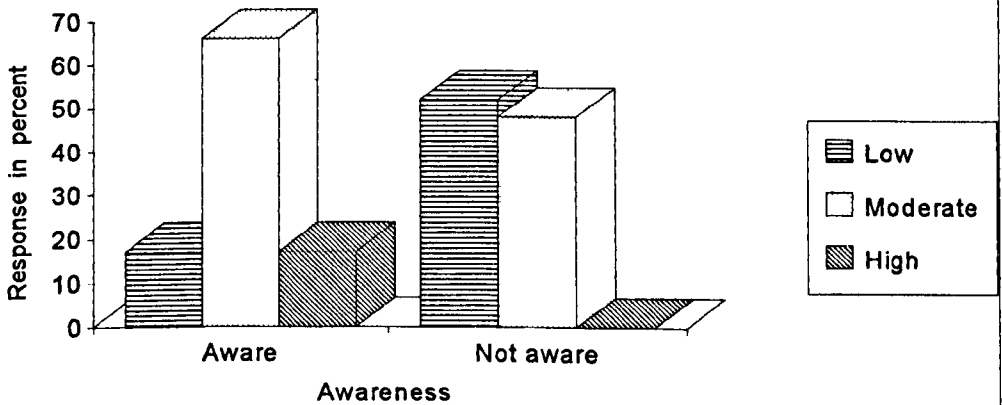
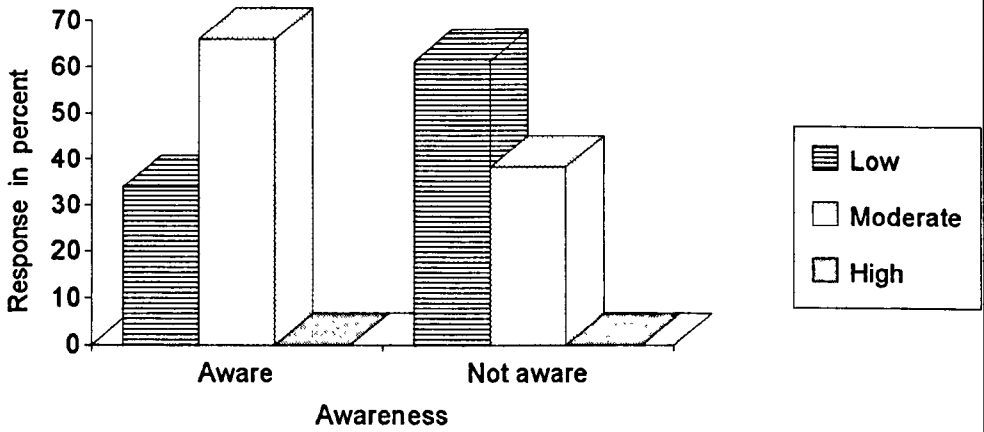


Figure 9.13 Distribution of tree survival categories in the forestry project by knowledge and awareness of participants



The apparent relationship between survival percentage of trees and knowledge and awareness of the participants was found statistically significant at 0.01 level in both agroforestry and forestry as shown in Tables 9.2 and 9.3.

Going through the overall results of the survival percentage of trees and the socio-economic profiles of the participants it can be concluded that there is a significant relationship between survival percentage of trees and caste, literacy, occupation, income and awareness of the participants and between the agro-ecological zones in both agroforestry and forestry.

Higher survival tends to be linked to scheduled tribes having higher literacy and agricultural labouring as the main occupation with low income and high awareness about the project. Hence the profitability of an individual agroforestry and forestry plot with similar externally fixed inputs appears to be determined (to some extent) thus:

$$\pi = f(S_t) = f(A, C, L, O, E, K) \quad (9.14)$$

where **C** is the caste group of the participants;

**L** is the literacy of the participants;

**O** is the occupation of the participant;

**E** is the economic condition of the participants and

**K** is the knowledge and awareness of the participants.

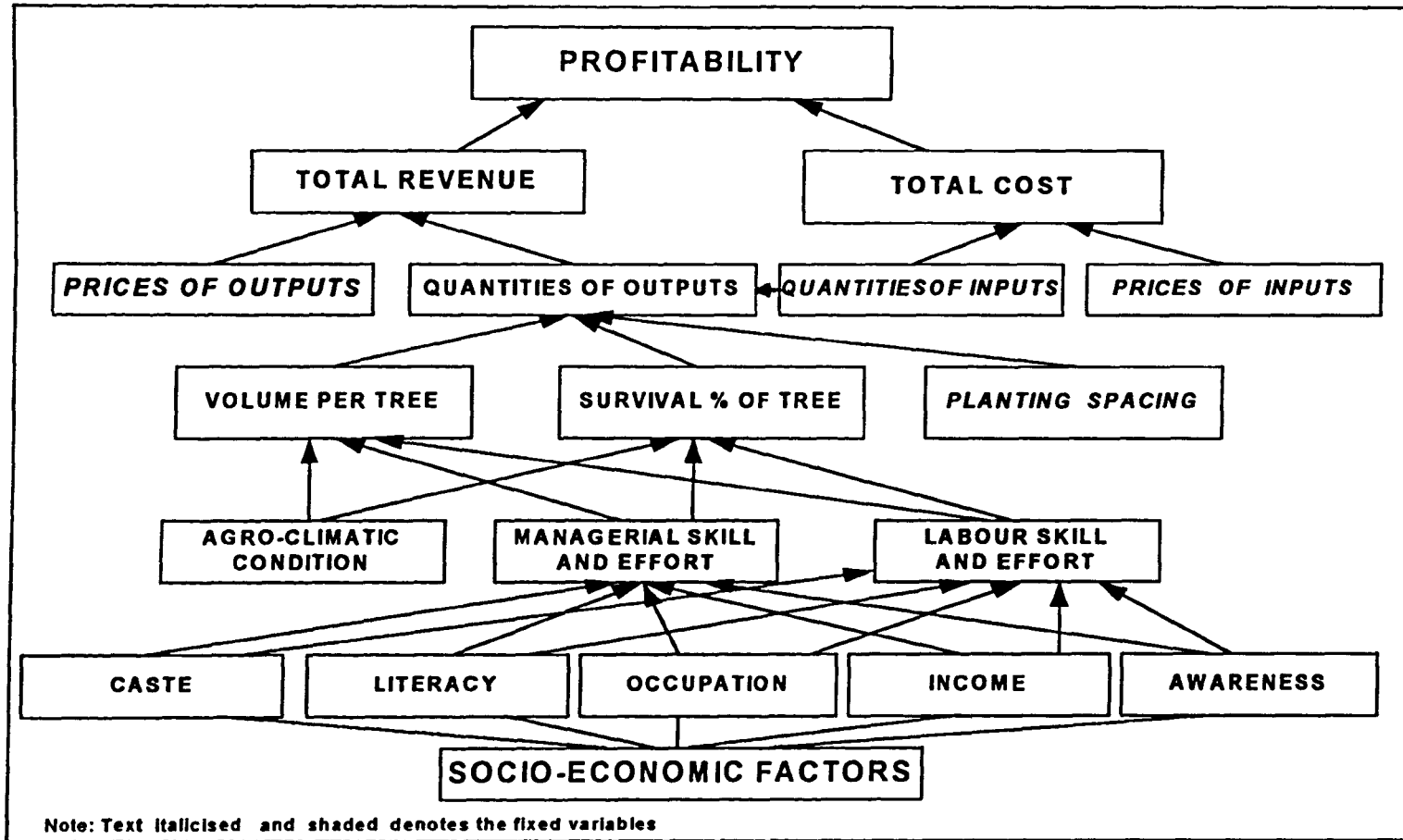
The above interaction of the agro-climatic and socio-economic factors determining project profitability can be shown through the flow diagram presented below in Figure 9.14.

## **Summary**

Based on the variation in the results of the financial and basic needs evaluations between zones and within zones (financial profitability), an attempt was made in this chapter to find the possible factors of variation in profitability in a zone with similar external factors such as technical, agro-climatic and policy package of a project. The factors other than these external factors have been outlined theoretically and then have been tested with the help of the responses gathered through the questionnaire survey. It has been found that survival is the main determinant of profitability and this in turn is determined (at some extent) by socio-economic factors such as caste, literacy, occupation, income and awareness of the participants involved in the projects.

The next and the last chapter concludes the present study after discussing its wider role, realities, possibilities and implications with regard to the methodology applied and results achieved in land use evaluation and also point a way forward for further improvement.

Figure 9.14 A flow diagram showing the socio-economic factors determining the profitability in plantation forestry.



## **Chapter 10**

### **Discussion, Conclusions and Suggestions for Improvement**

This chapter does not attempt to recapitulate the detailed analyses carried out in previous chapters because such details have already been discussed. Rather, an attempt is made here to discuss the wider role, realities, possibilities and implications of the methodologies applied and results achieved in the evaluation of land use projects in general and the agroforestry, forestry and agriculture projects in Orissa in particular. This is important because not only will it give scope for a critique of methodology but it will also point a way forward for its further refinement. Furthermore, points arising from the evaluation results can assist in the formulation and evaluation of future land use projects.

This chapter therefore concentrates on the following two aspects:

- a. A critical analysis of the refinement made in basic needs evaluation methodology together with suggestions for further refinement.
- b. A critical analysis of the results of the evaluation and suggestions made therein for further consideration in the formulation of and decision making in future land use projects.

#### **10.1 Discussion**

##### **10.1.1 A Critical analysis of the refinements made in the methodology for basic needs evaluation**

Physiographical, socio-economic and land use problems in India in general and Orissa in particular have provided the background for this study. Chapter 1 indicated that the earlier development planning (from 1951-1979) in India adopted a growth oriented strategy of economic development. As a result, issues such as an alleviation of poverty, unemployment and equitable income distribution were treated as secondary. This was due to the unrealistic assumptions that rapid economic development would ensure poverty mitigation through "trickle down" effects (Hicks and Streeten, 1979). In fact, according to Lal (1989) the capital intensive industrialization on which the growth strategy was based has led to the increased unemployment and underemployment resulting in chronic poverty.

Later decades of planning (1980 onwards) saw the gradual shift from a capital-oriented approach to a beneficiary based approach to economic development. Thus, social development was integrated with economic development to tackle directly the problems of poverty, unemployment and disparities in income distribution. Social forestry projects have been important initiatives aimed mainly at meeting the basic needs fulfilment of the rural poor, utilizing surplus degraded land, as well as labour resources.

To assess the impact of such projects in terms of basic needs fulfilment, a suitable analytical framework is essential. The use of conventional cost-benefit techniques to choose investment alternatives fails to tackle these issues. This is primarily due to the fact that the existing CBA is based on the growth strategy or its variant (Chapters 3 and 4). When a basic needs strategy is adopted, the choice of project should be based on their contribution towards the fulfilment of basic needs. Nair's (1981) basic needs approach provides a suitable framework for analyzing the impact of the project in terms of its ability to fulfil basic needs.

Like other analytical techniques, the strength and reliability of basic needs analysis depends on the validity of the underlying assumptions. Thus it is important to make reasonable assumptions based on as much factual information as possible. The methodology employed in the present study is based on Nair's approach. However, the refinements made in using the actual field information to improve the usefulness of the approach can be regarded as an innovative contribution of this study.

#### **10.1.1.1 Applicability of the methodology**

The two stage weighting outlined in the methodology makes the approach extremely flexible. At the first stage of weighting the production of basic needs goods and generation of basic needs income are taken into account by the social valuation of goods in terms of basic needs fulfilment. Thus non-basic goods and non-basic income are excluded. At the second stage of weighting, relative priority is given either to a goods balance sheet or an income balance sheet. This allows the decision maker to evaluate alternatives after deciding what relative weights he should put to the aggregate of basic needs value of goods against the aggregate of the basic needs value of income. In an open economy, which is usually not common in a developing country (Sharma, 1990), money can easily be converted into desired goods, the project choice is made directly on the basis of the income effect and thus zero weight is given to goods balance sheet. Conversely in a closed or less open economy which usually exists in the developing

countries where the basic needs goods supply is limited, project choice takes into account the goods effect also. Thus the choice of product mix, an aspect completely neglected in conventional approaches, is also taken into account. In the light of the above approach taken here, some the improvements and shortcomings of the methodology are discussed as follows.

### **10.1.1.2 Estimation of parameters**

As discussed in the foregoing section the reliability of conclusions from basic needs analysis largely depends on the assumptions made in estimation of the various parameters. The margin of error can be reduced considerably if assumptions are based on primary as opposed to secondary data.

#### **10.1.1.2.1 Identification of basic needs goods and estimation of basic needs income**

A pre-requisite for the application of Nair's methodology is the identification of basic needs goods and basic needs income (see Appendix 8.1). Although Nair did not identify the basic needs goods himself, an attempt in the present study has been made to identify these aspects through a household survey of 210 landless rural poor. Estimation of basic needs income, including the items from the monetised as well as the non-monetised sectors, has been made with further adjustment in line with the national physiological recommendations used in estimation of basic needs income. This procedure can now be applied to other regions of India or even other developing countries.

#### **10.1.1.2.2 Estimation of basic needs conversion factor (BNCF)**

The value of the BNCF of an input is estimated by knowing the proportion of inputs actually utilized in the fulfilment of basic needs. The value of the BNCF of output is estimated on the basis of how it is finally used after harvesting. In the present study attempts have been made to determine as precisely as possible what the actual end uses of the outputs were. Nevertheless, in some cases, particularly for the forestry components only a few stands were harvested. This means therefore that the BNCF for the timber components had to be estimated on the basis of a limited amount of primary data and a more comprehensive secondary data coverage of intended use based on information provided by the forestry department and various forestry associated companies involved in

timber purchasing and conversion. These statements describe how end uses of eucalyptus were foreseen at this current time. Such a procedure, whilst pragmatic, can nevertheless be criticized on two grounds.

Firstly, the current pattern of utilization rather than the actual end use pattern may not be relevant in case of projects with a long time horizon because this may change. Secondly, the BNCF has to be derived on the basis of the allocation of the marginal unit of production between different uses. This is a complicated exercise for which a refined and simplified technique is needed to disaggregate the value of goods or factors of production according to their distribution amongst the various income classes. The basic needs component can then be estimated more accurately.

#### **10.1.1.2.3 Estimation of social cost**

The social cost has been estimated in terms of the production of basic needs goods forgone and generation of basic needs income forgone. The methods of opportunity cost estimation involve a number of simplifying assumptions. The investment effects have not been considered on the assumption that the basic needs households consumed all income.

However, an attempt in the present study has been made to estimate the social cost of degraded land and labour employed in the projects, based on the primary data, which can be applied for similar conditions elsewhere.

#### **10.1.1.2.4 Estimation of basic needs income**

Basic needs income generated from inputs is estimated by disaggregating them into various components. Further, the incomes accruing to the local (or domestic) factors of production are identified and distributed among the different income groups. The income accruing to group 1 (the basic needs group) households is considered as basic needs income. This is a cumbersome process and without a ready made input-output table and an available analysis of the sectoral and group distribution of value added, the analysis would not have been possible. Due to the non-availability of an updated input-output table, an input-output table prepared during the seventies has been used in the present study with updating using further information. This information included for example, firstly the percentage share and allocation of funds in value added and material inputs on imported and locally made goods in manufacture of fertilizers, insecticides, polythene bags



and vehicles and secondly the distribution of payment on local inputs amongst the different income groups of the society.

The use of 0 and 1 as distributional weights, where any income exceeding basic needs income is given a social weight of zero, could be another aspect open to criticism. This is because the basic needs analysis sees the society divided essentially into two classes - those that are above the basic needs income level and those that are below. It is suitable for a country where income disparity is sharp enough to permit the division of society into privileged and unprivileged groups. The fact is however, that in reality, society does not consist of two clear-cut groups; rather there is a continuous spectrum from the lowest income group to the highest income group, and many above the basic needs income level can still be regarded as poor. Thus there is a disparity even between those who are above and those below the basic needs income level. Project benefits accruing to all groups need therefore to be weighted relatively.

#### **10.1.1.2.5 Estimation of aggregation weight**

The aggregation weights for the net goods effect and net income effect have been estimated on the basis of the supply and demand of basic needs goods and generation and requirement of basic needs income (as seen in Chapter 8). However, this process did not consider the possibility of changes over the life time of the projects due to the length of the project life. The process requires modification to consider different weights at different times, although in this study the weights would not be likely to change drastically over the project life and as the sensitivity analysis indicated, would not drastically alter the results. Apart from the above parameters, the following aspects are also open to criticism.

Price changes due to increased production have not been taken into account on the assumption that projects have only a marginal effect on the supply of goods. But the output changes may alter the relative prices and thus this needs more detailed study.

In spite of the above weaknesses the refinements made in Nair's methodology particularly in the identification of basic needs goods and the estimation of BNCF, aggregation weights and social costs of land and labour are some of the important contributions to this study. The improvement made in the approach can be useful in applying to another region or country where either the government or the international aid agencies consider the fulfilment of basic needs as an objective of the project. It is important however, to mention that a country with a weak data base may have problems in

deriving the various parameters. What is needed is to gather the disaggregated information through increased effort although this must be balanced against the costs of gathering such data. Obviously further refinements are required to improve the reliability and usefulness of the approach.

### **10.1.2 A critical analysis of the results of the land use evaluation**

Like Orissa, a large chunk of lands in other states of India and even in many developing countries have been in continuous degradation. This is mainly due to over use without any proper management and protection. The people derive a number of benefits without feeling any responsibility towards the regeneration of these lands.

In response to this, respective governments have taken up large scale social forestry projects with a primary objective of meeting the basic needs of the rural poor through the rehabilitation of these lands. In the past 15-20 years, although a vast amount of funds has been diverted for such projects, most of the evaluations have been carried out with little field level data and have relied very much upon estimates of the likely costs and benefits involved. These evaluations typically have also not considered the aspect of basic needs fulfilment. The evaluations in the present study are based on the actual details of 210 participants from three land use projects of Orissa including the aspects of basic needs fulfilment. Furthermore, the quantification and valuation of intermediate and final products from forestry represent another attempt to make the benefits estimates more reliable for carrying out the analyses. Because of its more realistic approach, this study should find some direct relevance and usefulness to many other parts of India as well as other developing countries.

#### **10.1.2.1 Summary of results obtained**

A discussion of the results of financial and basic needs evaluation has been given in respective chapters. To sum up, the financial evaluation of 210 plots of the three projects suggests that the degraded land diverted for the projects is able to produce the quantities of goods which are sufficient to make the projects viable even at a 15% discount rate, with the exception of the plots which were completely washed out. Overall, the projects have shown a positive financial impact across all the three agro-ecological zones with agroforestry ranking first followed by forestry with agriculture lagging some way behind. Amongst the agro-ecological zones, the Northern Zone ranks highest in terms of performance and the Central Zone at the bottom in agroforestry and forestry projects

whereas in agriculture, the Central Zone ranks at the top and the Coastal Zone at the bottom.

The reasons for variations in profitability between zones and projects have been discussed in Chapter 7. It is clear from the discussion that the gap in the net profitability between agroforestry and forestry is lower than agroforestry and agriculture. The slightly higher profitability in agroforestry in comparison to forestry has been seen mainly to be due to the higher revenue generated from the higher proportion of trees surviving, higher growth of trees and the additional income from agricultural crops. Substantially lower profitability in agriculture in comparison to agroforestry and forestry is due to the absence of tree components and the poor yield of agricultural crops due to the waste and degraded land being particularly unfit for agricultural production.

The zonal variation in profitability seems to be due to the variation in agro-climatic as well as socio-economic factors. The Northern Zone has shown best performance due to favorable agro-climatic and socio-economic conditions.

Taking a broader view of the overall impact of the projects in terms of basic needs fulfilment, the ranking of projects remains unchanged when compared to financial NPV's, although relative levels do change. In terms of basic needs fulfilment both agroforestry and forestry, especially in the Northern Zone, appear to meet a substantial proportion of the household basic requirements since this is additional to the basic needs level of the without situation. However, given that the basic needs level is a minimum and, if the household is solely dependent on the project for its livelihood, then even the agroforestry and forestry projects are not having a revolutionary effect on basic needs provisions only providing a relatively small proportion of basic needs. As far as agriculture is concerned, only a minimal extra proportion of basic needs are met, so this project can be deemed to be barely worthwhile in the case of degraded land of Orissa on basic needs generation criteria. On better land, this conclusion is likely to be different.

Nevertheless, the measure of basic needs fulfilment, the net annual basic needs impact is positive throughout. This suggests that all projects have brought about an improvement in the fulfilment of basic needs when compared to a situation without the project.

Discussion in Chapter 9 concludes that the survival percentage of trees is the major determinant of profitability within the agroforestry and forestry projects. It was also seen

that there was a significant relationship between survival percentage of trees and socio-economic factors such as caste, literacy, occupation, income and awareness. Hence the profitability of an individual plot with similar externally fixed inputs appears to be determined, to some extent, by

$$\pi = f(S_t) = f(A, C, L, O, E, K)$$

where  $\pi$  is the net profitability expressed in NPV;

$S_t$  is the survival percentage of trees;

A is the agro-climatic factors;

C is the caste group of the participants;

L is the literacy of the participants;

O is the occupation of the participant;

E is the economic condition of the participants and

K is the knowledge and awareness of the participants.

## 10.2 Conclusions

Cost-benefit analysis, although used widely in evaluation of land use projects (as seen in Chapters 3 and 4) has not been found suitable to evaluate a project which aims to achieve basic needs fulfilment as a primary objective. An alternative technique which can incorporate not only basic needs fulfilment, but also product and factor mix, is needed to analyse the projects with an objective directed at addressing a basic needs strategy.

The reliability of the results of basic needs analysis like other analysis depends on the reliability of the assumptions made in the estimation of the various parameters required for analysis. Therefore it is essential to make assumptions which are plausible and can be verified empirically. This means it is important to make assumptions based on as much factual information as possible. Nair's basic needs analysis, although an important contribution, can be criticized in this context. The current study, in making modifications to this methodology, has made a number of important improvements. These have been discussed in more detail earlier but in summary are :

- a. An identification of basic needs goods through a household survey and
  - i quantification and valuation of non-food items, and
  - ii quantification and valuation of items obtained from non-monetised sector.

- b. An estimation of basic needs income based on field data and its adjustment in line with the national recommendation
- c. An estimation of BNCF, for social valuation of goods and income, based on the primary information collected.
- d. An estimation of social costs of resources, based on the primary information, particularly for
  - i. degraded land and
  - ii. labour employed in the projects.
- e. An estimation of aggregation weights for goods balance sheet and income balance sheet based on the primary information.

Although the financial cost-benefit analysis and basic needs analysis involve differing methodologies, their results in this context give rise to a similar pattern of relative rankings of performance. Thus, when alternatives projects are likely to be similar in terms of participants and effects, CBA would give an acceptable first approximation of the likely magnitude of the basic needs value (BNV), although a high discount rate could make a favorable basic needs project have a negative NPV. Results however, would be expected to diverge where land use alternatives address different categories of beneficiaries.

As regards the evaluation of land use projects undertaken, the general conclusion is that the agroforestry design is the best project in terms of both financial profitability and basic needs fulfilment. Forestry could compete with agroforestry if the survival percentage of trees were to be increased to the level of the agroforestry project. Agriculture seems to be barely profitable in comparison to either agroforestry or forestry, mainly due to low productivity on poor and degraded soil. To increase the profitability of agriculture it would be necessary to take suitable measures to reclaim the soil which in any event would probably involve the introduction of trees.

This is important to remember that only one agroforestry and forestry design in terms of planting spacing has been evaluated in this study. Altering design to influence the financial profile of returns through time can be achieved in two ways. Firstly by respacing the trees to alter the physical environment allowing agricultural returns to be extended in time beyond the current three years period. Secondly by introducing perennial crops which utilize the environment from the existing design more productively e.g.

shade tolerant crops. Determining the most suitable design on an *ex ante* basis is difficult in the absence of technical data describing the productivity of the various components at alternative spacing.

There are wider socio-economic implications which also emanate from system design. The current design gives a relatively large lumpsum of cash at the end of the rotation (as seen in Chapter 7). Very poor people therefore suddenly become very rich albeit for a short period of time. In a country such as India with its highly structured caste system such socio-economic outputs can give rise to social friction amongst village communities. A more constant flows of benefits albeit at a lower annual level may be less divisive especially if basic needs fulfilment is a key objective.

The performance of a participant's plot is influenced not only by the agro-ecological zones, technological and policy packages, but also by relevant socio-economic aspects of the environment in which the project is implemented. Within the same agro-ecological zone, a given package of land use practices may be adopted at different rates and practised with different intensity due mainly to a differing socio-economic profile of the participants. The reasons for such variation have been discussed in Chapter 9.

### **10.3 Suggestions**

Despite the shortcomings discussed in this chapter the methodology refined for basic needs evaluation and applied in the present study can be applied in the other regions of India or elsewhere where basic needs fulfilment is a declared objectives of intervention. Specific field data would need to be collected in each case.

As far as the projects themselves are concerned, in addition to external factors such as technical, agro-climatic and policy issues, the socio-economic factors (as mentioned above) should also be incorporated into the design and planning and execution of such beneficiary oriented land use projects.

Identification, interpretation and incorporation of socio-economic variables affecting the profitability are important not only in designing land use projects for a particular region, but also in their successful implementation. The factors indicated as determinants of survival suggest that, to enhance the impact of a project, certain socio-economic factors are important such as literacy, profession, income and knowledge and awareness.

On part of the government or project agencies therefore, it is necessary to explore all possible methods to educate and motivate the project's participants towards the benefits of the project. This may be achieved by strengthening the existing infrastructure for both educating and creating awareness and increasing physical skills amongst the participants. There is therefore a need for further study of the mechanism of the relationship between the project performance and the socio-economic factors identified.

Although the agroforestry project appeared to be the best of the three in terms of both financial profitability and basic needs fulfilment, technical improvement to the design and husbandry of the system may well be possible thus improving the efficiency of the policy instrument at the beneficiary level. In particular, more work is needed at a technical level in collecting bio-physical data describing both the tree and understorey productivity at a range of alternative spacings. This will enable *ex-ante* bio-economic modelling exercises of alternative designs to be undertaken. It will also enable the socio-economic implications in terms of cash flow levels and temporal cash flow profiles of alternative designs to be properly understood as far as the needs of the intended or actual beneficiaries are concerned. The indications are that the suitability of the current design varies amongst existing beneficiaries. There were for example a number of cases of participants already adapting the system design to meet their particular requirements by incorporating understorey components which utilize the vertical and horizontal space in different ways. These included the horticultural crops with climbing habits such as yam (*Dioscorea alata*) and perennial fruit crops such as jackfruit (*Artocarpus heterophyllus*) and mango (*Mangifera indica*).

Similarly there are also indications that the current arrangements for financial payments to beneficiaries could also be improved in terms of their impact on the physical performance of the system. For example Chapter 9 has clearly indicated that tree survival is a key factor in explaining the variation in the profitability of the system between beneficiaries. The author's own personal experience of working for a period of nine years in the field of forestry plantation, management and administration in Orissa suggests that an emphasis on the protection of plantations and therefore improved survival, could be achieved by extending the period over which maintenance payments are made to at least five years. This would also enhance the interest and enthusiasm of the participants towards the project.

The study has only focused on the financial and social aspects of the performance of the various projects in each of the regions surveyed. It has not taken into account in

terms of quantification, the various less tangible but nevertheless important environmental impacts arising from the projects in their respective areas. Certainly further detailed study of these impacts could serve to complement the findings of this thesis.

Finally, funds and time are always constraints for such studies. There is nevertheless scope for further refinements (some of which have been illustrated in this chapter) of the basic needs evaluation applied in this study. It is hoped that these thoughts will provide incentives for future researchers to take up from where this study has finished.



## **ANNEXURES**

**Annexure 5.1 Format for gathering annual physical input data from the agroforestry, forestry and agriculture projects.**

Zone		District		Village		Participant		Plot no.		Area	
Input components	Units	Annual physical requirements of inputs									
		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
		Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
<b>[A] Agricultural crops</b>											
1. Land											
2. Labour	Man days										
i. Site preparation	Man days										
ii. Sowing /planting	Man days										
iii. Weeding	Man days										
iv. Fertilisers/ insecticides application	Man days										
v. Harvesting	Man days										
vi. Processing	Man days										
<b>Total (labour)</b>											
<b>3. Material</b>											
i. Seed	Kgs										
ii. Manures and fertilisers	Kgs.										
iii. Insecticides	Kgs										
iv. Tools and implement	LS										
<b>Total (material)</b>											
<b>Total agriculture cost</b>											
<b>[B] Forestry crops</b>											
1. Labour											
i. Site preparation	Man days										
ii. Seed/ Nursery raising	Man days										
iii. Planting	Man days										
iv. Weeding	Man days										
v. Fertilisers/ insecticides application	Man days										
vi. Pruning/ thinning	Man days										
<b>Total (labour)</b>											
<b>2. Material</b>											
i. Manures/fertilisers	Man days										
ii. Insecticides	Man days										
iii. Tools and implement	LS										
<b>Total (materials)</b>											
<b>Total (forestry)</b>											
<b>Total (agroforestry)</b>											

Q is the physical quantity of input, LS is the lumpsum amount spent on tools and implement

**Annexure 5.2 Format for gathering annual physical output data from the agroforestry, forestry and agriculture projects.**

Zone-----District-----Village-----Participant-----Plot no.-----Area-----											
Output components	Units	Annual physical quantities of outputs									
		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
		Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
<b>[A] Agricultural crops</b>											
i. Paddy											
ii. Maize	Qt.										
iii. Red gram	Qt.										
iv. Black gram	Qt.										
v. Horse gram	Qt.										
vi. Ground nut	Qt.										
vii. Niger	Qt.										
viii. Sesamum	Qt.										
ix. Pine apple	Qt.										
x. Others (specify, if any)	Qt.										
<b>Total (agriculture)</b>											
<b>[B] Forestry outputs</b>											
<b>a. Intermediate products</b>											
i. Dry leaves	Qt.										
ii. Twigs/ branches	Qt.										
iii. Grasses	Qt.										
iv. Bamboo	number										
v. Poles/ logs etc.	number										
<b>b. Final products</b>											
i. Firewood/laps and tops	Qt.										
ii. Timber	Qt.										
<b>Total (forestry)</b>											
<b>Total (agroforestry)</b>											

Q is the physical quantities of outputs, Qt. is quintal (1 quintal is equal to 100kgs.)

**Annexure 5.3 Format for gathering growth data from the agroforestry and forestry projects.**

Zone_____District_____beneficiary_____Plot-No._____Area_____Year_____						
Tree	Agroforestry			Forestry		
No.	Survival %	Top Ht. (m)	Dbh (cm)	Survival %	Top Ht. (m)	Dbh (cm)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

**Note: Dbh is diameter at breast height ( i.e 1.37 meters)**

Annexure 6.1 The frequency of the actual beneficiaries responses to various questions in the questionnaire survey); question nos.1 to 12 (except\* 1, 7, 8 and 9).

Category			N	Q.no. 2			Q.no. 3			Q.no. 4			Q.no. 5			Q.no. 6			Q.no. 10					Q.no. 11				Q. no. 12					
zone	Projects	Survival category		Options			Options			Options			Options			Options			Options					Options				Options					
				1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	5	1	2	3	4	1	2	3	4	5				
1.Northern	a. AF**	Low	2	2	0	0	0	2	1	2	0	2	1	0	1	1	2	0	0	2	0	0	0	0	0	1	0	1	0	0	0		
		Moderate	13	0	13	0	12	1	12	1	0	3	10	12	1	0	1	12	0	0	0	0	12	0	1	0	0	0	12	0	1		
		High	5	0	5	0	5	0	5	0	0	1	4	5	0	0	0	5	0	0	0	0	5	0	0	0	0	0	5	0	0		
	Total		20	2	18	0	17	3	17	3	1	4	15	18	2	0	1	19	0	0	0	19	0	1	0	1	0	18	0	1			
	b. F**	Low	3	3	0	0	0	3	0	3	0	3	1	1	1	1	2	0	0	3	0	0	0	0	3	0	0	0	1	0	2	0	0
		Moderate	17	0	16	1	16	1	15	2	4	11	16	1	0	0	17	0	0	0	17	0	0	0	16	0	1	0	0	0	16	0	1
High		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total		20	3	16	1	16	4	15	5	3	5	12	17	3	0	0	20	0	0	0	19	0	1	0	1	0	18	0	1	0	0		
c. AG**		20	1	19	0	16	4	16	4	2	4	14	15	4	1	0	19	1	0	0	19	0	1	0	0	0	0	0	0	0	0		
Total ( northern)			60	6	53	1	49	11	48	12	6	13	41	50	9	1	1	58	1	0	0	57	0	3	0	2	0	36	0	2	0		
2.Central	a. AF	Low	3	0	0	3	0	3	1	2	0	1	2	0	1	1	1	1	2	0	0	0	3	0	0	0	0	0	3	0	0	0	
		Moderate	17	4	11	2	12	5	10	7	3	5	9	12	4	1	0	17	0	0	0	16	0	1	0	0	0	16	0	1	0	1	
		High	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total		20	4	11	5	12	8	11	9	4	7	9	13	5	2	1	19	0	0	0	19	0	1	0	0	0	19	0	1	0	1	
	b. F	Low	11	2	9	0	4	7	1	10	1	2	8	5	4	2	0	10	1	0	0	10	0	1	0	0	0	0	9	0	2	0	
		Moderate	9	2	2	5	8	1	6	3	1	3	5	6	2	1	0	9	0	0	0	9	0	0	0	1	0	7	0	1	0		
High		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total		20	4	11	5	12	8	7	13	2	5	13	11	6	3	0	19	1	0	0	19	0	1	0	1	0	16	0	3	0	3		
c. AG		20	7	10	3	10	10	17	3	3	6	11	12	8	0	0	20	0	0	0	20	0	0	0	0	0	0	0	0	0	0		
Total ( central)			60	15	32	13	34	26	35	25	9	18	33	36	19	5	1	58	1	0	0	58	0	2	0	1	0	35	0	4	0	4	
3. Coastal	a. AF	Low	15	3	7	5	8	7	9	6	3	5	7	10	3	2	1	14	0	0	0	14	0	0	1	0	0	14	0	1	0	1	
		Moderate	12	2	9	1	12	0	12	0	1	3	8	8	3	1	0	12	0	0	0	12	0	0	0	1	0	11	0	0	0	0	
		High	3	1	2	0	3	0	3	0	0	0	3	3	0	0	0	3	0	0	0	3	0	0	0	0	0	3	0	0	0	0	
	Total		30	6	18	6	23	7	24	6	4	8	18	21	6	3	1	29	0	0	0	29	0	0	1	1	0	28	0	1	0	1	
	b. F	Low	17	6	8	3	12	5	4	13	4	6	7	9	5	3	0	16	1	0	0	16	0	1	0	0	0	16	0	1	0	1	
		Moderate	13	1	10	2	13	0	13	0	0	0	13	9	3	1	0	13	0	0	0	12	0	0	1	1	0	11	0	1	0	1	
High		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total		30	7	18	5	25	5	17	13	4	6	20	18	8	4	0	29	1	0	0	28	0	1	1	1	0	27	0	2	0	2		
c. AG		30	9	18	3	16	14	18	12	5	7	18	18	12	0	1	28	1	0	0	29	0	1	0	0	0	0	0	0	0	0		
Total ( coastal)			90	22	54	14	41	19	59	31	13	21	56	57	26	7	2	87	1	0	0	86	0	2	2	3	0	55	0	3	0	3	
Orissa ( average)			210	43	139	28	147	63	142	68	28	52	130	143	44	13	4	202	4	0	0	201	0	7	2	5	0	128	0	9	0	9	

Note : \* refers to the open ended questions of the questionnaire; \*\* refers to AF, F and AG i.e. the agroforestry, forestry and agriculture projects.

Source: Based on the questionnaire survey.

## Annexure 6.1 (contd.)

The frequency of the actual beneficiaries responses to various questions in the questionnaire survey);question nos. 13 to 22 (except\* 16 and 17).

Category			N	Q. no. 13					Q. no. 14					Q.no. 15				Q.no.18		Q.no. 19					Q. no. 20		Q. no. 21					Q. no. 22	
Zone	Projects	Survival category		Options		Options					Options				Options		Options					Options		Options					Options				
				1	2	1	2	3	4	5	1	2	3	4	1	2	1	2	3	4	5	1	2	1	2	3	4	5	1	2			
1.Northern	a. AF**	Low	2	1	1	1	1	0	0	0	2	0	0	0	2	0	2	0	0	0	0	1	1	1	0	1	0	0	0	0	2		
		Moderate	13	9	4	4	9	0	0	0	0	0	13	0	0	13	0	13	0	0	0	0	13	0	9	0	3	0	0	0	13		
		High	5	5	0	1	4	0	0	0	0	0	0	5	0	5	0	5	0	0	0	0	5	0	4	0	1	0	0	0	5		
	Total		20	15	5	6	14	0	0	0	2	13	5	0	20	0	20	0	0	0	0	19	1	14	0	5	0	0	0	20			
	b. F**	Low	3	2	1	1	2	0	0	0	3	0	0	0	3	0	3	0	0	0	0	2	1	2	0	1	0	0	0	3			
		Moderate	17	11	6	5	11	0	0	1	0	17	0	0	17	0	16	0	1	0	0	17	0	11	0	5	0	0	0	17			
High		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Total		20	13	7	6	13	0	0	1	3	17	0	0	20	0	19	0	1	0	0	19	1	13	0	6	0	0	0	20				
c. AG**		20	0	0	6	14	0	0	0	0	0	0	0	20	0	19	0	1	0	0	0	0	0	0	0	0	0	0	0				
Total (northern)			60	28	12	18	41	0	0	1	5	30	5	0	60	0	58	0	2	2	0	38	2	27	0	11	0	0	0	40			
2.Central	a. AF	Low	3	1	2	1	2	0	0	0	3	0	0	0	3	0	2	0	1	0	0	2	1	2	0	1	0	0	0	3			
		Moderate	17	11	6	5	11	0	0	1	0	17	0	0	17	0	16	0	1	0	0	16	1	10	0	5	0	0	0	17			
		High	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	Total		20	12	8	6	13	0	0	1	3	17	0	0	20	0	18	0	2	0	0	18	2	12	0	6	0	0	0	20			
	b. F	Low	11	7	4	3	7	1	0	0	11	0	0	0	11	0	10	0	1	0	0	10	1	5	0	2	0	0	0	11			
		Moderate	9	5	4	3	6	0	0	0	0	9	0	0	9	9	8	0	1	0	0	9	0	8	0	4	0	0	0	9			
High		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Total		20	12	8	6	13	1	0	0	11	9	0	0	20	0	18	0	2	0	0	19	1	13	0	6	0	0	0	20				
c. AG		20	0	0	7	11	1	0	1	0	0	0	0	20	0	18	0	2	0	0	0	0	0	0	0	0	0	0	0				
Total (central)			60	24	16	19	37	0	0	2	14	26	0	0	60	0	54	0	6	0	0	37	3	25	0	12	0	0	0	40			
3. Coastal	a. AF	Low	15	6	9	5	10	0	0	0	15	0	0	0	15	0	14	0	1	0	0	13	2	11	0	3	0	0	1	14			
		Moderate	12	11	1	4	8	0	0	0	0	12	0	0	12	0	11	0	1	0	0	12	0	9	0	2	0	0	0	12			
		High	3	3	0	1	2	0	0	0	0	0	3	0	3	0	3	0	0	0	0	3	0	3	0	0	0	0	0	3			
	Total		30	20	10	10	20	0	0	0	15	12	3	0	30	0	28	0	2	0	0	28	2	23	0	5	0	0	1	29			
	b. F	Low	17	6	11	5	12	0	0	0	17	0	0	0	17	0	15	0	2	0	0	15	2	12	0	3	0	0	0	17			
		Moderate	13	13	0	4	9	0	0	0	0	13	0	0	13	0	12	0	1	0	0	13	0	11	0	2	0	0	0	13			
High		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Total		30	19	10	9	21	0	0	0	17	13	0	0	30	0	27	0	3	0	0	28	2	23	0	5	0	0	0	30				
c. AG		30	0	0	7	23	0	0	0	0	0	0	0	30	0	27	0	3	0	0	0	0	0	0	0	0	0	0					
Total (coastal)			90	39	21	26	64	0	0	0	32	25	3	0	90	0	82	0	6	0	0	56	4	46	0	10	0	0	1	59			
Orissa (average)			210	91	49	63	142	2	0	3	51	81	8	0	210	0	194	0	16	0	0	131	9	98	0	33	0	0	1	139			

Note : \* refers to the open ended questions of the questionnaire; \*\* refers to AF, F and AG i.e. the agroforestry, forestry and agriculture projects.

Source: Based on the questionnaire survey.

Annexure 6.1 The frequency of the actual beneficiaries responses to various questions in the questionnaire survey ;question nos. 24 to 35 (except\* 31, 34 and 35).

Category			N	Q. no. 24			Q. no. 25			Q. no. 26			Q. no. 27					Q. no. 28					Q.no. 29		Q.no. 30		Q. no. 32			
Zone	Projects	Survival category		Options			Options			Options			Options					Options					Options		Options		Options			
				1	2	0	1	2	3	4	1	2	0	1	2	3	4	5	6	7	1	2	1	2	1	2				
1.Northern	a. AF**	Low	2	2	0	2	0	0	1	1	2	2	0	0	0	0	0	0	0	1	1	1	1	0	2	0	1	1	1	1
		Moderate	13	13	0	0	8	5	0	13	0	4	6	2	0	0	13	0	9	0	3	0	12	1	0	13	12	1		
		High	5	5	0	0	1	4	0	5	0	2	3	0	0	0	5	0	4	0	1	0	5	0	0	5	5	0		
	Total		20	20	0	2	9	9	0	19	1	8	9	2	0	0	19	1	14	0	5	0	19	1	1	19	18	2		
	b. F**	Low	3	2	1	0	2	1	0	2	1	3	0	0	0	0	2	1	2	0	1	0	2	1	1	2	2	1		
		Moderate	17	17	0	0	11	5	0	17	0	7	7	2	0	0	17	0	11	0	5	0	17	0	0	17	17	0		
High		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Total		20	19	1	0	13	6	0	19	1	10	7	2	0	0	19	1	13	0	6	0	19	1	1	19	19	1			
c. AG**			20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total ( northern)			60	39	1	2	22	15	0	38	2	18	16	4	0	0	38	2	27	0	11	0	38	2	2	38	37	3		
2.Central	a. AF	Low	3	2	1	1	2	0	2	1	2	0	1	0	0	2	1	2	0	1	0	1	2	2	1	2	1			
		Moderate	17	17	0	2	11	4	0	17	0	7	8	1	0	0	16	1	10	0	5	0	16	1	0	17	16	1		
		High	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	Total		20	19	1	3	13	4	0	19	1	9	8	2	0	0	18	2	12	0	6	0	17	3	2	18	18	2		
	b. F	Low	11	11	0	1	9	1	0	9	2	5	4	2	0	0	10	1	5	0	2	0	11	0	1	10	9	2		
		Moderate	9	9	0	0	5	3	0	9	0	3	3	1	0	0	9	0	8	0	4	0	9	0	0	9	9	0		
High		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Total		20	20	0	1	14	4	0	18	2	8	7	3	0	0	19	1	13	0	6	0	20	0	1	20	18	2			
c. AG			20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Total ( central)			60	39	1	4	27	8	0	37	3	17	15	5	0	0	37	3	25	0	12	0	37	3	3	37	36	4		
3. Coastal	a. AF	Low	15	14	1	4	7	4	0	13	2	7	5	1	0	0	13	2	11	0	3	0	13	2	2	13	13	2		
		Moderate	12	12	0	0	8	4	0	12	0	4	7	2	0	0	12	0	9	0	2	0	12	0	0	12	11	1		
		High	3	3	0	0	0	3	0	3	0	1	1	0	0	0	3	0	3	0	0	0	3	0	0	3	3	0		
	Total		30	29	1	4	15	11	0	28	2	12	13	3	0	0	28	2	23	0	5	0	28	2	2	28	27	3		
	b. F	Low	17	16	1	2	12	3	0	15	2	9	5	2	0	0	15	2	12	0	3	0	15	2	1	16	16	1		
		Moderate	13	13	0	0	7	4	0	13	0	5	5	2	0	0	13	0	11	0	2	0	13	0	0	13	12	1		
High		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Total		30	29	1	2	19	7	0	28	2	14	10	4	0	0	28	2	23	0	5	0	28	2	1	28	28	2			
c. AG			30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Total ( coastal)			90	58	2	6	34	18	0	56	4	26	23	7	0	0	56	4	46	0	10	0	56	4	3	57	55	5		
Orissa (average)			210	136	4	12	83	41	0	131	9	61	54	16	0	0	131	9	98	0	33	0	131	9	8	132	128	12		

Note : \* refers to the open ended questions of the questionnaire; \*\* refers to AF, F and AG i.e. the agroforestry, forestry and agriculture projects.

Source: Based on the questionnaire survey.

Annexure 7.1 Market prices of inputs and outputs involved in the agroforestry, forestry and agriculture projects by agro-ecological zone.

Zone	Project Year	Input prices		Output values															
		Labour (Rs./WD*)	Fertiliser (Rs./kg)	Prices of agricultural products (figure in Rs./100kgs.)										Prices of forestry products (Rs./100kgs)					
				Peddy	R.G.	B.G.	H.G.	Niger	Sesamum	Maize	G.nut	Dioac	P.apple	Dry leaves	Twigs	Grass	Bamboo	Poles	Firewood
1. Northern	0	7.00	3.00	170.00	325.00	275.00	0.00	275.00	425.00	475.00	375.00	0.00	0.00	5.00	28.00	6.00	5.00	10.00	25.00
	1	10.00	3.50	180.00	350.00	300.00	0.00	300.00	450.00	500.00	400.00	0.00	0.00	5.50	30.00	6.50	5.00	10.00	32.00
	2	10.00	4.00	180.00	350.00	300.00	0.00	350.00	500.00	500.00	450.00	0.00	0.00	6.00	32.00	7.00	6.00	11.00	35.00
	3	10.00	4.50	200.00	400.00	350.00	0.00	350.00	550.00	600.00	500.00	0.00	0.00	6.50	35.00	8.00	7.00	12.00	35.00
	4	11.00	4.50	220.00	450.00	400.00	0.00	400.00	600.00	650.00	550.00	0.00	0.00	6.50	36.00	8.00	7.00	14.00	38.00
	5	11.00	5.00	250.00	500.00	450.00	0.00	450.00	600.00	700.00	600.00	0.00	0.00	7.00	36.00	8.50	8.00	15.00	40.00
	6	21.00	5.25	300.00	550.00	550.00	0.00	500.00	650.00	750.00	650.00	0.00	0.00	7.25	36.50	8.50	8.00	16.00	42.00
	7	21.00	5.50	325.00	600.00	600.00	0.00	550.00	700.00	900.00	700.00	0.00	0.00	7.50	36.50	9.00	9.00	18.00	44.00
	8	21.00	5.75	350.00	650.00	650.00	0.00	600.00	800.00	950.00	750.00	0.00	0.00	8.00	38.00	9.50	10.00	20.00	45.00
9	21.00	6.00	400.00	700.00	700.00	0.00	650.00	900.00	1000.00	800.00	0.00	0.00	8.50	38.50	10.00	12.00	22.00	45.00	
2. Central	0	7.00	3.00	170.00	325.00	275.00	0.00	0.00	435.00	0.00	475.00	0.00	0.00	5.00	32.00	7.00	5.75	10.00	25.00
	1	10.00	3.50	180.00	350.00	300.00	0.00	0.00	450.00	0.00	400.00	0.00	0.00	5.50	35.00	7.50	6.00	11.00	32.00
	2	10.00	4.00	180.00	375.00	325.00	0.00	0.00	475.00	0.00	450.00	0.00	0.00	6.00	36.00	8.00	6.50	12.00	35.00
	3	10.00	4.50	200.00	400.00	350.00	0.00	0.00	500.00	0.00	500.00	0.00	0.00	7.00	36.50	8.25	7.00	14.00	35.00
	4	11.00	4.50	200.00	450.00	400.00	0.00	0.00	550.00	0.00	550.00	0.00	0.00	7.25	37.00	8.50	7.00	15.00	38.00
	5	11.00	5.00	220.00	500.00	450.00	0.00	0.00	600.00	0.00	600.00	0.00	0.00	7.50	37.50	9.00	7.25	16.00	40.00
	6	21.00	5.25	250.00	550.00	550.00	0.00	0.00	650.00	0.00	650.00	0.00	0.00	8.00	38.00	9.25	7.50	17.00	42.00
	7	21.00	5.50	275.00	600.00	600.00	0.00	0.00	700.00	0.00	700.00	0.00	0.00	8.50	38.50	9.50	8.00	18.00	44.00
	8	21.00	5.75	300.00	650.00	650.00	0.00	0.00	750.00	0.00	750.00	0.00	0.00	9.00	39.00	10.00	8.25	20.00	45.00
9	21.00	6.00	350.00	700.00	700.00	0.00	0.00	800.00	0.00	800.00	0.00	0.00	9.50	40.00	10.50	8.50	24.00	50.00	
3. Coastal	0	7.00	3.00	180.00	300.00	275.00	350.00	0.00	275.00	0.00	0.00	225.00	2.25	5.00	30.00	6.00	5.25	10.00	30.00
	1	10.00	3.50	170.00	325.00	300.00	375.00	0.00	300.00	0.00	0.00	250.00	2.50	5.50	32.00	6.25	5.50	11.00	32.00
	2	10.00	4.00	180.00	250.00	325.00	400.00	0.00	325.00	0.00	0.00	275.00	2.75	6.00	35.00	6.50	6.00	12.00	35.00
	3	10.00	4.50	200.00	400.00	350.00	400.00	0.00	350.00	0.00	0.00	300.00	3.00	6.50	36.00	7.00	6.50	12.00	35.00
	4	11.00	4.50	220.00	450.00	400.00	425.00	0.00	400.00	0.00	0.00	350.00	3.25	6.75	36.50	7.50	7.00	13.00	38.00
	5	11.00	5.00	250.00	475.00	450.00	450.00	0.00	450.00	0.00	0.00	375.00	3.50	7.00	37.00	7.50	7.20	14.00	40.00
	6	21.00	5.25	275.00	500.00	475.00	475.00	0.00	475.00	0.00	0.00	400.00	3.75	7.50	37.00	8.00	7.50	15.00	42.00
	7	21.00	5.50	300.00	525.00	500.00	500.00	0.00	500.00	0.00	0.00	425.00	4.00	7.50	37.50	8.50	7.50	16.00	44.00
	8	21.00	5.75	325.00	575.00	525.00	525.00	0.00	525.00	0.00	0.00	450.00	4.50	8.00	38.00	8.50	8.00	18.00	45.00
9	21.00	6.00	400.00	600.00	600.00	625.00	0.00	650.00	0.00	0.00	500.00	5.00	8.50	38.00	9.00	8.50	20.00	50.00	

Note: \* is working day; R.G is red gram, a pulse crop, B.G is black gram, H.G. is horse gram, Niger is an oilseed crop, Sesam is sesamum, an oilseed crop, Dioac is dioscorea; a vegetable crop.

Source: Prices of agricultural products from the Government of Orissa, Department of Agriculture (GOO,1991) and prices of forest products from questionnaire survey and Forest Department (OFD,1993).



**Annexure 7.2 Details of the annual direct and indirect costs involved in the Social Forestry Project, Orissa.**  
(from 1983-84 to 1987-88)

(figures in million rupees)

Components	Annual expenses for various components					
	1983-84	1984-85	1985-86	1986-87	1987-88	Total
<b>(A) Direct Cost</b>						
<b>a. Plantation</b>						
i. Nursery	0.20	2.34	8.27	9.13	18.57	38.52
ii. Village Wood Lot (VWL)	0.09	2.15	6.51	13.72	41.99	64.46
iii. Reforestration of degraded forest	0.10	2.35	6.10	13.56	23.13	45.24
iv. Rehabilitation of degraded forest	0.05	0.55	1.70	2.15	3.17	7.62
v. Farm forestry	0.00	1.20	2.62	2.93	7.31	14.01
vi. Forest farming for rural poor (FFRP)	0.01	0.41	1.70	2.65	7.12	11.90
<b>Total</b>	<b>0.45</b>	<b>9.00</b>	<b>26.9</b>	<b>44.14</b>	<b>101.29</b>	<b>181.78</b>
<b>(B) Indirect costs</b>						
<b>a. Establishment</b>						
i. Staff salaries and allowances	0.40	3.50	8.26	11.71	14.05	37.92
ii. Travel expenses	0.03	0.60	1.35	1.48	2.22	5.68
iii. Office expenses	0.11	0.89	2.10	3.29	5.90	12.29
iv. Vehicle and equipment	0.40	0.90	1.60	0.00	0.00	2.90
v. Buildings	0.00	0.50	2.55	2.00	6.15	11.21
<b>b. Overhead</b>						
vi. Research	0.00	0.00	0.20	0.37	0.55	1.16
vii. Training	0.05	0.04	0.60	1.46	1.51	3.82
viii. Publicity	0.02	0.20	0.40	0.76	1.48	2.81
ix. Monitoring and evaluation	0.00	0.15	0.02	0.66	1.42	2.16
x. Protection	0.00	0.06	0.59	3.04	5.25	8.98
<b>Total (overhead)</b>	<b>0.07</b>	<b>0.10</b>	<b>1.81</b>	<b>6.29</b>	<b>10.21</b>	<b>18.93</b>
<b>Grand total</b>	<b>1.46</b>	<b>0.55</b>	<b>44.57</b>	<b>68.91</b>	<b>139.82</b>	<b>270.70</b>

Source: Compiled from OFD (1993).

Annexure 7.3 Annual financial costs for various components of the agroforestry project by agro-ecological zone.

(figures in Rs./ha at 1992-93 prices)

Zone	Project year	Direct cost						Total Direct Cost	Indirect cost										Total Indirect cost	Total Cost (Direct + Indirect)			
		Labour	Polythene bags	Seeds	Fertilisers	Insecticides	Tools		Establishment				Total Establishment	Overhead							Total overhead		
									Salary and allowance	Office expenses	Vehicles	Building		Research	Training	Publicity	Monitoring	Protection					
1. Northern	0	3605.72	384.28	0.00	0.00	0.00	114.00	4104.00	147.01	36.75	24.50	36.75	245.01	6.13	20.83	12.25	1.23	20.83	61.25	306.27	4410.27		
	1	4522.84	0.00	527.80	1503.32	418.24	0.00	6972.20	249.75	62.44	41.63	62.44	416.25	10.41	35.38	20.81	2.08	35.38	104.06	520.31	7492.51		
	2	2779.52	0.00	371.00	949.44	279.33	0.00	4379.29	156.87	39.22	26.15	39.22	261.45	6.54	22.22	13.07	1.31	22.22	65.36	326.81	4706.10		
	3	1516.86	0.00	126.41	334.85	110.03	0.00	2088.15	74.80	18.70	12.47	18.70	124.67	3.12	10.60	6.23	0.62	10.60	31.17	155.83	2243.98		
	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	6028.46	0.00	0.00	0.00	0.00	0.00	317.28	6345.74	227.31	56.83	37.89	56.83	378.85	9.47	32.20	16.84	1.89	32.20	94.71	473.56	6819.30		
Northern (total/ha)		18453.40	384.28	1025.21	2787.61	807.60	431.28	23689.38	855.74	213.93	142.62	213.93	1426.23	35.66	121.23	71.31	7.13	121.23	356.56	1782.79	25672.17		
2. Central	0	3605.72	384.28	0.00	0.00	0.00	114.00	4104.00	147.01	36.75	24.50	36.75	245.01	6.13	20.83	12.25	1.23	20.83	61.25	306.27	4410.27		
	1	4815.72	0.00	444.01	1620.53	414.05	0.00	7294.31	261.29	65.32	43.55	65.32	435.48	10.89	37.02	21.77	2.18	37.02	108.87	544.35	7838.66		
	2	2903.80	0.00	323.02	1067.09	299.03	0.00	4482.74	159.86	39.98	26.84	39.98	296.43	6.66	22.65	13.32	1.33	22.65	66.81	333.04	4795.78		
	3	1310.18	0.00	151.05	367.01	109.46	0.00	1967.68	70.48	17.62	11.75	17.62	117.47	2.94	9.99	5.87	0.59	9.99	29.37	146.84	2114.52		
	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9	3241.51	0.00	0.00	0.00	0.00	0.00	170.81	3412.12	122.23	30.56	20.37	30.56	203.71	5.06	17.32	10.19	1.02	17.32	50.93	254.84	3666.76		
Central (total/ha)		15776.71	384.28	918.08	3084.63	792.54	284.61	21240.85	760.87	190.22	126.81	190.22	1266.11	31.70	107.79	63.41	6.34	107.79	317.03	1565.14	22825.99		
3. Coastal	0	3605.72	384.28	0.00	0.00	0.00	114.00	4104.00	147.01	36.75	24.50	36.75	245.01	6.13	20.83	12.25	1.23	20.83	61.25	306.27	4410.27		
	1	4761.12	0.00	341.67	1662.57	416.18	0.00	7181.54	257.25	64.31	42.87	64.31	426.75	10.72	36.44	21.44	2.14	36.44	107.19	535.94	7717.48		
	2	2618.64	0.00	290.56	1048.12	297.50	0.00	4252.82	152.34	38.08	25.39	38.08	253.90	6.35	21.58	12.69	1.27	21.58	63.47	317.37	4570.19		
	3	1460.73	0.00	248.31	420.87	130.33	0.00	2280.24	80.96	20.24	13.49	20.24	134.94	3.37	11.47	6.75	0.67	11.47	33.73	166.67	2426.91		
	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
9	4447.45	0.00	0.00	0.00	0.00	0.00	234.08	4681.53	167.70	41.92	27.95	41.92	279.49	6.99	23.76	13.97	1.40	23.76	69.87	349.37	5030.90		
Coastal (total/ha)		16891.66	384.28	880.54	3131.56	844.01	348.08	22480.13	805.26	201.31	134.21	201.31	1342.10	33.55	114.08	67.10	6.71	114.08	335.52	1677.62	24157.75		

Note: \* includes the labour costs in planting and harvesting of forestry and agricultural crops, \*\* includes the costs of tools in planting and harvesting of forestry and agricultural crops.

Source: Based on the questionnaire survey and from the official records of the Social Forestry Project, Orissa (OFD, 1993).

Annexure 7.4 Annual financial costs for various components of the forestry project by agro-ecological zone.

(figures in Rs./ha at 1992-93 prices)

Zone	Project year	Direct cost					Total Direct Cost	Indirect cost										Total Indirect Cost	Total cost (Direct + Indirect cost)				
		Labour	Polythene bags	Fertiliser	Insecticides	Tools		Establishment				Overhead					Total overhead costs						
								Salary and allowance	Office expenses	Vehicles	Buildings	Establishment	Research	Training	Publicity	Monitoring				Protection			
1. Northern	0	4505.44	434.58	0.00	0.00	114.00	5054.02	181.04	45.28	30.17	45.28	301.73	7.54	25.85	15.09	1.51	25.85	75.43	377.17	5431.19			
	1	3312.40	0.00	1274.00	127.40	0.00	4713.80	168.85	42.21	28.14	42.21	281.42	7.04	23.92	14.07	1.41	23.92	70.36	351.78	5065.58			
	2	2084.00	0.00	825.80	86.00	0.00	2975.80	108.59	28.65	17.78	28.65	177.85	4.44	15.10	8.88	0.89	15.10	44.41	222.08	3197.88			
	3	828.80	0.00	0.00	0.00	0.00	828.80	29.62	7.40	4.94	7.40	49.36	1.23	4.20	2.47	0.25	4.20	12.34	61.70	888.50			
	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	5278.77	0.00	0.00	0.00	0.00	277.73	5554.50	198.97	49.74	33.18	49.74	331.81	8.29	28.19	16.58	1.66	28.19	82.90	414.51	5969.01			
Northern (total/ha)		15985.41	434.58	2099.60	213.40	391.73	19124.72	685.06	171.27	114.18	171.27	1141.77	28.54	97.05	57.09	5.71	97.05	285.44	1427.22	20551.94			
2. Central	0	4505.44	434.58	0.00	0.00	114.00	5054.02	181.04	45.28	30.17	45.28	301.73	7.54	25.85	15.09	1.51	25.85	75.43	377.17	5431.19			
	1	3312.40	0.00	1274.00	127.40	0.00	4713.80	168.85	42.21	28.14	42.21	281.42	7.04	23.92	14.07	1.41	23.92	70.36	351.78	5065.58			
	2	2084.00	0.00	825.80	86.00	0.00	2975.80	108.59	28.65	17.78	28.65	177.81	4.44	15.10	8.88	0.89	15.10	44.40	222.01	3197.01			
	3	828.80	0.00	0.00	0.00	0.00	828.80	29.62	7.40	4.94	7.40	49.36	1.23	4.20	2.47	0.25	4.20	12.34	61.70	888.50			
	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9	3281.01	0.00	0.00	0.00	0.00	171.83	3432.84	122.98	30.74	20.49	30.74	204.93	5.12	17.42	10.25	1.02	17.42	51.23	256.17	3688.81			
Central (total/ha)		13969.85	434.58	2099.00	213.40	285.63	17002.26	609.04	152.26	101.51	152.26	1015.06	25.38	86.28	50.75	5.08	86.28	253.77	1268.83	18271.09			
3. Coastal	0	4505.44	434.58	0.00	0.00	114.00	5054.02	181.04	45.28	30.17	45.28	301.73	7.54	25.85	15.09	1.51	25.85	75.43	377.17	5431.19			
	1	3312.40	0.00	1274.00	127.40	0.00	4713.80	168.85	42.21	28.14	42.21	281.42	7.04	23.92	14.07	1.41	23.92	70.36	351.78	5065.58			
	2	2084.00	0.00	825.80	86.00	0.00	2975.80	108.59	28.65	17.78	28.65	177.85	4.44	15.10	8.88	0.89	15.10	44.41	222.08	3197.88			
	3	828.80	0.00	0.00	0.00	0.00	828.80	29.62	7.40	4.94	7.40	49.36	1.23	4.20	2.47	0.25	4.20	12.34	61.70	888.50			
	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
9	3799.15	0.00	0.00	0.00	0.00	199.95	3999.10	143.25	35.81	23.88	35.81	238.75	5.97	20.29	11.94	1.19	20.29	59.89	298.44	4297.54			
Coastal (total/ha)		14507.79	434.58	2099.60	213.40	313.95	17569.32	629.35	157.34	104.89	157.34	1048.91	26.22	89.16	52.45	5.24	89.16	262.23	1311.14	18880.46			

Note: \* includes the labour costs in planting and harvesting of forestry crops, \*\* includes the costs of tools in planting and harvesting of forestry crops.

**Annexure 7.5 Annual financial costs for various components of the Agriculture project by agro-ecological zone.**

(figures in Rs./ha at 1992-93 prices)

Zone	Project year	Direct cost				Total cost
		Labour	Seeds	Fertilisers	Insecticides	
1. Northern	0	0.00	0.00	0.00	0.00	0.00
	1	2760.94	552.18	697.51	251.16	4261.79
	2	2084.64	249.31	595.12	184.04	3113.11
	3	1985.91	202.01	618.91	194.77	3001.60
	4	2214.08	556.99	669.33	215.34	3655.74
	5	1789.72	239.56	551.31	153.18	2733.77
	6	1706.37	368.87	543.75	145.62	2764.61
	7	4187.65	201.78	594.87	174.46	5158.76
	8	3177.50	213.55	506.00	138.50	4035.55
9	2822.10	801.32	521.64	126.04	4271.10	
<b>Northern (total /ha)</b>		<b>22728.91</b>	<b>3385.57</b>	<b>5298.44</b>	<b>1583.11</b>	<b>32996.03</b>
2. Central	0	0	0.00	0.00	0.00	0.00
	1	2225.86	487.76	522.34	218.10	3454.06
	2	2007.24	302.72	529.76	189.20	3028.92
	3	1877.79	341.85	561.67	178.10	2959.41
	4	1706.44	632.25	499.50	171.68	3009.87
	5	1715.34	229.63	496.80	176.64	2618.41
	6	1548.25	304.00	472.50	155.00	2479.75
	7	3599.00	822.00	593.83	170.80	5185.63
	8	2365.00	274.00	384.00	124.00	3147.00
9	2564.00	612.72	475.40	132.48	3784.60	
<b>Central (total/ha)</b>		<b>19608.92</b>	<b>4006.93</b>	<b>4535.80</b>	<b>1516.00</b>	<b>29667.65</b>
3. Coastal	0	0.00	0.00	0.00	0.00	0.00
	1	2414.53	197.53	471.38	255.16	3338.60
	2	2150.00	258.76	491.69	172.00	3072.45
	3	1639.82	329.77	477.00	212.64	2659.23
	4	1507.63	140.55	372.22	202.76	2223.16
	5	1376.32	363.95	399.97	126.96	2267.20
	6	1416.25	214.46	387.50	155.83	2174.04
	7	3533.93	390.68	507.80	153.48	4585.89
	8	2570.00	230.60	353.83	127.33	3281.76
9	2559.33	190.62	428.72	124.20	3302.87	
<b>Coastal (total /ha)</b>		<b>19167.81</b>	<b>2316.92</b>	<b>3890.11</b>	<b>1530.36</b>	<b>26905.20</b>

Source: Based on the questionnaire survey and the official records of the Agriculture Department, Government of Orissa.

**Annexure 7.6 Annual financial returns for various components of the agroforestry project by agro-ecological zone.**

(figures in Rs./ha at 1992-93 prices)

Zone	Project year	Annual returns for various components					Total return (agriculture + forestry)
		Agricultural crops	Forestry crops			Total return (forestry)	
			Intermediate products	Final products			
				Timber	Firewood		
1. Northern	0	0.00	0.00	0.00	0.00	0.00	0.00
	1	3183.54	0.00	0.00	0.00	0.00	3183.54
	2	2136.24	43.00	0.00	0.00	43.00	2179.24
	3	1358.66	55.65	0.00	0.00	55.65	1414.31
	4	0.00	226.44	0.00	0.00	226.44	226.44
	5	0.00	637.56	0.00	0.00	637.56	637.56
	6	0.00	442.50	0.00	0.00	442.50	442.50
	7	0.00	427.00	0.00	0.00	427.00	427.00
	8	0.00	281.00	0.00	0.00	281.00	281.00
9	0.00	0.00	93722.56	6274.58	99997.14	99997.14	
<b>Northern (total /ha)</b>		<b>6678.44</b>	<b>2113.15</b>	<b>93722.56</b>	<b>6274.58</b>	<b>102110.29</b>	<b>108788.73</b>
2. Central	0	0.00	0.00	0.00	0.00	0.00	0.00
	1	3051.23	0.00	0.00	0.00	0.00	3051.23
	2	2560.85	61.56	0.00	0.00	61.56	2622.21
	3	1809.44	111.05	0.00	0.00	111.05	1920.49
	4	0.00	320.03	0.00	0.00	320.03	320.03
	5	0.00	577.49	0.00	0.00	577.49	577.49
	6	0.00	539.21	0.00	0.00	539.21	539.21
	7	0.00	160.14	0.00	0.00	160.14	160.14
	8	0.00	14.74	0.00	0.00	14.74	14.74
9	0.00	0.00	58941.19	5510.80	64451.99	64451.99	
<b>Central (total/ha)</b>		<b>7421.32</b>	<b>1784.22</b>	<b>58941.19</b>	<b>5510.80</b>	<b>66236.21</b>	<b>73657.53</b>
3. Coastal	0	0.00	0.00	0.00	0.00	0.00	0.00
	1	2830.00	0.00	0.00	0.00	0.00	2830.00
	2	1777.00	42.00	0.00	0.00	42.00	1819.00
	3	1204.00	171.00	0.00	0.00	171.00	1375.00
	4	54.50	425.56	0.00	0.00	425.56	480.06
	5	81.00	500.00	0.00	0.00	500.00	581.00
	6	118.00	350.00	0.00	0.00	350.00	468.00
	7	137.00	245.00	0.00	0.00	245.00	382.00
	8	13.30	131.00	0.00	0.00	131.00	144.30
9	0.00	0.00	72407.64	5733.18	78140.82	78140.82	
<b>Coastal (total /ha)</b>		<b>6214.80</b>	<b>1884.56</b>	<b>72407.64</b>	<b>5733.18</b>	<b>80005.38</b>	<b>86220.18</b>

Source: Based on the questionnaire survey

**Annexure 7.7 Annual financial returns for various components of the forestry project by agro-ecological zone.**

(figures in Rs./ha at 1992-93 prices)

Zone	Project Year	Returns			Total returns
		Intermediate products	Final products		
			Timber	Firewood	
1. Northern	0	0.00	0.00	0.00	0.00
	1	0.00	0.00	0.00	0.00
	2	51.24	0.00	0.00	51.24
	3	105.36	0.00	0.00	105.36
	4	381.41	0.00	0.00	381.41
	5	827.20	0.00	0.00	827.20
	6	652.11	0.00	0.00	652.11
	7	286.38	0.00	0.00	286.38
	8	9.26	0.00	0.00	9.26
	9	0.00	86354.94	6026.81	92381.75
<b>Northern (total /ha)</b>		<b>2312.96</b>	<b>86354.94</b>	<b>6026.81</b>	<b>94894.71</b>
2. Central	0	0.00	0.00	0.00	0.00
	1	29.73	0.00	0.00	29.73
	2	54.47	0.00	0.00	54.47
	3	80.38	0.00	0.00	80.38
	4	311.87	0.00	0.00	311.87
	5	740.37	0.00	0.00	740.37
	6	557.64	0.00	0.00	557.64
	7	238.85	0.00	0.00	238.85
	8	22.78	0.00	0.00	22.78
	9	0.00	53366.04	5055.16	58421.20
<b>Central (total/ha)</b>		<b>2036.09</b>	<b>53366.04</b>	<b>5055.16</b>	<b>60457.29</b>
3. Coastal	0	0.00	0.00	0.00	0.00
	1	5.69	0.00	0.00	5.69
	2	54.61	0.00	0.00	54.61
	3	100.79	0.00	0.00	100.79
	4	384.51	0.00	0.00	384.51
	5	713.51	0.00	0.00	713.51
	6	586.03	0.00	0.00	586.03
	7	266.05	0.00	0.00	266.05
	8	52.71	0.00	0.00	52.71
	9	0.00	62172.73	5529.86	67702.59
<b>Coastal (total /ha)</b>		<b>2163.90</b>	<b>62172.73</b>	<b>5529.86</b>	<b>69866.49</b>

Source: Based on the questionnaire survey

**Annexure 7.8 Annual financial returns for various components of the Agriculture project by zone.**

(figures in Rs./ha at 1992-93 prices)

Zone	Project Year	Total returns
1. Northern	0	0.00
	1	4334.33
	2	4153.8
	3	3415.32
	4	4386.72
	5	4579.53
	6	3935.00
	7	3452.29
	8	3968.50
	9	4128.96
<b>Northern (total /ha)</b>		<b>36354.45</b>
2. Central	0	0.00
	1	3654.56
	2	4045.01
	3	3348.54
	4	4496.54
	5	3978.54
	6	4030.94
	7	4883.05
	8	4484.25
	9	4290.19
<b>Central (total/ha)</b>		<b>37211.62</b>
3. Coastal	0	0.00
	1	2729.39
	2	2926.29
	3	3520.26
	4	3605.28
	5	3787.87
	6	3461.86
	7	4124.92
	8	3995.17
	9	2955.47
<b>Coastal (total /ha)</b>		<b>31106.53</b>

Source: Based on the questionnaire survey

Annexure 7.9 Results of the financial evaluation of the agroforestry project in the Northern Zone of Orissa.

Plot no.	Area of plot (ha)	Survival percentage of trees	NPV at varying discount rates (figure in Rs./hectare at 1992-93 prices)						IRR	BCR at 10% D.R.
			0%	5%	7%	10%	12%	15%		
1	0.5	35%	32107.88	17757.95	13882.73	9421.70	7141.90	4499.55	24%	2.08
2	0.5	37%	33195.90	18382.49	14382.53	9778.20	7425.33	4698.45	24%	2.11
3	0.5	7%	2920.99	1.57	-756.80	-1599.65	-2011.14	-2461.44	5%	0.80
4	0.5	32%	27393.27	15017.78	11673.75	7822.86	5854.27	3572.14	23%	1.91
5	0.5	38%	35764.64	20145.43	15917.62	11041.33	8543.53	5640.75	27%	2.25
6	0.5	40%	38731.70	22103.32	17594.06	12385.17	9712.04	6598.85	28%	2.39
7	0.5	55%	51509.02	29844.06	23961.46	17158.56	13662.57	9584.33	32%	2.86
8	0.5	52%	50792.18	29412.17	23607.07	16893.98	13444.28	9420.25	32%	2.83
9	0.5	47%	47445.37	27289.01	21821.15	15502.81	12258.89	8478.83	30%	2.69
10	0.5	50%	50059.36	28756.05	22979.03	16305.35	12880.17	8890.45	30%	2.77
11	0.5	53%	52628.34	30448.57	24428.61	17469.06	13893.88	9724.97	31%	2.88
12	0.5	0%	-7030.84	-6342.30	-6098.06	-5760.37	-5552.51	-5263.82	-100%	0.25
13	0.5	50%	47969.28	27854.94	22388.48	16062.40	12808.81	9009.99	32%	2.76
14	0.5	48%	50840.42	29586.97	23811.32	17127.50	13689.84	9675.82	33%	2.86
15	0.5	49%	53465.03	31308.36	25285.24	18312.61	14724.72	10532.76	34%	2.97
16	0.5	50%	52959.84	30972.12	24992.26	18067.70	14503.52	10338.16	34%	2.95
17	0.5	51%	53816.96	31564.14	25508.39	18492.36	14878.90	10653.06	34%	2.99
18	0.5	46%	49795.99	29153.74	23536.09	17027.68	13675.75	9755.98	34%	2.85
19	0.5	52%	54905.13	32384.01	26250.07	19138.44	15472.64	11181.40	36%	3.05
20	0.5	50%	52269.33	30493.64	24572.51	17717.10	14189.27	10067.49	33%	2.91
<b>Orissa (average) (per ha)</b>		<b>42%</b>	<b>83153.98</b>	<b>47613.40</b>	<b>37973.75</b>	<b>26836.48</b>	<b>21119.67</b>	<b>14459.80</b>	<b>29%</b>	<b>2.47</b>

Note: ha is hectare, NPV is net present value, IRR is internal rate of return, BCR is benefit-cost ratio and D.R. is discount rate.

Annexure 7.10 Results of the financial evaluation of the forestry project in the Northern Zone of Orissa.

Plot no.	Area of plot (ha)	Survival percentage of trees	NPV at varying discount rates (figure in Rs/hectare at 1992 - 93 prices)						IRR	BCR at 10% D.R.
			0%	5%	7%	10%	12%	15%		
1	0.5	25%	26660.20	14348.53	11027.22	7207.73	5258.45	3003.09	21%	2.04
2	0.5	28%	29063.56	15809.11	12230.69	8112.77	6009.44	3573.42	22%	2.16
3	0.5	12%	10843.02	4702.63	3063.79	1197.38	256.71	-815.00	13%	1.18
4	0.5	30%	30627.51	16810.03	13074.70	8771.62	6570.92	4018.44	23%	2.25
5	0.5	34%	38067.05	21366.10	16843.33	11625.05	8951.08	5842.39	26%	2.61
6	0.5	26%	30781.00	16867.28	13108.92	8781.81	6570.21	4006.77	23%	2.24
7	0.5	39%	42900.30	24318.60	19282.43	13467.69	10485.43	7014.67	27%	2.83
8	0.5	35%	37561.96	21033.93	16560.31	11400.78	8758.12	5687.38	26%	2.58
9	0.5	38%	42816.58	24276.53	19251.49	13449.36	10473.40	7009.72	27%	2.83
10	0.5	40%	44183.44	25097.27	19923.34	13948.55	10883.62	7315.85	28%	2.89
11	0.5	45%	48236.04	27615.66	22020.73	15554.73	12234.62	8365.46	29%	3.07
12	0.5	41%	43028.81	24408.00	19360.40	13531.67	10541.77	7061.52	27%	2.84
13	0.5	0%	-7291.45	-6630.20	-6394.20	-6066.58	-5864.09	-5581.78	-100%	0.00
14	0.5	38%	44579.13	25341.56	20127.18	14105.95	11017.25	7421.77	28%	2.90
15	0.5	40%	43527.50	24660.67	19550.50	13652.94	10629.65	7112.84	27%	2.85
16	0.5	32%	35920.17	20058.99	15766.13	10815.37	8279.84	5333.90	25%	2.50
17	0.5	35%	38414.44	21571.08	17009.16	11745.29	9047.76	5911.51	26%	2.62
18	0.5	32%	34803.79	19345.73	15163.99	10343.48	7876.02	5011.04	25%	2.45
19	0.5	37%	40941.86	23160.04	18339.50	12772.89	9917.50	6594.06	27%	2.75
20	0.5	40%	44316.38	25244.25	20070.32	14092.09	11023.34	7448.49	28%	2.91
<b>Orissa ( average ) ( per ha )</b>		<b>32%</b>	<b>74441.93</b>	<b>41681.45</b>	<b>32812.22</b>	<b>22581.54</b>	<b>17340.63</b>	<b>11249.76</b>	<b>26%</b>	<b>2.56</b>

Note: ha is hectare, NPV is net present value, IRR is internal rate of return, BCR is benefit-cost ratio and D.R. is discount rate.



Annexure 7.11 Results of the financial evaluation of the agriculture project in the Northern Zone of Orissa.

Plot no.	Area of plot (ha)	NPV at varying discount rates (figure in Rs./hectare at 1992-93 prices)						BCR at 10% D.R.
		0%	5%	7%	10%	12%	15%	
1	0.5	1490.43	1207.46	1105.35	964.15	877.77	759.21	1.09
2	0.5	1277.38	1107.81	1036.20	929.68	860.62	761.48	1.09
3	0.5	209.28	244.56	242.22	227.99	213.56	187.27	1.02
4	0.5	1391.55	1210.33	1136.26	1027.42	957.45	857.51	1.10
5	0.5	1968.56	1476.95	1314.29	1100.12	974.68	808.86	1.11
6	0.5	1085.77	713.05	589.68	427.65	333.16	209.00	1.04
7	0.5	3085.51	2677.18	2544.53	2370.27	2267.80	2130.89	1.23
8	0.5	2638.17	2136.59	1977.45	1772.63	1654.94	1501.60	1.17
9	0.5	2102.19	1904.01	1833.62	1736.20	1676.16	1592.65	1.17
10	0.5	2819.95	2317.51	2159.47	1956.87	1840.78	1689.69	1.19
11	0.5	2217.54	2011.08	1944.15	1856.03	1803.98	1733.97	1.18
12	0.5	1702.89	1698.30	1685.26	1658.44	1637.25	1602.39	1.16
13	0.5	1133.29	1144.58	1142.24	1133.93	1126.01	1111.67	1.11
14	0.5	-376.32	-85.19	1.17	106.85	164.30	234.89	1.01
15	0.5	851.50	613.32	533.45	427.46	364.93	281.74	1.04
16	0.5	910.13	669.07	586.68	476.34	410.81	323.23	1.04
17	0.5	991.08	1201.25	1238.48	1261.66	1261.03	1243.22	1.12
18	0.5	1689.78	1582.03	1531.05	1451.11	1397.02	1316.51	1.14
19	0.5	3598.06	3070.50	2884.14	2628.57	2472.97	2259.76	1.24
20	0.5	2796.18	2513.50	2402.04	2240.22	2136.88	1989.59	1.21
<b>Orissa (average) (per ha)</b>		<b>3358.29</b>	<b>2941.39</b>	<b>2788.77</b>	<b>2575.36</b>	<b>2443.21</b>	<b>2259.51</b>	<b>1.12</b>

Note: ha is hectare, NPV is net present value, IRR is internal rate of return, BCR is benefit-cost ratio and D.R. is discount rate.

Annexure 7.12 Results of the financial evaluation of the agroforestry project in the Central Zone of Orissa.

Plot no.	Area of plot (ha)	Survival percentage of trees	NPV at varying discount rates (figure in Rs./hectare at 1992-93 prices)						IRR	BCR at 10% D.R.
			0%	5%	7%	10%	12%	15%		
1	0.5	30%	21476.68	11451.05	8750.01	5647.22	4065.79	2238.82	21%	1.67
2	0.5	28%	20923.44	11026.48	8362.53	5304.85	3748.05	1951.83	20%	1.63
3	0.5	32%	26098.91	14251.42	11053.53	7373.85	5494.45	3317.74	23%	1.86
4	0.5	12%	6439.20	2131.38	996.12	-282.74	-918.48	-1630.78	9%	0.96
5	0.5	35%	29769.44	16448.82	12848.84	8702.33	6581.95	4122.76	24%	2.00
6	0.5	30%	24975.15	13747.08	10709.49	7208.10	5416.11	3336.01	23%	1.85
7	0.5	31%	27347.70	15313.27	12050.61	8283.09	6350.72	4101.97	25%	1.96
8	0.5	0%	-5769.45	-5272.92	-5094.77	-4846.58	-4692.65	-4477.34	-100%	0.38
9	0.5	32%	28764.27	16164.81	12747.45	8799.90	6774.38	4416.21	26%	2.02
10	0.5	27%	23050.56	12646.93	9829.85	6580.55	4916.43	2983.40	23%	1.77
11	0.5	36%	30315.22	17080.46	13491.08	9344.90	7217.41	4740.35	26%	2.07
12	0.5	34%	31543.03	18031.38	14357.08	10103.69	7915.67	5360.89	28%	2.16
13	0.5	30%	28320.90	15981.65	12632.01	8759.99	6771.55	4454.31	26%	2.01
14	0.5	35%	31237.25	17815.22	14167.14	9945.75	7775.16	5241.98	28%	2.14
15	0.5	32%	26996.24	14993.47	11741.86	7989.50	6066.44	3830.65	24%	1.93
16	0.5	32%	25176.45	13619.23	10501.68	6916.68	5087.13	2970.34	22%	1.81
17	0.5	31%	24973.44	13545.54	10461.60	6914.16	5103.17	3007.07	22%	1.81
18	0.5	29%	21894.45	11508.15	8716.46	5515.56	3887.78	2012.08	20%	1.65
19	0.5	32%	24686.00	13344.02	10285.45	6769.04	4974.94	2899.68	22%	1.79
20	0.5	0%	-6807.50	-6153.93	-5921.72	-5600.33	-5402.28	-5126.93	-100%	0.28
<b>Orissa (average) (per ha)</b>		<b>27%</b>	<b>50349.03</b>	<b>27598.87</b>	<b>21448.76</b>	<b>14363.92</b>	<b>10740.56</b>	<b>6538.07</b>	<b>23%</b>	<b>1.86</b>

Note: ha is hectare, NPV is net present value, IRR is internal rate of return, BCR is benefit-cost ratio and D.R. is discount rate.

Annexure 7.13 Results of the financial evaluation of the forestry project in the Central Zone of Orissa.

Plot no.	Area of plot (ha)	Survival percentage of trees	NPV at varying discount rates (figure in Rs./hectare at 1992-93 prices)						IRR	BCR at 10% D.R.
			0%	5%	7%	10%	12%	15%		
1	0.5	23%	19913.80	10198.84	7588.49	4596.89	3076.64	1326.58	18%	1.68
2	0.5	26%	21798.56	11317.74	8500.14	5269.40	3626.51	1733.63	19%	1.77
3	0.5	24%	20117.35	10321.23	7688.23	4669.97	3135.75	1369.10	18%	1.69
4	0.5	5%	-472.78	-2312.04	-2770.36	-3259.48	-3484.91	-3712.27	-1%	0.48
5	0.5	26%	23397.20	12378.10	9409.35	5999.05	4260.95	2253.13	20%	1.88
6	0.5	24%	24459.21	13025.75	9943.14	6400.03	4593.03	2504.04	21%	1.93
7	0.5	23%	19774.36	10133.12	7540.67	4568.11	3056.71	1315.91	18%	1.68
8	0.5	24%	21031.75	10893.09	8165.39	5036.09	3443.90	1608.48	19%	1.74
9	0.5	26%	23914.39	12643.07	9607.87	6122.61	4347.13	2297.19	20%	1.89
10	0.5	30%	26162.94	14033.30	10762.27	7001.78	5083.34	2864.68	21%	2.01
11	0.5	27%	20010.98	10277.38	7661.05	4661.66	3136.85	1380.73	18%	1.69
12	0.5	23%	19402.13	9869.55	7310.48	4379.74	2891.65	1180.22	18%	1.65
13	0.5	25%	21171.73	11004.51	8267.77	5126.83	3527.95	1683.78	19%	1.76
14	0.5	28%	24547.39	13046.12	9946.94	6386.36	4571.40	2474.44	20%	1.93
15	0.5	0%	-7291.46	-6630.21	-6394.21	-6066.58	-5864.10	-5581.79	-100%	0.00
16	0.5	26%	21932.81	11459.32	8640.28	5404.81	3757.66	1857.50	19%	1.80
17	0.5	25%	22134.35	11565.91	8721.10	5455.95	3793.67	1876.07	19%	1.80
18	0.5	30%	28029.64	15204.32	11741.11	7755.39	5719.44	3361.38	22%	2.12
19	0.5	26%	23625.37	12428.35	9416.69	5961.60	4203.32	2175.55	20%	1.87
20	0.5	23%	20144.89	10362.23	7731.23	4713.86	3179.30	1411.26	18%	1.70
Orissa (average) (per ha)		23%	42210.97	21870.73	16399.85	10124.62	6932.35	3253.02	19%	1.75

Note: ha is hectare, NPV is net present value, IRR is internal rate of return, BCR is benefit-cost ratio, D.R. is discount rate.

Annexure 7.14 Results of the financial evaluation of the agriculture project in the Central Zone of Orissa.

Plot no.	Area of plot (ha)	NPV at varying discount rates (figure in Rs./hectare at 1992-93 prices)						BCR at 10% D.R.
		0%	5%	7%	10%	12%	15%	
1	0.5	7017.56	5433.87	4934.42	4294.91	3929.72	3457.17	1.50
2	0.5	6029.02	4443.82	3950.47	3324.78	2971.07	2518.08	1.37
3	0.5	7529.90	5618.97	5026.23	4275.71	3851.96	3309.63	1.50
4	0.5	7268.63	5510.32	4961.02	4262.23	3865.79	3356.08	1.50
5	0.5	4444.38	3442.46	3126.71	2722.30	2491.19	2191.79	1.29
6	0.5	4084.03	3050.15	2731.58	2329.72	2103.57	1814.91	1.25
7	0.5	3112.23	2259.89	2000.73	1676.56	1495.63	1266.43	1.18
8	0.5	5478.58	4132.94	3718.11	3194.46	2899.49	2522.51	1.34
9	0.5	5063.93	3983.32	3640.24	3199.15	2946.28	2617.87	1.34
10	0.5	3079.13	2401.88	2186.23	1908.73	1749.61	1543.08	1.20
11	0.5	2078.16	1660.61	1527.29	1355.14	1255.99	1126.59	1.15
12	0.5	2775.93	2246.48	2075.32	1852.49	1723.10	1552.98	1.20
13	0.5	2126.80	1909.38	1827.84	1712.48	1640.35	1539.28	1.18
14	0.5	2775.51	2396.96	2269.16	2098.21	1996.33	1859.12	1.22
15	0.5	1922.75	1683.35	1598.25	1481.18	1409.71	1311.51	1.16
16	0.5	2078.94	1849.73	1766.51	1650.56	1578.93	1479.47	1.17
17	0.5	2399.66	2018.08	1895.54	1736.07	1643.26	1520.63	1.18
18	0.5	1859.51	1524.67	1418.17	1280.48	1200.91	1096.48	1.13
19	0.5	2388.11	1961.69	1824.41	1645.68	1541.71	1404.52	1.17
20	0.5	1873.16	1546.00	1440.93	1304.28	1224.83	1120.03	1.13
<b>Orissa (average) (per ha)</b>		<b>7538.59</b>	<b>5907.46</b>	<b>5391.92</b>	<b>4730.51</b>	<b>4351.94</b>	<b>3860.82</b>	<b>1.25</b>

Note: ha is hectare, NPV is net present value, IRR is internal rate of return, BCR is benefit-cost ratio, D.R. is discount rate.

Annexure 7.15 Results of the financial evaluation of the agroforestry project in the Coastal Zone of Orissa.

Plot no.	Area of plot (ha)	Survival percentage of trees	NPV at varying discount rates (figures in Rs./ha at 1992-93 prices)						IRR	BCR at 10% D.R.
			0%	5%	7%	10%	12%	15%		
1	0.5	6%	1016.28	-1049.78	-1575.70	-2149.31	-2422.29	-2710.96	2%	0.73
2	0.5	22%	17676.87	8983.62	6654.67	3991.74	2642.15	1093.23	18%	1.48
3	0.5	23%	18825.40	9834.05	7416.14	4642.90	3232.14	1605.97	19%	1.55
4	0.5	20%	14080.42	6752.10	4794.95	2563.47	1436.66	149.21	15%	1.31
5	0.5	24%	22646.66	12558.17	9822.07	6662.67	5042.63	3158.44	24%	1.79
6	0.5	25%	22230.21	12079.29	9335.00	6174.35	4558.68	2686.20	22%	1.73
7	0.5	26%	23763.82	12888.01	9947.22	6559.92	4828.27	2821.33	22%	1.77
8	0.5	23%	20333.71	10805.46	8233.59	5275.69	3766.36	2020.89	20%	1.63
9	0.5	23%	20181.58	10783.09	8247.59	5331.91	3844.06	2122.96	21%	1.63
10	0.5	21%	17169.30	8889.83	6662.99	4108.86	2809.62	1312.25	19%	1.49
11	0.5	20%	16334.98	8310.45	6154.14	3682.94	2427.22	981.92	18%	1.44
12	0.5	0%	-6111.64	-5547.86	-5346.99	-5068.43	-4896.46	-4658.92	-100%	0.35
13	0.5	22%	16718.37	8237.18	5968.05	3376.86	2065.87	564.52	16%	1.40
14	0.5	24%	19458.36	9959.84	7412.73	4498.12	3019.63	1320.99	18%	1.53
15	0.5	23%	18237.47	9144.44	6709.32	3926.28	2516.76	900.53	17%	1.47
16	0.5	51%	45977.12	26210.75	20855.92	14675.02	11505.85	7818.45	29%	2.61
17	0.5	48%	43968.18	25044.53	19917.59	13999.35	10964.64	7433.40	28%	2.55
18	0.5	45%	37567.20	21113.37	16662.90	11532.63	8906.36	5856.33	26%	2.30
19	0.5	50%	46586.00	26729.38	21342.98	15118.98	11923.67	8200.53	30%	2.66
20	0.5	47%	41368.61	23499.21	18658.83	13072.23	10208.11	6876.08	28%	2.46
21	0.5	50%	46425.56	26513.74	21118.33	14889.37	11694.79	7976.73	29%	2.63
22	0.5	48%	40293.15	22632.28	17858.39	12357.90	9543.62	6277.10	26%	2.38
23	0.5	43%	35428.70	19683.09	15430.55	10534.53	8031.95	5130.64	25%	2.19
24	0.5	52%	48739.60	27866.61	22210.39	15680.03	12330.67	8432.24	29%	2.70
25	0.5	47%	45255.57	25751.84	20469.47	14373.40	11248.45	7613.46	28%	2.58
26	0.5	51%	44574.88	25280.87	20058.44	14034.44	10948.18	7360.47	28%	2.54
27	0.5	48%	44832.12	25968.62	20844.45	14916.40	11868.59	8311.29	31%	2.65
28	0.5	0%	-5964.59	-5432.46	-5242.20	-4977.76	-4814.13	-4585.74	-100%	0.36
29	0.5	49%	51310.91	29778.98	23931.51	17167.95	13691.26	9634.17	32%	2.86
30	0.5	50%	49214.89	28643.14	23052.09	16581.16	13252.52	9365.13	33%	2.81
Orissa (average)/ha			62247.33	34569.30	27086.73	18465.70	14055.59	8938.53	25%	2.06

Note: ha is hectare, NPV is net present value, IRR is internal rate of return, BCR is benefit-cost ratio and D.R. is discount rate.

Annexure 7.16 Results of the financial evaluation of the forestry project in the Coastal Zone of Orissa.

Plot no.	Area of plot (ha)	Survival percentage of trees	NPV at varying discount rates (figures in Rs./ha at 1992-93 prices)						IRR	BCR at 10% D.R.
			0%	5%	7%	10%	12%	15%		
1	0.5	16%	12829.15	5881.17	4025.33	1909.67	841.76	-377.47	14%	1.29
2	0.5	17%	14674.98	7020.74	4970.47	2627.59	1441.52	82.65	15%	1.40
3	0.5	15%	11972.15	5323.82	3550.86	1532.64	515.84	-642.33	13%	1.23
4	0.5	18%	16314.21	8003.23	5775.02	3226.55	1934.87	452.75	16%	1.48
5	0.5	20%	17505.61	8687.33	6324.28	3622.21	2252.89	681.71	17%	1.54
6	0.5	5%	-210.03	-2223.44	-2722.73	-3253.98	-3498.10	-3743.73	-0%	0.48
7	0.5	17%	14185.54	6642.09	4627.75	2331.58	1172.52	-151.07	15%	1.35
8	0.5	19%	16285.44	7926.76	5690.06	3135.60	1843.06	362.69	16%	1.47
9	0.5	18%	15450.11	7426.92	5281.25	2832.06	1593.61	176.35	15%	1.43
10	0.5	15%	12113.04	5355.40	3556.97	1512.88	484.81	-684.04	13%	1.23
11	0.5	18%	15968.35	7769.05	5572.95	3063.21	1792.39	335.81	16%	1.46
12	0.5	16%	13260.34	6155.00	4255.37	2088.12	993.15	-258.38	14%	1.32
13	0.5	18%	14902.83	7133.85	5054.98	2681.09	1480.20	105.38	15%	1.40
14	0.5	20%	17212.32	8480.27	6143.14	3473.23	2121.68	572.78	16%	1.52
15	0.5	0%	-7291.45	-6630.20	-6394.20	-6066.58	-5864.09	-5581.78	-100%	0.00
16	0.5	38%	37786.78	21148.36	16646.88	11456.84	8799.41	5712.52	26%	2.59
17	0.5	40%	40367.40	22779.18	18012.96	12510.89	9689.73	6407.65	27%	2.72
18	0.5	42%	42451.08	24068.05	19084.78	13330.23	10378.33	6942.24	27%	2.82
19	0.5	41%	42190.10	23957.86	19012.17	13298.20	10365.49	6949.75	27%	2.82
20	0.5	38%	38601.49	21678.85	17096.47	11809.77	9100.93	5951.94	26%	2.63
21	0.5	36%	35451.92	19776.57	15532.99	10638.46	8131.49	5218.59	25%	2.49
22	0.5	39%	40092.83	22612.02	17875.84	12409.14	9606.50	6346.38	26%	2.71
23	0.5	41%	41553.09	23549.27	18667.28	13028.51	10135.37	6766.99	27%	2.78
24	0.5	37%	38167.44	21462.42	16935.88	11710.94	9032.25	5916.45	26%	2.62
25	0.5	42%	45624.22	26029.65	20713.76	14571.17	11417.82	7744.05	28%	2.97
26	0.5	38%	38835.19	21865.61	17267.49	11959.95	9238.86	6073.65	26%	2.65
27	0.5	5%	-401.27	-2355.77	-2838.07	-3348.73	-3581.72	-3813.65	-1%	0.46
28	0.5	0%	-7291.45	-6630.20	-6394.20	-6066.58	-5864.09	-5581.78	-100%	0.00
29	0.5	39%	40219.25	22716.51	17971.81	12493.14	9683.17	6413.06	27%	2.72
30	0.5	40%	40401.46	22829.72	18066.49	12566.46	9745.51	6462.54	27%	2.73
Orissa (average)/ha		25%	50975.33	27255.30	20859.60	13507.89	9758.07	5422.42	21%	1.98

Note: ha is hectare, NPV is net present value, IRR is internal rate of return, BCR is benefit-cost ratio and D.R. is discount rate.

Annexure 7.17 Results of the financial evaluation of the agriculture project in the Coastal Zone of Orissa.

Plot no.	Area of plot (ha)	NPV at varying discount rates (figures in Rs./ha at 1992-93 prices)						BCR at 10% D.R.
		0%	5%	7%	10%	12%	15%	
1	0.5	2164.26	1844.79	1734.04	1583.54	1492.58	1368.58	1.18
2	0.5	2848.88	2384.25	2227.06	2016.64	1891.22	1722.39	1.23
3	0.5	2470.06	2072.52	1936.74	1753.97	1644.48	1496.46	1.20
4	0.5	2234.20	1854.75	1725.65	1552.32	1448.77	1309.15	1.17
5	0.5	2105.68	1661.65	1510.98	1309.89	1190.72	1031.67	1.16
6	0.5	2221.90	1722.70	1556.32	1336.46	1207.33	1036.26	1.16
7	0.5	1685.22	1231.39	1083.70	891.58	780.49	635.54	1.11
8	0.5	1574.45	1086.91	929.86	726.92	610.37	459.29	1.09
9	0.5	4153.11	3427.89	3187.58	2870.02	2683.04	2434.11	1.36
10	0.5	1519.47	1062.29	914.27	722.40	611.86	468.15	1.09
11	0.5	2770.18	2075.95	1853.05	1564.94	1399.12	1183.33	1.19
12	0.5	2491.56	1854.98	1650.96	1387.57	1236.16	1039.38	1.17
13	0.5	2567.74	1953.59	1755.04	1497.32	1348.38	1153.81	1.18
14	0.5	2520.50	1914.93	1719.37	1465.69	1319.20	1127.98	1.18
15	0.5	2360.28	1763.62	1572.61	1326.24	1184.77	1001.08	1.16
16	0.5	520.67	569.25	570.85	561.44	549.63	526.51	1.06
17	0.5	-716.35	-345.95	-241.99	-120.14	-57.07	16.32	0.99
18	0.5	730.52	773.10	771.38	756.47	740.76	711.66	1.08
19	0.5	556.73	641.75	652.76	653.64	646.69	628.59	1.07
20	0.5	878.54	851.38	829.21	789.48	760.41	715.03	1.09
21	0.5	1780.77	1394.03	1263.28	1089.01	985.84	848.17	1.12
22	0.5	1893.17	1510.20	1379.66	1204.83	1100.86	961.55	1.14
23	0.5	1546.36	1226.80	1116.87	969.01	880.80	762.37	1.11
24	0.5	1540.74	1219.42	1108.88	960.20	871.50	752.40	1.11
25	0.5	1237.59	992.36	905.26	786.10	713.97	615.95	1.09
26	0.5	1645.88	1281.62	1158.95	995.93	899.69	771.64	1.11
27	0.5	2448.68	1842.62	1648.36	1397.61	1253.45	1066.06	1.17
28	0.5	2757.62	2069.80	1850.62	1568.63	1407.03	1197.54	1.19
29	0.5	2666.63	1988.66	1773.64	1497.79	1340.15	1136.30	1.18
30	0.5	13021.90	10106.05	9161.84	7934.36	7223.82	6293.96	1.96
Orissa ( average)/ha		4546.46	3602.22	3287.12	2869.99	2624.40	2298.08	1.17

Note: ha is hectare, NPV is net present value, IRR is internal rate of return, BCR is benefit-cost ratio and D.R. is discount rate.

**Annexure 7.18 The composition of the average market value from intermediate and final products derived from the agroforestry and forestry projects.**

( figures in Rs./ha at 1992-93 prices)

<b>Outputs</b>	<b>Agroforestry</b>	<b>Forestry</b>	<b>Average</b>
1. Agricultural outputs	6753.27	Nil	6753.27
2. Forestry outputs			
a. Intermediate products			
i. Dry leaves	166.85	155.56	161.20
ii. Twigs	450.18	492.00	471.10
iii. Grasses	78.40	73.60	76.00
iv. Poles	847.05	767.89	807.47
v. Bamboo	315.07	433.89	374.48
b. Timber (estimated)	75023.80	67297.90	71160.85
c. Firewood (estimated)	5839.52	5537.28	5688.40

Source: Based on the questionnaire survey.



**Annexure 9.1 Results of regression analysis.**

<b>Agroforestry project</b>					
Dependent variable is NPV ( in Rs/hectare) Independent variable is survival percentage of trees		Dependent variable is NPV ( in Rs/hectare) Independent variable is volume per tree		Dependent variable is NPV ( in Rs/hectare) Independent variables are survival percentage of trees and volume per tree	
<b>Regression Output:</b>		<b>Regression Output:</b>		<b>Regression Output:</b>	
Constant	-5282.639	Constant	-5977.23	Constant	-5618.77907
Std Err of Y Est	1238.8457	Std Err of Y Est	5042.522	Std Err of Y Est	1241.5773
R Squared	0.9654789	R Squared	0.42806	R Squared	0.965836
No. of Observations	70	No. of Observations	70	No. of Observations	70
Degrees of Freedom	68	Degrees of Freedom	68	Degrees of Freedom	67
X Coefficient(s)	42392	X Coefficient(s)	307933	X Coefficient(s)	41691.866      11726.7808
Std Err of Coef.	972.07	Std Err of Coef.	43164	Std Err of Coef.	1283.8      14005.08877
T statistics	43.61	T statistics	7.1341	T statistics	32.47535      0.83732
<b>Forestry project</b>					
Dependent variable is NPV ( in Rs/hectare) Independent variable is survival percentage of trees		Dependent variable is NPV ( in Rs/hectare) Independent variable is volume per tree		Dependent variable is NPV ( in Rs/hectare) Independent variables are survival percentage of trees and volume per tree	
<b>Regression Output:</b>		<b>Regression Output:</b>		<b>Regression Output:</b>	
Constant	-5906.71	Constant	-7412.26	Constant	-6519.588
Std Err of Y Est	808.51524	Std Err of Y Est	4445.957	Std Err of Y Est	790.9465
R Squared	0.9803365	R Squared	0.40541	R Squared	0.981458
No. of Observations	70	No. of Observations	70	No. of Observations	70
Degrees of Freedom	68	Degrees of Freedom	68	Degrees of Freedom	67
X Coefficient(s)	47835	X Coefficient(s)	315763	X Coefficient(s)	46567.872      21096.6552
Std Err of Coef.	821.55	Std Err of Coef.	46373	Std Err of Coef.	1020.6883      10477.3
T statistics	58.225	T statistics	6.8092	T statistics	45.62398      2.01355

## **APPENDICES**

## Appendix 1.1

### Tribal Groups of Orissa

The tribal population constitutes nearly 23% of the total population of Orissa. This is three times more than the national average of 8%. There are nearly 60 tribal groups which are found in a contiguous belt extending from north, west and south of the state (ORG,1993). The majority of the tribal population are concentrated in six tribal intensive districts namely Koraput, Phulbani, Mayurbhanj, Sundargarh, Sambalpur and Keonjhar. The distribution of tribal groups in three agro-ecological zones of Orissa is given below in Table 1.

**Table 1 The distribution of tribal groups in Orissa.**

Agro-ecological zone	District	Tribal groups
1. Northern Zone	1. Keonjhar	Bhuyan, Ho, Santhal, Juang, Bhumija
	2. Sundargarh	Bhumija, Ho, Gond, Kant, Kharia, Kisan, Munda, Oraon
	3. Mayurbhanj	Bhumija, Santhal, Lodha
	4. Dhenkanal	Batkudi, Bhumija, Bhuiyan, Gond, Juang, Saora, Shabar
2. Central Zone	5. Sambalpur	Bhuiyan, Chamar, Gond, Kant, Khadia, Kisan, Munda, Oraon, Pab
	6. Bolangir	Gond
3. Coastal Zone	7. Cuttack	Gond, Chamar
	8. Balasore	Bhumija, Santhal
	9. Puri	Gond, Chamar
	10. Ganjam	Kharia, Bhumija, Bhuiyan, Gond, Juang, Kohla, Munda, Santhal

Source: ORG (1993).

Tribals in Orissa are socially, economically and politically backward and are closely associated with the forest for their livelihood (Sharma,1990). They generally live in a secluded place mainly inside forest or remote areas with least exposure to the outside world. Deforestation has a direct adverse effect on the livelihood of the tribal population.

## **Appendix 2.1**

### **A Description and Classification of Wastelands in India**

#### **1 Description**

With increasing human and animal pressure on land, the production of vegetation for food and other uses has extended to areas under great ecological stress and less favourable environment. The growing demand for fuel, fodder, wood and food has extensively depleted protective plant cover and exposed surface soils to pressure and degradation which have resulted in partial or even complete loss of productivity.

The National Wasteland Development Board (NWDB) has defined wasteland as the "land which can be brought under vegetative cover with reasonable effort and is deteriorating for lack of appropriate water and soil management". Wasteland which could be improved by application of scientific, technological and other resources so as to provide economically and ecologically viable vegetative cover, may fall under private and public ownership. Public ownership means community lands, government forest lands, departmental lands and likewise. Reclaiming such degraded land and putting it into good use is a multi-dimensional problem (NWDB,1989).

#### **2 Classification**

Based on physical or chemical features, NWDB (1987) has classified the waste land into the following types.

##### **2.1 Gullied land**

The gullies are formed as a result of localised surface run off affecting the unconsolidated material resulting in the formation of perceptible channels causing undulating terrain. The gullies are the first stage of excessive land dissection followed by networking which lead to the ravinous land.

##### **2.2 Ravinous land**

The word ravine is usually associated not with an isolated gully but a network of gullies formed generally in deep alluvium and entering a nearby river and flowing much

lower than the surrounding table lands. Ravines are the extensive system of gullies usually developed along river courses.

### **2.3 Upland with or without scrub**

This land is caused due to excessive erosion and may or may not have scrub cover. Such land occupies relatively high topographic locations but excludes hilly and mountainous terrain.

### **2.4 Waterlogged and marshy land**

This is land where the water is at or near the surface and water stands for most of the year, however, the surface water bodies like lakes, ponds and tanks do not fall under this category.

### **2.5 Saline/ alkaline soil**

Salt affected land is generally characterised by presence of excessive soluble salts (saline) or high exchangeable sodium which has adverse effect on growth of plants. Alkali soil has an exchangeable sodium percentage (ESP) of about 15 which is generally considered as the limit between normal and alkali soil.

### **2.6 Shifting cultivation area**

Such land is the result of the cyclical land use consisting of felling of trees and burning of forest areas for growing crops. This results in extensive soil losses, land degradation and extinction of flora and fauna. Sandy areas are those which have established in coastal or island areas.

### **2.7 Wasteland arising due to mining and industrial activities**

Lands where mining activities bring about the deterioration of land whereas industrial lands are deteriorated on account of large scale industrial discharge.

### **2.8 Bouldery land**

These lands have been subject to fluvial action in recent past resulting in the presence of gravel boulders at the surface and or in sub-soil.

## **Appendix 2.2**

### **Recommendations of the National Commission on Agriculture (NCA) related to Forestry Development**

1. Forest department should organise extension units in the districts, to propagate the methods of tree plantation with the help of the agricultural extension staffs.
2. Development of fodder and grass should be made as an important component of mixed forestry with the optimum input and technology.
3. Degraded forest should be rehabilitated.
4. Afforestation along the railway line, canals and roads should be taken up by the forest department.
5. The state government should identify areas of degraded forest with the consumption of forest produce by adjoining population.
6. Farm forestry should be organised on a large scale so that planting of trees on bunds and boundaries of the field of farmers is taken up by the farmers themselves.
7. Selection of species in farm forestry should be taken into account with the acceptability of the farmers and local needs.
8. An afforestation programme should be able to supply the fuelwood and small timber
9. In order to provide additional employment to the landless labour, the state government should take up agri-silviculture .
10. In order to monitor the progress of the social forestry projects, financially supported by the central government - a cell in the centre should be created to undertake frequent appraisal work. Extension organisation at state level should also be organised.
11. A pilot scheme for development of farm forestry should be taken up in 100 selected districts in the country during fifth FYP.
12. All social forestry programme should be executed by engaging local labour and no contract system should be introduced.
13. To popularise the social forestry programme field demonstration with involvement of local panchayat, Co-operatives and state government should be involved.

## **Appendix 2.3**

### **Village Forest Committee (VFC) and Joint management Plan (JMP)**

The Social Forestry Project in Orissa has two management instruments which are the foundation for implementing the aims of the project. These are the Village Forest Committee (VFC) and the Joint Management Plan (JMP). The VFC is an organisation collaborating with the project official at the village level whereas the JMP is a document through which the relation between the project and the village is manifested and regulated.

**1. The VFC :** The VFC is the counterpart of the social forestry staff in the village. The social forestry official such as the Village Forest Worker (VFC), the Social Forestry Supervisor (SFS) and the Deputy Director of social forestry in the district are responsible for constituting the VFC. It is a statutory body formed under the provision of village forest rules (Patnaik et al., 1989) and has specified duties and responsibilities as enumerated below.

- a. Selection of site and demarcation of area for social forestry programme in collaboration with the village forest worker.
- b. Identification of landless poor for providing employment.
- c. Organising the training of villagers to teach them the needs and benefits of plantation.
- d. Identification of the FFRP beneficiaries.
- e. Preparation of JMP.
- f. Ensure the equitable distribution of produce and other benefits from plantation among villagers giving preference to the requirements of the weaker sections of the communities.

**2. JMP:** The joint management plan is an agreement between the Social Forestry Project and the village. It constitutes the instruments for the execution of the project in the village. It has the status of a legal document and defines the legal rights of the community to the resources referred to in the plans as well as the obligations and responsibilities of project staff and the village. Thus the preparation of the JMP is crucial in achieving the aims and objectives of the project. The JMP deals with,

- a. Decision arrived regarding species to be planted and their purpose,

- b. Details of employment of village labour for various plantation operations such as site, preparation, pitting, planting and weeding,
- c. Methods of protection of the community plantations,
- d. Mode of distribution of resources and benefits for village wood lot.

The JMP consists of four parts. The first part is the summary of the existing resources in village. The second part deals with the issues related to the selection of plantation site, compartment and species. In the third part, the technical aspects of nursery and plantation establishment are dealt with along with the issues related to employment of worker and their working conditions. The last and the fourth part deals with the administrative, legal and management aspects of the project.



## Appendix 5.1

### Part 1

#### Village Profile

**Name of village** \_\_\_\_\_

**Name of district** \_\_\_\_\_

**Name of agro-ecological zone** \_\_\_\_\_

#### 1. Population details

a. Total population \_\_\_\_\_

b. No. of household \_\_\_\_\_

c. No. of big farmers \_\_\_\_\_

d. No. of small farmers \_\_\_\_\_

e. No. of marginal farmers \_\_\_\_\_

f. No. of landless people \_\_\_\_\_

#### 2. Livestock details

a. Total \_\_\_\_\_

b. Cattle \_\_\_\_\_

c. Goat /sheep \_\_\_\_\_

d. Others (specify, if any) \_\_\_\_\_

#### 3. Land use details

a. Total land \_\_\_\_\_

b. Agricultural land \_\_\_\_\_

c. Forest land \_\_\_\_\_

d. Grazing land \_\_\_\_\_

e. Wasteland \_\_\_\_\_

## Appendix 5.1

### Part 2

### Main Questionnaire for Field Survey in Orissa (India)

Name of respondent \_\_\_\_\_

Name of village \_\_\_\_\_

Name of district \_\_\_\_\_

Name of agro-ecological zone \_\_\_\_\_

#### [A] Participant's socio-economic profile

1. How many members are in your family ?

Male (adult)	[ ] <sup>1</sup>	Female (adult)	[ ] <sup>2</sup>
Children	[ ] <sup>3</sup>	Total	[ ] <sup>4</sup>

2. Which of the following groups do you belong to ?

Scheduled caste	[ ] <sup>1</sup>	Scheduled tribe	[ ] <sup>2</sup>
Other (specify, if any)	[ ] <sup>3</sup>		

3. Please say whether you are

Literate	[ ] <sup>1</sup>	Illiterate	[ ] <sup>2</sup>
----------	------------------	------------	------------------

4. What is your occupation ?

Agriculture labour	[ ] <sup>1</sup>	Non-agriculture labour	[ ] <sup>2</sup>
Other (specify, if any)	[ ] <sup>3</sup>		

5. Are you a

Full time worker	[ ] <sup>1</sup>	Part time worker	[ ] <sup>2</sup>
Seasonal worker	[ ] <sup>3</sup>		

6. What is the total monthly income of your family from all sources ?

Source	Income (Rs.)
(a) Agricultural wages	
(b) Non-agricultural profession i. ii.	
(c) Others (specify if any) i. ii.	

**[ B ] Participant's basic consumption needs**

7. How much do you consume and how much do you spend each day on the following goods in your family ?

Goods	Quantity (gms.)	Expenditure (Rs.)
<b>i. Cereal / food grain</b> a. Rice b. Wheat c. Others (specify, if any)		
<b>ii. Pulses and there products</b> a. b.		
<b>iii. Fruits and vegetables</b> a.. b c.		
<b>iv. Milk and milk products</b>		
<b>v. Non-veg. items</b> a. Meat b. Fish/eggs c.		
<b>vi. Vanaspati and edible oils</b> a. b. c.		
<b>vii. Sugar</b>		
<b>viii. Others (specify, if any)</b>		
<b>Total (food)</b>		

8. How much do you spend monthly on clothing requirements in your family ?

Members	Monthly expenses (Rs.)
1. Male	
2. Female	
3. Children	

9. How much do you require and how much do you spend monthly on following items (fuel, light and housing requirements) in your family ?

Items	Monthly requirement	Monthly expenses (Rs.)
<b>i. Fuel</b>		
a. Fuelwood		
b. Dung cake		
c. Others (specify,if any)		
<b>ii. Light</b>		
a. Kerosene oil		
b. Electricity		
c. Others (specify,if any)		
<b>iii. Housing</b>		
a. Forest materials		
b. Others(specify,if any)		
<b>iv. Others</b>		

10. How do you manage the medical treatment of yourself and your family ?

- Private treatment on own expenses [ ]<sup>1</sup>
- Free treatment in government hospital [ ]<sup>2</sup>
- Partly private and partly free (specify, % in each) [ ]<sup>3</sup>
- No treatment [ ]<sup>4</sup>
- Others (specify, if any) [ ]<sup>5</sup>

11. How do you manage the education of your children ?

- Free education in government school [ ]<sup>1</sup>
- Private education on own cost [ ]<sup>2</sup>
- No education [ ]<sup>3</sup>
- Others (specify, if any) [ ]<sup>4</sup>

**(C) Participant's knowledge and awareness about project**

12. Which of the following is the object of raising the FFRP ?

- To fulfil subsistence needs of food, fuel, fodder and timber [ ]<sup>1</sup>
- To earn additional income [ ]<sup>2</sup> Both [ ]<sup>3</sup>
- Others (specify,if any) [ ]<sup>4</sup> Do not know [ ]<sup>5</sup>

13. Did you aware about the rights and obligations of the FFRP since beginning of the project ?

- Yes [ ]<sup>1</sup> No [ ]<sup>2</sup>

14. How the land used in the FFRP/ Agriculture were in use earlier ?

- Barren and degraded land used for grazing [ ]<sup>1</sup>
- Barren and degraded land without any use [ ]<sup>2</sup>
- cultivated land [ ]<sup>3</sup> Other (specify, if any) [ ]<sup>4</sup>
- Do not know [ ]<sup>5</sup>

**(D) Participant's involvement in the FFRP**

15. What is the present survival percentage of main tree species in your plot ?

- Low (<25%) [ ]<sup>1</sup> Moderate (25-50%) [ ]<sup>2</sup>
- High (>50%) [ ]<sup>3</sup> Do not know [ ]<sup>4</sup>

16. If survival is low in q. no. 15, can you explain why ?

**a. Socio-economic reasons**

- i.
- ii.
- iii.
- iv.

**b. Agro-climatic reasons**

- i.
- ii.
- iii.
- iv.

17. If survival is moderate or high in q. no. 15, can you explain why ?

**a. Socio-economic reasons**

- i.
- ii.
- iii.
- iv.

**b. Agro-climatic reasons**

- i.
- ii.
- iii.
- iv.

**(E) Benefits from the FFRP**

18. Did you get agricultural produce from your FFRP plot ?

Yes [ ]<sup>1</sup> No [ ]<sup>2</sup>

19. If yes to q. no. 18, how did you use the harvested produce ?

Own consumption (100%) [ ]<sup>1</sup> Sold (100%) [ ]<sup>2</sup>

Partially consumed partially sold [ ]<sup>3</sup> Other (specify,if any) [ ]<sup>4</sup>  
(state % in both)

Do not know [ ]<sup>5</sup>

20. Did you get any intermediate produce from your FFRP plot ?

Yes [ ]<sup>1</sup> No [ ]<sup>2</sup>

21. If yes to q. no.20, please tell how did you use them ?

Own consumption (100%) [ ]<sup>1</sup> Sold (100%) [ ]<sup>2</sup>

Partially consumed and partially sold [ ]<sup>3</sup> Other(specify,if any) [ ]<sup>4</sup>  
(state percentages in each)

Do not know [ ]<sup>5</sup>

22. Did you harvest trees from your FFRP plot ?

Yes [ ]<sup>1</sup> No [ ]<sup>2</sup>

23. If no to q. no. 22, tell the main reasons ?

- i.
- ii.
- iii.
- iv.
- v.

24. Do you think the FFRP has helped you in fulfilling the basic needs of your family ?

Yes [ ]<sup>1</sup> No [ ]<sup>2</sup>

25. If yes to q. no. 24, tell the extent of basic needs fulfilment ?

0-25% [ ]<sup>1</sup> 25-50% [ ]<sup>2</sup>  
 50-75% [ ]<sup>3</sup> 75-100% [ ]<sup>4</sup>  
 100% [ ]<sup>5</sup> Other (specify, if any) [ ]<sup>6</sup>

26. Do you think the FFRP has helped in increasing the income of your family ?

Yes [ ]<sup>1</sup> No [ ]<sup>2</sup>

27. If yes to q. no. 26, tell how it has increased your income ?

Providing employment [ ]<sup>1</sup> Employment+sale of forest produce [ ]<sup>2</sup>  
 Employment+sale of agril produce + sale of forest produce [ ]<sup>3</sup>  
 Other (specify, if any) [ ]<sup>4</sup>

**(F) Attitudes and opinions of participants about the FFRP**

28. What is your opinion about the quality of land selected for the FFRP ?

Appropriate for forestry [ ]<sup>1</sup>  
 More appropriate for forestry than agriculture [ ]<sup>2</sup>  
 Inappropriate for forestry [ ]<sup>3</sup> Inappropriate for Agriculture [ ]<sup>4</sup>  
 Inappropriate for agriculture and forestry both [ ]<sup>5</sup>  
 Other (specify, if any) [ ]<sup>6</sup>  
 Do not Know [ ]<sup>7</sup>

29. Do you agree with the suitability of tree species planted in your FFRP plot ?

Yes [ ]<sup>1</sup> No [ ]<sup>2</sup>

30. Do you think the existing marketing facilities for agricultural and forest produce are adequate ?

Yes [ ]<sup>1</sup> No [ ]<sup>2</sup>

31. If no to q. no. 30, please suggest the measures to improve the conditions ?

- i.
- ii.
- iii.
- iv.
- v.

32. Are you willing to participate in FFRP in future ?

Yes [ ]<sup>1</sup> No [ ]<sup>2</sup>

33. If yes to q. no. 32, can you tell the important reasons ?

- i.
- ii.
- iii.
- iv.
- v.

34. How do you plan to utilise the revenue received after the final harvest of your FFRP plot ?

- i
- ii
- iii
- iv
- v.

35. How will the *Eucalyptus hybrid* wood be used after its final harvest ?

- i
- ii
- iii
- iv.
- v



## **Appendix 5.2**

### **Planning for the Field Work in Orissa (India)**

With an object to collect a large quantum of qualitative as well as quantitative data for intended study, it was felt necessary to proceed for field study in Orissa state of India. Before proceeding for the above study, a well structured and carefully designed questionnaire and formats were developed in the first nine months of the study. Necessary permission was taken from the Director, the Social Forestry Project Orissa in advance. The supervisor of the studies Mr. T. H. Thomas initiated the request letter to the Director, Social Forestry Project, Orissa for extending all possible help in course of the field survey (Appendix 5.2a). Consequent upon the realisation of the importance of the study, the Director Social Forestry Project, Orissa showed a very quick and encouraging response and requested his joint directors and deputy directors for extending all possible help during the survey (Appendix 5.2b).

After receiving positive response with regards to help and co-operation, field survey was conducted between mid October 1993 to mid March 1994 and relevant information were collected within the stipulated six months time.

5.2a



1st September 1993.

Mr. S. Bose, I.F.S.  
 Director,  
 Social Forestry Project,  
 Orissa 1,  
 Suryanagar,  
 Bhubneswar,  
 Orissa,  
 India.

SCHOOL OF AGRICULTURAL AND FOREST SCIENCES  
 YSGOL GWYDDORAU AMAETH A CHOEDWIGAETH  
 UNIVERSITY COLLEGE OF NORTH WALES  
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 Bangor, Gwynedd LL57 2UW, UK  
 Tel/Ffôn: (0248) 351151  
 Fax/Ffacs: (0248) 354997

Dear Mr. Bose,

May I introduce myself. My name is Terry. H. Thomas. I am the supervisor of Mr. J.P. Singh. Mr. Singh is undertaking Ph.D. studies in Agroforestry. He has intended to do research on Evaluation of Agroforestry with particular reference to Basic Needs Fulfilment in Orissa. For the above studies Mr. Singh needs relevant data pertaining to the Social Forestry Project in general and FFRP component in particular from the Social Forestry Project of Orissa. He has planned to go to Orissa to collect the above data during mid October 1993 to mid March 1994. He intends to collect socio-economic data from various sampled districts of the whole of Orissa.

To collect these data he will be required to consult some of the pertinent documents from your office as well as from the office of the various social forestry divisions of the State. Beside these he would also require the co-operation of relevant field staff of the various social forestry divisions. Without help of your field and official staff Mr. Singh will be unable to collect his intended data.

I would appreciate therefore if the necessary help would be extended through your office and field staff to Mr. Singh so that he can complete his targeted job. I plan to also visit Orissa sometime in November 1993 during the course of Mr. Singh's field survey. It would be helpful to meet you at that time. Mr. Singh will let you know the exact programme of my visit and details of his project and requirements.

With best wishes,

Yours sincerely,

T.H. Thomas  
 Senior Tutor

5.2b

S. BOSE, IFS  
Director



Social Forestry Project, Orissa  
Bhubaneswar  
OH 406576  
Res 56476

No. 5693 dt 12.10.93

To

All Deputy Directors,  
Social Forestry Project,  
Orissa.

Sub:

Field study by Sri J.P. Singh, IFS

Please find herewith a copy of letter of Terry H. Thomas, Senior Tutor addressed to me which will speak for itself. I had requested to all Regional Joint Directors to request you to extend assistance to Mr. Singh during collection of information required for his research work. I suppose your RJD might have already written to you in this regard.

You are, however, requested to extend all possible assistance to Mr. Singh in this mission irrespective of fact whether you had received such instructions from your RJD or not. His guide Mr. Terry H. Thomas, Senior Tutor is expected to visit from 9th to 18th Nov. 1993. Please ~~take~~ necessary field visits on this occasion also.

L organize

*[Signature]*  
12.X.93  
DIRECTOR

Memo No. 5694 / dt 12-10-93

Copy to all Regional Joint Directors, SFP  
Orissa for information and necessary action in continuation of this office letter No. 6114 dt. 21.9.93.

*[Signature]*  
12.X.93  
DIRECTOR

Memo No. 5695 / Dt. 12.10.93

Copy to Sri J.P. Singh, IFS, for information and necessary action. He is requested to meet the officers concerned for his research work.

*[Signature]*  
12.X.93  
DIRECTOR

## Appendix 5.3

### Silvicultural Notes of Some of the tree Species Planted under the FFRP

#### 1. *Eucalyptus* hybrid (*Eucalyptus tereticornis*)

*Eucalyptus* hybrid is an exotic species and is commonly known as Mysore gum in India. Boland (1981) believes that the *Eucalyptus* hybrid is principally a typical Australian *Eucalyptus tereticornis* probably from the southern provenance and that many *Eucalyptus* hybrid plantations in India contain some mixture of *Eucalyptus camendulensis*. *Eucalyptus* hybrid was first grown in on a plantation scale in 1952 in Karnataka state of India. Since then, this species has been planted extensively under varying climatic and edaphic conditions throughout the country. On account of its quick growth, drought resistant, high yielding capacity, coppicing power, low susceptibility to grazing and browsing, good fuelwood and small timber and its adaptability to differing environmental conditions, it has come to occupy an important place in the present farm forestry in India (Sharma, 1978).

The *Eucalyptus* wood produces good raw materials for the paper and pulp industries. Barks and leaves are used for producing oxalic acids and oil for medicinal purposes (Sharma, 1990) respectively. It is also used as a fuelwood for domestic cooking and heating. The wood of *Eucalyptus* hybrid is heavy and burns slowly (calorific value = 4800 cal/gm, Sharma, 1990). The trees of *Eucalyptus* hybrid are harvested at short rotations for maximum profitability (7 to 9 years, Chaturvedi, 1986).

#### 2 *Acacia auriculiformis*

*Acacia auriculiformis* commonly known as sunajhari in Orissa is an indigenous species of India. It is a short rotation crop which provides good fuelwood and small timber. This species belongs to family Leguminosae and can be propagated either by planting of seedlings or by direct sowing. The tree seeds profusely every year. It is an evergreen species and is not browsed by cattle. The species can be grown in varying climatic conditions like *Eucalyptus* hybrid and can withstand the adverse climatic conditions. It is also a drought resistant species and provides profuse shade during summer. The leaves and branches are used as fuel for domestic cooking and heating. The trees have a short rotation age and are usually harvested between 7 to 10 years; however, the species does not coppice well.

### **3. *Acacia nilotica***

*Acacia nilotica* commonly known as babul in Orissa belongs to family Leguminosae and can be propagated either through direct sowing or by planting. The species has a wide distribution ranging from semi-arid regions of Rajasthan in the north to southern and eastern parts such as Orissa and Bihar. The species is a moderate sized and spiny evergreen trees which grows up to a height of 20 metres.

The leaves and barks of *Acacia nilotica* provide an excellent fodder for goats and sheep and this is the reason the species is more prone to grazing and browsing. Its bark is also used in making gums (gum arabic) and in tanning purposes. The wood is heavy and is used as fuelwood and charcoal making. It can tolerate high temperature but susceptible to frost. The species is not a coppicer and grows well on black cotton soil and even saline soil having adequate moisture.

### **3. *Dalbergia sissoo***

*Dalbergia sissoo* commonly known as sissoo in Orissa, is a fast growing species and can be propagated through almost all the common methods such as direct sowing, entire transplanting, stumps planting and root seedlings. The species is widely grown in many parts of the country such as Orissa, Harayana, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Maharastra and Gujarat. The species is suitable for fuelwood, fodder charcoal and timber. The timber is used for various purposes such as in making agricultural implements, furniture and musical instruments. The species needs protection because of its vulnerability to grazing and browsing. It coppices well and is frost hardy.

## **Appendix 7.1**

### **A copy of the Spreadsheet in Quattro Pro (V 4.0) Showing the Computation for the Financial Evaluation**

As stated in Chapter 7, the computations for financial evaluation of three projects have been carried out by using a spreadsheet (Borland Quattro Pro V 4.0). Three different spreadsheets have been developed for three agro-ecological zones each covering three projects. A spreadsheet is a computerised version of a blank page comprising rows and columns of data which are used to undertake either simple or in some cases very complex calculations very quickly. It is therefore referred to as a transparent tool. (Thomas et al.,1989). Typically similar groups of variables which may provide input to a calculation, for example schedules of product prices or input costs are grouped together in panels. The results of the calculation, let us say profitability are similarly grouped together in an another panel. Panels may extend horizontally to the right on the screen or vertically downward or both in each case extending from home which may be thought of as top left hand corner of the page.

In terms of the design of the spreadsheet used here the basic computational arrangements have been kept similar in all cases. In the home area of the spreadsheet, the cost and price schedule of inputs and outputs involved in the projects are given. Moving to the right, the overall results of the financial evaluation for each of the individual plots under each project is presented. Further rights are the details of the annual real costs and benefits and net cash-flows of individual plots of three projects. Thus the spreadsheets 1, 2 and 3 give the details of the financial evaluations of the Northern, Central and the Coastal Zone respectively each covering agroforestry, forestry and agriculture projects. A copy of the print out for the Northern Zone (for example) is kept in the pouch at the covering end of the thesis.

## **Appendix 8.1**

### **Identification of Basic Needs Goods and Estimation of Basic Needs Income for Orissa**

The identification of basic needs goods and estimation of basic needs income are the two pre-requisites for the application of basic needs analysis. These are important because basic needs goods directly enter the consumption basket and basic needs income provides the necessary purchasing power. What constitute basic needs goods and what do not, however, is a debatable and subjective issue, an attempt here is made to identify the basic needs goods and estimate the basic needs income in the light of the improvement suggested in Nair's approach in Chapter 4. Emphasis has been given to the identification of the goods and services which are particularly relevant to the land use projects of Orissa.

#### **1 Identification of basic needs goods**

Based on the ILO's (1976 and 1977) definition, the goods and services needed to maintain a minimum standard of living in Orissa can be grouped into (a) private consumption goods, such as food, shelter, clothing, fuelwood, and (b) private utilities services such as health care, education, drinking water and sanitation. A brief description for identification of each item is given below.

##### **1.1 Private consumption goods**

###### **1.1.1 Food**

Various studies have been undertaken to work out the requirements of a minimum balanced diet in terms of per capita calorie and protein intake sufficient to maintain the human's physiological functions. The average per capita calorie norm prescribed in India ranges between 2100 and 2400 (Sinha et al., 1979; GOI, 1993). An intake norm of 2250 calories per day has been adopted by Dandekar and Rath (1971) for estimating poverty in India and Panikkar (1979) adopted a daily intake norm of 2200 calories for agricultural labourers in Kerala.

The usual procedure adopted to estimate the basic needs income (or the estimation of poverty line) in Indian conditions is that the minimum prescribed diet is costed at market prices. The figure so obtained is then adjusted using a ratio of food to total expenditure in order to know the necessary minimum expenditure on non-food items.

Under the constitution of India and her states, the public utilities services are supposed to be provided free by the concerned state or central government (GOI, 1993). So the cost incurred in public utilities services such as education and health care is not included in the consumption expenditure of an individual. The above approach is based on two assumptions (GOI, 1993). Firstly, that the calorie requirement pattern in individual states population in various states of India follows the all India pattern. Secondly, the price structure of the consumption basket and the price trends are identical across states.

However, there are important inter-state differences in terms of population and activity status as well as in climate and topography which need to be reflected in calorie requirements. Accordingly the normative calorie requirement would differ from state to state within India. It is also inherent in the poverty line concept that non-food expenditure such as fuelwood, clothing and housing are not normally estimated in the same way as food components. Rather a food: non-food ratio is fixed in order to account for necessary minimum expenditure on non-food items.

Household surveys generally fail to take into account the consumption derived from the non-monetised sector, especially free goods such as fuel from the forest and cattle dung from fields and common paths. This is because of the difficulty in estimating quantities and imputed prices.

Hence, a practical and realistic approach to the estimation of basic needs income will have to be based on (a) the estimation of the state-specific poverty line which would reflect the inter-state differences in population, activity composition, climate, topography and price structure; (b) the estimation of monetary value of non-monetised goods and (c) the estimation of both food and non-food expenditure .

In line with the above approach, a household survey of 210 rural poor was conducted. Appendix 5.1 gives a set of questions (q. nos. 7 - 11) used for the purpose. Using this information consumption baskets containing food and non-food items for three agro-ecological zones were prepared. Table 6.4 in chapter 6 presents the consumption baskets for the three zones. The average of the three zones was computed to identify the consumption basket for Orissa as a whole. Then nutrient availability with regard to the calorie and protein contents of the food components was estimated with the help of the medical bio-chemistry books (Malhotra, 1993 and Park and Park, 1989). Finally, the monthly expenditure on each item was estimated. Table 1 below gives the component of



the food basket, daily requirements, nutrient availability and monthly expenditure for the consumption basket for Orissa.

Calorie consumption (2500 calories) in rural Orissa is slightly above the national recommended average of 2400. This is due to the higher consumption of cereals, particularly rice, by the majority of population who are engaged in physical work such as agricultural labour. However, the average protein consumption (51grams) is less than that of the national recommended prescription of 58 grams (Malhotra, 1993). This happens due to the lower consumption of protein-rich foods which usually cost more than cereals. Low consumption of food items other than cereals is also due to relatively high cost.

## **1.2 Clothing**

Clothing is one of the most important non-food items in the basic needs consumption basket of the rural poor. Although it is difficult to estimate precisely the requirement of clothing merely on biological needs, it is plausible to assume that low income groups in Orissa usually consume the cheapest quality of coarse cotton and synthetic textiles (GOO, 1993). The average amount spent on clothing as gathered from the household survey is given below in Table 1 and this is assumed to be the basic needs consumption of clothing.

## **1.3 Fuelwood**

Fuelwood is the major source of domestic energy for the rural poor in Orissa. Nearly 95% of the low income families use fuelwood for cooking and heating (OFD, 1989). National level surveys generally underestimate the expenditure on fuelwood because a major portion of the fuelwood is procured free from forests and wasteland. Several studies have been made to estimate the quantity of fuelwood needed for domestic consumption. Shah (1988) estimated the daily per capita fuelwood consumption in India as 1kg while Openshaw (1974) suggested 2.7 kgs. for the developing world as a whole. Shah's estimate for firewood consumption can be used as a rough estimate for Orissa.

The low income group in Orissa does not spend money directly on firewood, but their time and effort spent in procuring the firewood cannot be ignored. Thus the foregone value of time and effort can be considered as the imputed price of the firewood.

Families in Orissa on average spend half a day to collect about 20 kgs of firewood from the nearby forest (Kumar, 1994; Singh, 1994 and Pathak,1994). Assuming per capita per day consumption of 1 kg (Shah,1988) of firewood, one person can manage for 20 days using the firewood collected from a half day's effort. The marginal productivity of this labour is estimated as 42% of a fully employed worker (Appendix 8.4) and current daily wage rate for labour employed in the Social Forestry Project in Orissa is Rs. 25/working day (OFD, 1993). Using this information the forgone wage benefits in the collection of 20 kgs of firewood would be Rs. 5.04 (i.e.  $25 \times 1/2 \times 0.42$ ). Thus the imputed price of 1 kg of firewood would be Rs. 0.25 which is less than the market price (Rs. 0.50 to 0.75 per kg) of firewood in Orissa.

## **1.4 Housing**

Unlike the prescribed norm for the minimum food requirement, no precise information is available as to what constitutes the minimum housing requirement. However, the average amount spent on construction and repair of low cost houses owned by the rural poor can be considered as the basic needs requirement on housing (Nair, 1981). This has been estimated through household survey. The houses owned by the rural poor in Orissa are made from locally available materials such as bamboo, grass and sunburnt bricks. These materials are usually available at low prices (Mohapatra, 1994). The information gathered from the household survey indicates that on average, Rs. 15 per capita per month is spent on construction and repair of these houses. Thus this amount is taken as the basic needs expenses of housing (Table 1).

## **2 Public utilities services**

### **2.1 Education**

FAO (1969) has prescribed primary education as an important component in the basic needs strategy. It has also emphasised that almost all children in the age group of 7 to 16 should be enrolled in school. A similar principle has been adopted in Orissa as the minimum education requirement (GOO, 1992). Furthermore, under the constitution of India, state governments are expected to provide free primary education. Thus expenditure on primary education has been excluded from the minimum expenditure on basic needs of an individual.

## 2.2 Health care

Like education, primary health care is considered as the minimum health care. Its expenses are also borne by the respective states throughout India and even the medicines in the primary health care schemes are provided free of cost in government hospitals and health centres. Thus the minimum expenditure on health care is also excluded from the minimum expenditure on basic needs of an individual.

## 2 Estimation of basic needs income

Based on the methodology suggested in Chapter 4, the basic needs income has been estimated from the quantities and expenses of various components listed in the average basic needs basket of Orissa. The following paragraphs describe the details of the estimation of the basic needs income for Orissa.

Since the expenditure figures shown below in Table 1 are based on the average consumption expenditure of the project beneficiaries, they should be adjusted to ensure that they meet the national recommendations of basic needs calorie and protein level. It is clear from Table 1 that there is no problem in calorie fulfilment, but there is a deficit in protein consumption. In order to have a minimum protein level, it is necessary to add the expenditure needed (based on the local price and availability of constituents in Orissa) to meet the protein deficit (i.e.  $58 - 51.6 = 6.8$  gms). The average cost per gram of protein in Orissa is approximated as Rs. 1.42 (based on the questionnaire survey). So the additional cost needed to meet the prescribed protein requirement would be Rs. 9.66 (i.e.  $1.42 \times 6.8$ ). Thus the total expenditure on food is adjusted to Rs. 135.29 ( i.e. Rs. 125.63 + Rs. 9.66) and in the total Rs. 182.64 ( i.e.  $135.29 + 47.35$ ). The annual per capita basic needs expenses based on the above calculation would be Rs. 2191.68 (i.e.  $Rs. 182.64 \times 12$ ).

Following the ICMR recommendations the basic needs income so derived needs to be further adjusted for consideration of the number of dependent members in the family. The responses gathered from the questionnaire show that on average a family constitutes 6 members (3 Adults and 3 children). Considering three children equivalent to two dependent adult consumption unit and one lady equivalent to one dependent adult consumption unit, the main bread winner of the family has to earn at least three times more to support the whole family. This consideration is based on the assumption that there are limited employment opportunities for old ladies and children in rural areas

(GOO, 1993). Thus an average annual amount needed for a family consisting of 6 members equivalents (i.e.1 bread winner + 3 dependent adult consuming units) will be about Rs. 8766.72 (i.e. Rs. 2191.98 x 4). Not only this, it is important to keep a surplus amount to meet the unforeseen exigencies such as death, marriage and accident. For this, a lump sum of Rs. 334 (i.e. about 4 to 5%) may be required in addition to the above figure of Rs. 8766.72. Thus the basic needs income for a family needed in Orissa can be taken as Rs. 9000 per annum.

**Table 1 Average per capita per day basic needs consumption and monthly expenditure in Orissa at 1992-93 prices.**

Items	Quantity (gm/day)	Calorie (gm)	Protein (gm)	Cost/month (Rs.)
<b>A. Food</b>				
i. Cereal				
a. Rice	520	1820	36.4	64.58
b. Wheat	30	105	3.6	4.14
ii. Pulses	30	105	6.0	8.28
iii. Vegetables	100	100	1.0	11.04
iv. Milk	30	20	1.2	4.97
v. Fish / Meat	20	40	3.0	11.04
vi. Edible oil	10	90	0.0	8.28
vii. Sugar	30	120	0.0	5.80
viii. Other(spices etc.)		100	0.0	7.50
<b>Total (food)</b>		<b>2500</b>	<b>51.2</b>	<b>125.63</b>
<b>B. Non-food</b>				
i. Clothing				8.35
ii. Fuel				7.50
iii. Housing				15.00
iv. Light				9.00
v. Other (contingencies)				7.50
<b>Total (Non-food)</b>				<b>47.35</b>
<b>Food+Non-food</b>				<b>172.98</b>

## Appendix 8.2

### Estimation of Basic Needs Conversion Factor (BNCF)

As discussed in Chapter 4, the basic needs conversion factor (BNCF) is a coefficient which indicates the proportion of inputs or outputs that directly or indirectly enter the basic needs basket. The values of BNCF are used to estimate the social value of inputs or outputs in terms of basic needs fulfilment. This is done by multiplying the BNCF by the market value of goods. It was realised in Nair's approach that precise estimation of the BNCF depends on the identification of the actual use of inputs and outputs. In line with the improvement suggested in Nair's approach in Chapter 4, an attempt is made here to estimate the BNCF of inputs and outputs involved in land use projects in Orissa. This has been done with the help of the information gathered both through the household survey and from official sources.

#### 1 Estimation of BNCF of outputs

Table 1 below gives a list of outputs derived from land use projects in Orissa. These outputs are of two types (a) agricultural outputs and (b) forestry outputs. Estimation of the BNCF of each output is undertaken as follows.

##### 1.1 BNCF of agricultural outputs

Agricultural outputs comprise cereals, pulses, oilseeds and few vegetable and fruit crops. Responses gathered through the questionnaire survey indicate that nearly 95 % of these outputs were directly consumed by the producer for basic needs fulfilment (see Chapter 6). The remainder were sold in the market and the products which were sold were again utilised in basic needs consumption. This implies that all produce directly enters into the basic consumption basket. It is therefore reasonable to estimate a BNCF of 1 for each agricultural output. Details of the questionnaire responses are presented in Chapter 6.

##### 1.2 BNCF of forestry outputs

As shown in Table 1, forestry's outputs are of two types namely intermediate products and final products. Intermediate products are those which are utilised before

final harvest of the main crops. This also includes agricultural products in agroforestry projects. Final products on the other hand are obtained after final harvest of the main crop.

**Table 1** Outputs from agroforestry, forestry and agriculture projects in Orissa.

Type of outputs	Details of outputs	
<b>1. Agricultural outputs</b>	Local name	Botanical name
	<b>A. Cereal crops</b>	
	i. Paddy	<i>Oryza sativa</i>
	ii. Maize	<i>Zea mays</i>
	<b>b. Pulse crops</b>	
	i. Red gram	<i>Cajanus cajan</i>
	ii. Black gram	<i>Phaseolus mungo</i>
	iii. Horse gram	<i>Dichous biflorus</i>
	<b>c. Oilseed crops</b>	
	i. Sesamum	<i>Sesamum indicum</i>
	ii. Ground nut	<i>Arachis hypogea</i>
	iii. Niger	<i>Guizotia abyssinica</i>
	<b>d. Fruits and vegetables</b>	
i. Pine apple	<i>Ananas comosus</i>	
ii. Yam	<i>Dioscorea alata</i>	
iii. Ladies finger	<i>Hibiscus esculentus</i>	
<b>2. Forestry outputs</b> <b>a. Intermediate products</b> (before final harvesting)	Grasses, twigs, branches, dry leaves, bamboos, poles and agricultural products (listed above)	
<b>b. Final products</b> (after final harvesting)	Lops and tops and side branches of Eucalyptus hybrid	
i. Firewood		
ii. Main timber, wood		

Source: Based on the questionnaire survey.

### 1.2.1 BNCF of intermediate products

Land use projects provide a number of intermediate products before harvest. These constitute mainly forage grasses and leaf fodder, bamboo and twigs, branches and dry leaves and poles of various species such as *Acacia auriculiformis*, *Cassia siamea*, and *Dendrocalamus strictus*, cashewnut etc. These have various uses for the rural poor. For example, forage grass and leaf fodder are used for animal feeding, dry leaves as firewood for domestic cooking and heating, twigs and branches of various species as firewood and fencing of the household and farms and bamboo and poles of various species as firewood, fencing and construction and repair of rural houses. In other words all these intermediate products are directly utilised by the rural poor for their basic consumption needs. Since all the intermediate products directly enter the consumption basket a BNCF of 1 seems to be appropriate for each of the intermediate products and, like agricultural products, an average BNCF of 1 is estimated for all the intermediate products together.

### 1.2.2 BNCF of final products

As stated earlier, the *Eucalyptus* hybrid was the only species retained for harvesting in the agroforestry and forestry plots. The other species (as reported by the respondent) had already been utilised as intermediate benefits. Responses from the field survey and information from the official records revealed that the *Eucalyptus* hybrid species after harvest would be utilised broadly in two ways. Firstly, its lops and tops constituting of leaves, twigs and side branches would be used as firewood for domestic cooking, heating and fencing of the houses and farms. Hence a BNCF of 1 would be appropriate for these portions. Secondly, the main part containing the wood would be utilised for various purposes including both for basic as well as non-basic uses. Estimation of the BNCF of this portion needs detailed examination to know the utility of each unit. The proportion which is used for basic needs fulfilment has been estimated after disaggregating the produce into its various uses. Based on the information available from the Orissa Forest Development Corporation, the officials of the Orissa Forest Department and the questionnaire survey (OFDC, 1994 ; OFD,1993; Kumar and Singh, 1994), the intermediate and final uses of each unit of *Eucalyptus* hybrid have been analysed and a BNCF of 0.73 estimated. Table 2 below presents the details of the analysis.

**Table 2 Estimation of the BNCF of Eucalyptus hybrid for Orissa.**

(Average yield of Eucalyptus hybrid from the FFRP is 70 cu.m./ ha )

Primary good	Intermediate products	Final Uses			BNCF
		Uses	Proportion	Volume	
Eucalyptus hybrid  Average yield/ha (70 cu. m.)	(A) Eucalyptus poles (girth size 0-30 cm) (25% of total yield = 17.5 cu.m)				
	a. Household and agriculture use (40 % of (A) = 7 cu.m.	i. Household and farm fencing	15% of (A)a	1.05 cu.m.	1
		ii. Agricultural implements	5% of (A)a	0.35 cu.m.	1
		iii. Agricultural farming	10% of (A)a	0.70 cu.m.	1
		iv. Construction			
		a. Town building, bridges and industrial uses	20% of (A)a	1.40 cu.m.	0
		b. Rural houses, community halls etc.	50% of (A)a	3.50 cu.m.	1
	b. Firewood billet (60 % of (A) = 10.5 cu.m.	i. Firewood for cooking and heating	90% of (A)b	9.45 cu.m.	1
		ii. Firewood for other than cooking	10% of (A)b	1.05 cu.m.	0
	(B) Eucalyptus logs (girth size > 30cms) 75% of total yield = 52.50 cu.m.				
	a. Billet and log size for pulp and paper factory (25 % of B) = 13.125 cu.m.	i. Rough and cheap quality Paper for basic use	25% of (B)a	3.28 cu.m.	1
		ii. Fine quality paper for non-basic use	75% of (B)a	9.84 cu.m.	0
	b. Log sizes for construction and repair of houses (50% of B) = 26.25 Cu.m.	i. Construction of town buildings,bridges,roads.	20% of (B)b	5.25 cu.m	0
		ii. Construction and repair of rural houses	50% of (B)b	13.13cu.m.	1
	iii. Household and farm fencing	20% of (B)b	5.25 cu.m.	1	
	iv. Farm operation and agricultural implements	10% of (B)b	2.62 cu.m.	1	
c. Fire wood billet (25% of (B) = 13.125 cu.m.	i. Firewood for cooking and heating	90 % of c.	11.81cu.m.	1	
	ii. Firewood for other than cooking	10 % of c.	1.31 cu.m.	0	
Total timber used in basic needs fulfilment = 51.14 cu.m. ( i.e the sum of volumes having BNCF value of 1). So the BNCF of Eucalyptus hybrid = 51.1/70 = 0.73					

Source: Based on the information collected from Orissa Forest Development Corporation (OFDC,1994); Orissa Forest Department (OFD,1993),



It is evident from Table 2 that eucalyptus after harvesting would be utilised under two different sizes. One quarter of the total out turn as poles (girth size 0-30 cm) and the rest three quarters as the logs (girth size > 30cm).

Within the poles, 40% would be utilised for household and agricultural farming and the rest as firewood for different purposes. From the poles earmarked for household and agricultural farming, 80% would be utilised for basic uses in various forms and 20% as non-basic uses while 90% of the poles reserved for firewood would be used as domestic fuelwood for cooking and heating and the rest for non-basic uses such as industrial cooking for bricks and tiles making.

## **2 BNCF of inputs**

Like outputs, the BNCF of inputs are estimated to know the proportion of input utilised for basic needs fulfilment. The important inputs involved in the three land use projects are fertilisers, insecticides, seeds, polythene bags and tools and implement.

### **2.1 Fertiliser**

Assuming elastic supply of fertiliser, extra demand from the projects will entail diversion of resources into extra fertiliser production. Hence the BNCF of fertiliser must relate to the production of basic needs goods forgone as a consequence. Consideration of the cost of these resources is based on the distribution pattern of income in fertiliser production (see Appendix 8.3). This is further discussed in Appendix 8.4.

### **2.2 Insecticides**

Insecticides are assumed to follow the same production pattern as fertilisers ( Das and Sarangi, 1994; Nair, 1981), and so have been considered in the same way.

### **2.3 Polythene bags**

As with fertiliser, resource diversion into the production of polythene bags is assumed to mirror the pattern of income distribution in their production. This is considered in Appendix 8.3.

### 2.3 Tools and equipment

The tools and equipment used in land use projects in Orissa typically include the traditional agricultural implements such as ploughs, spades and pick-axes. This is mainly due to non-mechanised land use practices. The tools used in these practices are made from materials which are locally available and are used by small farmers who cultivate primarily to meet their basic needs. Thus demand for more tools can be assumed to lead to the diversion of resources from producing basic needs goods within the area. In the absence of any information on factor shares it is assumed that the cost of tools would be made of 50% of material inputs and 50% labour. If both sets of resources would have been used in basic needs goods production, a BNCF of 1 would be appropriate. However, since the labour may have been otherwise unemployed, the labour element is adjusted by a factor of 0.42 (discussed in detail in Appendix 8.4). Thus the BNCF of tools is considered as 0.71 (i.e.  $0.5 + 0.5 \times 0.42$ ).

Based on the above estimation a list of the BNCF of all output and inputs is given below in Table 3. It is however, important to point out here that the values of BNCF estimated here, although based on the actual field information have been subject to some simplifying assumptions. Furthermore, the estimates made here are restricted to the particular conditions that exist in Orissa; the application of these values to other regions of India or elsewhere needs further modification depending on the condition prevailing in that region or country.

Using the BNCF values of outputs, the social value of goods (goods effect) produced from agroforestry, forestry and agriculture projects in three agro-ecological zones in Orissa have been computed and is presented below in Table 4.

**Table 3 BNCF of outputs and inputs involved in the projects.**

<b>Input/output</b>	<b>Products</b>	<b>BNCF</b>
<b>1. Output</b>	<b>a. Agricultural products</b> (all agricultural products together)	<b>1.00</b>
	<b>b. Forestry products</b>	
	I. Intermediate products (all intermediate products together)	<b>1.00</b>
	II. Final products	
	i. Firewood	<b>1.00</b>
	ii. Eucalyptus wood	<b>0.73</b>
<b>2. Input</b>	i. Labour	<b>0.42</b>
	ii. Polythene bags	<b>0.06</b>
	iii. Fertilisers	<b>0.08</b>
	iv. Insecticides	<b>0.08</b>
	v. Tools and equipment	<b>0.71</b>

**Table 4 Basic needs value of goods (goods effect) of the agroforestry, forestry and agriculture projects by agro-ecological zone.**

Zone	Project's outputs	Basic Needs Conversion Factor (BNCF)	Agroforestry		Forestry		Agriculture	
			Financial Value of Outputs (Rs/ha)	Basic needs value of outputs (Rs/ha)	Financial Value of outputs (Rs/ha)	Basic needs value of outputs (Rs/ha)	Financial Value of outputs (Rs/ha)	Basic needs value of outputs (Rs/ha)
1. Northern	(A) Agricultural outputs All outputs together	1.00	6678.44	6678.44	0.00	0.00	36354.45	36354.45
	(B) Forestry outputs							
	a. Intermediate products	1.00	2113.15	2113.15	2312.96	2312.96	0.00	0.00
	b. Final products							
	i. Lops and tops (firewood)	1.00	6274.58	6274.58	6026.81	6026.81	0.00	0.00
ii. Eucalyptus hybrid wood	0.73	93722.56	68417.47	86354.94	63039.11	0.00	0.00	
	<b>Total</b>		<b>108788.73</b>	<b>83483.64</b>	<b>94694.71</b>	<b>71376.88</b>	<b>36354.45</b>	<b>36354.45</b>
2. Central	(A) Agricultural outputs All outputs together	1.00	7421.32	7421.32	0.00	0.00	37211.62	37211.62
	(B) Forestry outputs							
	a. Intermediate products	1.00	1784.22	1784.22	2036.09	2036.09	0.00	0.00
	b. Final products							
	i. Lops and tops (firewood)	1.00	5510.80	5510.80	5055.16	5055.16	0.00	0.00
ii. Eucalyptus hybrid wood	0.73	58941.19	43027.07	53366.04	38957.21	0.00	0.00	
	<b>Total</b>		<b>73657.53</b>	<b>57743.41</b>	<b>60457.29</b>	<b>46048.46</b>	<b>37211.62</b>	<b>37211.62</b>
3. Coastal	(A) Agricultural outputs All outputs together	1.00	6214.80	6214.80	0.00	0.00	31106.53	31106.53
	(B) Forestry outputs							
	a. Intermediate products	1.00	1864.56	1864.56	2163.90	2163.90	0.00	0.00
	b. Final products							
	i. Lops and tops (firewood)	1.00	5733.18	5733.18	5529.86	5529.86	0.00	0.00
ii. Eucalyptus hybrid wood	0.73	72407.64	52857.58	62172.73	45386.09	0.00	0.00	
	<b>Total</b>		<b>86220.18</b>	<b>66670.12</b>	<b>69866.49</b>	<b>53079.85</b>	<b>31106.53</b>	<b>31106.53</b>

Source: Based on the questionnaire survey and reports of the OFDC (1994), Das (1994) and OFD (1993).

## Appendix 8.3

### Estimation of Basic Needs Income from Inputs and Outputs of the Projects

Based on the methodology discussed in Chapter 4, basic needs income generated from the projects has been estimated. Details of the input costs are given in Annexures 7.3, 7.4 and 7.5 and output values in Annexures 7.6, 7.7 and 7.8. The expenditure details have been disaggregated to identify the distribution of payments for inputs between basic income, non-basic income and savings and investments. From the expenditure details it is clear that the inputs involved in the projects are of two types namely (a) direct inputs and (b) indirect inputs. Direct inputs consist of the inputs directly involved in various operations of plantation and harvesting. Plantation operations include the inputs such as land, labour, seeds, fertilisers, insecticides, polythene bags as well as tools and implement. Indirect inputs involve firstly the inputs in establishment of the projects such as staff's salaries and allowances, maintenance of offices, vehicles, and buildings and secondly the inputs in overhead charges such as in research, training, publicity, monitoring and evaluation and protection of the project's activities. The following section describes the details of the estimation of the basic need income generated by each input.

#### 1.1 Direct inputs

##### 1.1.1 Land

Land used in the projects under the current study is made available free of cost by the government of Orissa. Since no payment is made to the owner of the land, it need not require to take into account the estimation of basic needs income in case of land. Thus the basic needs income generated by the use of land is considered as nil.

##### 1.1.2 Labour

Expenditure details presented in Annexures 7.3, 7.4 and 7.5 show that the major portion of expenditure in projects goes towards the payment of wages to the labourers. These labourers are mostly semi-skilled and non-skilled and are drawn mostly from the agricultural sector. They are primarily the landless unemployed or seasonally employed. It is estimated that even if these labourers were employed throughout the year at 1992-93 wage rate (i.e. Rs. 25 per man day) their annual income would not exceed the basic need income (Rs. 9000 , see Appendix 8.1). This means, the entire payment of these labourers

is utilised in meeting the basic consumption needs and hence the total labour costs incurred in projects are considered as basic needs income.

### 1.1.3 Fertiliser

The use of fertiliser in any project can be estimated by disaggregating the fertiliser into its various factors of production and identifying the value added and other income amongst the various factors of production. Income generation from fertiliser depends on the place of its production i.e. whether it is domestically produced or imported. If the entire requirements of projects are met through imported fertiliser then basic needs income is considered as nil, due to no involvement of local factors of production. On the other hand, if locally produced fertilisers are used in the project then the expenditure on fertiliser is considered as payment to the local factors of production. Government data show that nearly 10% of total fertiliser requirements are still met through imports with the remainder met through domestic production (GOO,1992; Das and Sarangi,1994). Disaggregation of the various components of fertiliser production and their payments to the owners of the factors of production are described below.

Approximately 10% of the total expenditure on fertiliser in India is spent on transportation and 5% on the retail and wholesale margin (GOI, 1994). Inputs involved in transportation involve both imported as well as domestically available goods and services in the proportion of 25% and 75% respectively. Using Nair's approach the ex-factory cost of domestically produced fertiliser can be disaggregated into (a) value added , margin etc. as 58% and (b) intermediate inputs as 42%. Nearly one fifth of the expenditure on the intermediate inputs are spent on imported materials such as petroleum and chemicals (Nair, 1981 and GOI, 1994). The allocation of expenditures on purchase of fertiliser worth one rupee is disaggregated and is shown below in Table 2.

In Table 2, the outlays shown on items 1.1, 3 and 4.2.1 involve the direct and indirect expenditure on imports of fertiliser and hence are excluded from estimation of basic needs income. Conversely the outlays on local factors of production presented in items 1.2, 2, 4.1 and 4.2.2. are considered for estimation of basic needs income. The outlay on local factors of productions is further disaggregated to identify the distribution of income to the different owners of factors of production. The distribution of payments to local factors of production is given below in Table 3.

**Table 2 Components of the costs of fertiliser worth rupee one.**

Item	% share	Allocation in rupee
(A) Total input	100%	1.00
1 Transport	10% of (A)	0.10
1.1 Imported material (fuel etc.)	25% of 1	0.03
1.2 Locally supplied material	75% of 1	0.07 <sup>+</sup>
2. Whole sale and retail margin	5% of (A)	0.05 <sup>+</sup>
3. Direct import of fertiliser	10% of (A) -(1+2)	0.08
4. Local production	90% of (A) -(1+2)	0.76
4.1 Value added	58% of 4	0.46 <sup>+</sup>
4.2 Material input	42% of 4	0.32
4.2.1 Imported material input	20% of 4.2	0.06
4.2.2 Domestically available input	80% of 4.2	0.25 <sup>+</sup>

Note <sup>+</sup> payment made to local factors of production.

Source : Compiled from Nair (1981) and Government of India report (GOI, 1994).

**Table 3 Distribution of local factors of production amongst various groups of the society .** (figures in rupee)

Local factors of production	Total payment <sup>+</sup>	Distribution amongst different groups		
		Group I	Group II	Group III
1. Transport	0.07	0.05	0.01	0.01
2. Whole sale and retail margin	0.05	0.02	0.02	0.01
3. Value added	0.46	0.07	0.21	0.18
4. Local input	0.25	0.05	0.15	0.05
<b>Total</b>	<b>0.83</b>	<b>0.19</b>	<b>0.39</b>	<b>0.25</b>

Note: + Compiled from Table 2.

Source : Sinha et al. (1979) and Nair (1981).

Group I (basic needs group, see Chapter 4) receives only Rs. 0.19 out of every one rupee cost of fertiliser. Thus a factor of 0.19 is used for estimating the basic needs income generated from use of fertilisers in the projects.

#### 1.1.4 Insecticides

As stated earlier, the pattern of production of insecticides in India is almost similar to that of fertiliser. Thus the disaggregation of expenditures incurred on insecticides is carried out in the same manner as in the case of fertiliser. Accordingly the distribution of payment to group I would also be similar to fertiliser and so a factor of 0.19 is also used for insecticides.

#### 1.1.5 Polythene bags

Polythene bags constitute an important input in any plantation activity due to its use in nursery raising. Unlike fertiliser, the polythene bag is very light in weight and involves less cost in transportation and handling. It is estimated that the cost of transport of polythene bags amounts to some 3% of the total outlay. Similarly 2% of total cost is regarded as payment against whole sale covering the wholesale and retail margin, Although ready made polythene is not imported like fertiliser and insecticides, its major manufacturing ingredient "neptha" is still being imported to the extent of 80 % of its total requirement in the country (GOI, 1994). The rest of the neptha requirement is either met by substituting other ingredients or through domestic production. Considering the existing situation of polythene manufacturing in India, outlay on various factors of production of polythene is disaggregated and is shown below in Table 4.

Payment made to local factors of production include the items under 1.2, 2 3.1 and 3.2.2 and is presented below in Table 4. These payments are further distributed between the different income groups in line with Nair's approach as shown below in Table 5.

Table 5 shows that the payment received by group I comes to around Rs. 0.15 for every one rupee worth of polythene bags. Thus a factor of 0.15 is estimated for computing the basic needs income from the use of the polythene bags in the projects.



**Table 4 Components of cost of polythene bags worth one rupee.**

Items	% share	Distribution of outlay
(A) Total Expenditure	100 %	1.00
1 Transport	3 % of (A)	0.03
1.1 Imported input	75 % of 1	0.01
1.2 Locally available input	25 % of 1	0.03 <sup>+</sup>
2 Whole sale and retail margin	2 % of (A)	0.02 <sup>+</sup>
3 Local production of polythene	100 % of (A - 1+2)	
3.1 Value added	49 % of 3	0.46 <sup>+</sup>
3.2 Material input	51 % of 3	0.48
3.2.1 Imported material	80 % of 3.2	0.39
3.2.2 Locally available material	20 % of 3.2	0.10 <sup>+</sup>

Note + payments made to local factors of production

Source: Based on Nair (1981).

**Table 5 Distribution of income amongst different groups.**

(figures in rupee)

Local factors of production	Total payment	Distribution amongst different groups		
		Group I	Group II	group III
1 Transport	0.03	0.01	0.01	0.01
2 Whole sale and retail margin	0.02	0.01	0.01	0.00
3 Value added	0.46	0.11	0.26	0.09
4 Local input	0.09	0.02	0.05	0.01
<b>Total</b>	<b>0.60</b>	<b>0.15</b>	<b>0.34</b>	<b>0.11</b>

Source: Based on Nair (1981).

### 1.1.6 Seeds

Seeds used in agroforestry and forestry plantations in Orissa are mostly collected locally. Subsequently, these seeds are used to raise the seedlings for plantation purposes. Usually semi-skilled and non-skilled labourers are engaged in collecting seeds and raising seedlings. Since the wages earned by these labourers are entirely used for

basic needs consumption, it is plausible to assume that all the expenditure accruing in collection of seeds as the basic needs income. Hence, a factor of 1 is considered appropriate.

### **1.1.7 Tools and equipment**

As stated in Appendix 8.2, the tools and equipment used in agricultural and forestry activities mainly include indigenous instruments and are mainly produced by the rural poor using locally available material. Hence 100% of income from the sale of tools is assumed to be of a basic needs nature. Thus a factor of 1 can be estimated to compute the basic needs income generated from investment in tools and implement.

## **1.2 Indirect inputs**

Expenditures under each item of indirect inputs given in Annexures 7.3, 7.4 and 7.5 are used to estimate the generation of basic needs income. These are described below.

### **1.2.1 Establishment**

Cost incurred in payment of wages, salary (other than daily wages labours) travelling expenses and maintenance of office, building and motor vehicle constitute the establishment cost. Nearly 80% of the total indirect cost has been spent under establishment charges (OFD, 1993 and Kumar, 1994). The basic needs income generated from the various inputs involved in establishment charges is described below.

#### **1.2.1.1 Salaries and allowances to staffs**

Official documents show that very few permanent field staff (other than unskilled daily wage labourers) are engaged exclusively for the plantation activities in the Social Forestry Project in Orissa (OFD, 1993). These are mostly from the semi-skilled type having primary knowledge of reading and writing. Their nature of work is mainly supervisory such as watch and ward of the plantation, maintenance of field plantation records and recording attendance of the labourers. Such staff get slightly higher wages than unskilled daily wage labourers. However, their annual earning do not exceed the required basic needs income (Bose, 1994). So the entire expenditure of the projects under staff salary is considered as basic needs income and hence a factor of 1 is used to compute the basic needs income from this input.

### 1.2.1.2 Training

The Social Forestry Project of Orissa organises regular training both for field staff and farmers with a purpose to create awareness amongst the persons involved in the project. Although the expenses incurred under staff training constitute only 1.4% of total expenses, its impacts in terms of generation of basic needs income could be quite substantial. The distribution of value added in the education sector among different groups estimated by Sinha et al. (1979) is presented below in Table 6.

**Table 6 Distribution of value added in the education sector.**

(figures in percent)

Income groups	Percentage distribution
Group I	37.7
Group II	59.8
Group III	2.5

Source : Based on Sinha et al. (1979).

Although only 37.7% of the income goes to the basic needs group, this estimate does not seem appropriate in the condition that exists in the Social Forestry Project of Orissa. This is because the people engaged in social forestry projects are mostly from the landless rural poor. In other words, the payments made to group I during training in the Social Forestry Project are likely to be proportionately higher than that of the estimate made by Sinha et al. which is related to the education sector for India as a whole. Although it is difficult to get an accurate proportion, it would be reasonable to assume that nearly 70% of total payments made during training are received by the people within group I (Mohapatra, 1994). Hence a factor of 0.70 is appropriate to use to estimate the generation of basic needs income from investment in staff salary and allowances.

### 1.2.1.3 Maintenance of offices

Office expenses include expenditure on day today requirements for paper, telephone, postage and stationary items. Due to non-availability of information on disaggregation of expenditure between various factors of production it is difficult to estimate precisely the generation of basic needs income from office expenses. However, Nair's estimate of equal distribution between the three income groups can be used for the purpose, giving a factor of 0.33.

#### **1.2.1.4 Constructions and repairs of buildings**

Costs of construction and repair of buildings in social forestry projects in Orissa are split between wages (nearly 40%) and material inputs such as timber, tiles and bricks (OFD, 1993). Usually the buildings constructed under the Social Forestry Project are located in the rural areas and the labour employed in the construction of these buildings are mainly the rural. Based on estimates distribution of value added and other income in rural housing, it is plausible to assume that nearly 60% of the payments are received by group I (Sinha et al., 1979 and OFD, 1993). Hence a factor of 0.60 has been used in estimating the basic needs income generated from the construction and repair of buildings in the projects.

#### **1.2.1.5 Maintenance of vehicles**

Investment on motor vehicle includes the expenses on both domestic as well as imported goods. The disaggregation between the different factors of production involved is done on the basis of Nair's approach, incorporating the data related to the existing situation of vehicle manufacture in India. Table 7 below gives the components of the costs of vehicle per rupee and Table 8 details the distribution amongst the income groups.

As group I receives Rs. 0.14 out of each rupee investment in motor vehicles, 0.14 is considered as the basic needs factor.

### **1.2.2 Overhead**

#### **1.2.2.1 Research , monitoring and evaluation**

There is no precise information available on income generation from the expenditure on research, monitoring and evaluation. However, based on information gathered from the officials of the Forest Department (Pathak, 1994 and Kumar, 1994) it is assumed that nearly 20 % of the payment goes towards group I. Hence a BNCF factor of 0.20 is used.

**Table 7 Components of costs of vehicle worth rupee one.**  
(figures in rupee)

Items	% share	Allocation in rupee
(A) Total cost	100%	1.00
1. Excise duty/ sale tax	20% of (A)	0.20 <sup>+</sup>
2. Value added	51% of [(A)-1]	0.41 <sup>+</sup>
3. Cost of inputs	49% of [(A) -1]	0.39
3.1 Imported input	20% of 3	0.08
3.2 Local input	80% of 3	0.31 <sup>+</sup>

Note : + local factors of production. Source: Based on Nair (1981) and GOI (1994).

**Table 8 Distribution of income amongst different groups.**

(figures in rupee)

Local factors of production	Total outlay <sup>+</sup>	Distribution amongst income group		
		Group I	Group II	Group III
1. Excise	0.20	nil	nil	0.20
2. Value added	0.41	0.08	0.28	0.05
3. Local input	0.31	0.06	0.19	0.06
<b>Total</b>	<b>0.92</b>	<b>0.14</b>	<b>0.47</b>	<b>0.31</b>

Note + Compiled from Table 9.

Source: Based on Sinha et al. (1979) and Nair (1981) .

#### 1.2.2.2 Protection

Usually, plantations under the Social Forestry Project in Orissa are protected by engaging labourers during the first three years of the project (OFD, 1989). In case of fire and other natural hazards locally made fire fighting implements and skilled persons are employed. It is estimated that nearly 80% of the protection costs are paid to the labourers who are unskilled and illiterate (Kumar, 1994 and Singh, 1994). Thus a factor of 0.80 is considered for estimating the basic needs income from expenditure on protection.

A summary table showing the proportional distribution of payments to local factors of production and the payments received by the basic needs income group is given below in Table 9.

### **1.3 Basic needs income from output**

As stated in Chapter 4, the basic needs income generated from the output of the project is calculated from the proportion of benefit which is spent on basic needs consumption. The guidelines of FFRP project in Orissa state that beneficiaries would be the recipients of the entire revenue generated through the projects. This means that unlike inputs there is no distribution of value added amongst other groups of the society.

From FFRP, the agricultural and forest products (except eucalyptus timber) are directly consumed by the rural poor for basic consumption needs. As regards the revenue received after the final harvest of eucalyptus, the responses from the household survey, details of which are presented in Chapter 6, suggest that 90 % of the revenue would be utilised for basic needs consumption. Hence it might be reasonable to estimate a factor of 0.90 for computing the basic needs income generated from the final outputs of the project involving forestry. However, for ease of computation and because almost all beneficiaries are below the basic needs income level, a BNCF of 1 has been used throughout.

Using the basic needs conversion factor for the generation of basic needs income, the basic needs income generated from each input and output involved in agroforestry, forestry and agriculture projects in three agro-ecological zones in Orissa have been computed and are presented below in Tables 10, 11 and 12 respectively.

**Table 9 Proportional distribution of expenditure on inputs.**

(figures in rupee)

<b>Inputs</b>	<b>Total expenditure</b>	<b>expenditure on local factors of production*</b>	<b>Payment received by basic needs Income group* (Group I)</b>
<b>A. Direct inputs</b>			
i. Land	0.00	0.00	0.00
ii. Labour	1.00	1.00	1.00
iii. Seeds	1.00	1.00	1.00
iv. Ploythene bags	1.00	0.60	0.15
v. Fertilisers	1.00	0.83	0.19
vii. Insecticides	1.00	0.83	0.19
viii. Tools and equipment	1.00	1.00	1.00
<b>B. Indirect inputs</b>			
<b>a. Establishment</b>			
i. Salary and allowances	1.00	1.00	1.00
ii. Office expenses	1.00	1.00	0.33
iii. Vehicles	1.00	0.92	0.14
iv. Buildings construction and repairs	1.00	1.00	0.60
<b>b. Overhead</b>			
v. Research	1.00	1.00	0.20
vi. Training	1.00	1.00	0.70
vii. Publicity	1.00	1.00	0.70
viii. Monitoring and evaluation	1.00	1.00	0.20
ix. Protection	1.00	1.00	0.80

Note: \* denotes for every rupee spent on the item.

**Table 10 Basic needs income (income effect) from the inputs and outputs of the projects in the Northern Zone.**

Project's inputs and outputs	Factors for estimating the basic needs income generated from inputs and outputs	Agroforestry		Forestry		Agriculture	
		Financial cost of inputs and net benefits from outputs of project (Rs/ha)	Basic needs income (Rs/ha)	Financial cost of project (Rs/ha)	Basic needs income (Rs/ha)	Financial cost of project (Rs/ha)	Basic needs income (Rs/ha)
<b>(1) Inputs</b>							
<b>A. Direct inputs</b>							
i. Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ii. Labour	1.00	18453.40	18453.40	15985.41	15985.41	22728.91	22728.91
iii. Seeds	1.00	1025.21	1025.21	0.00	0.00	3385.57	3385.57
iv. Polythene bags	0.15	384.28	57.64	434.58	65.19	0.00	0.00
v. Fertilisers	0.19	2787.61	529.65	2099.60	398.92	5298.44	1006.70
vi. Insecticides	0.19	807.60	153.44	213.40	40.55	1583.11	300.79
vii. Tools and Equipment	1.00	431.28	431.28	391.73	391.73	0.00	0.00
<b>B. Indirect inputs</b>							
<b>a. Establishment</b>							
i. Salary and allowances	1.00	855.74	855.74	685.06	685.06	0.00	0.00
ii. Office expenses	0.33	213.93	70.60	171.27	56.52	0.00	0.00
iii. Vehicle	0.14	142.62	19.97	114.18	15.99	0.00	0.00
iv. Buildings	0.60	213.93	128.36	171.27	102.76	0.00	0.00
<b>b. Overhead</b>							
v. Research	0.20	35.66	7.13	28.54	5.71	0.00	0.00
vi. Training	0.70	121.23	84.86	97.05	67.94	0.00	0.00
vii. Publicity	0.70	71.31	49.92	57.09	39.96	0.00	0.00
viii. Monitoring and evaluation	0.20	7.13	1.43	5.71	1.14	0.00	0.00
ix. Protection	0.80	121.23	96.98	97.05	77.64	0.00	0.00
<b>Total</b>		<b>25472.49</b>	<b>21965.60</b>	<b>20392.09</b>	<b>17934.51</b>	<b>32996.03</b>	<b>27421.97</b>
<b>(2) Outputs</b>							
(agricultural and forestry products)	1.00	83116.57	83116.57	74142.77	74142.77	3358.36	3358.36

Source: Compiled and computed from Table 9 of Appendix 8.3 and Annexures 7.3-7.8.



**Table 11 Basic needs income (Income effect) from the inputs and outputs of the projects in the Central Zone.**

Project's inputs and outputs	Factors for estimating the basic needs income generated from inputs and outputs	Agroforestry		Forestry		Agriculture	
		Financial cost of inputs and net benefits from outputs of project (Rs/ha)	Basic needs income (Rs/ha)	Financial cost of project (Rs/ha)	Basic needs income (Rs/ha)	Financial cost of project (Rs/ha)	Basic needs income (Rs/ha)
<b>(1) Inputs</b>							
<b>A. Direct inputs</b>							
i. Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ii. Labour	1.00	15776.71	15776.71	13969.65	13969.65	19608.92	19608.92
iii. Seeds	1.00	918.08	918.08	0.00	0.00	4006.93	4006.93
iv. Polythene bags	0.15	384.28	57.64	434.58	65.19	0.00	0.00
v. Fertilisers	0.19	3084.63	586.08	2099.00	398.81	4535.80	861.80
vi. Insecticides	0.19	792.54	150.58	213.40	40.55	1516.00	288.04
vii. Tools and Equipment	1.00	284.61	284.61	285.63	285.63	0.00	0.00
<b>B. Indirect inputs</b>							
<b>a. Establishment</b>							
i. Salary and allowances	1.00	760.87	760.87	609.04	609.04	0.00	0.00
ii. Office expenses	0.33	190.22	62.77	152.26	50.25	0.00	0.00
iii. Vehicle	0.14	126.81	17.75	101.51	14.21	0.00	0.00
iv. Buildings	0.60	190.22	114.13	152.26	91.36	0.00	0.00
<b>b. Overhead</b>							
v. Research	0.20	31.7	6.34	25.38	5.08	0.00	0.00
vi. Training	0.70	107.79	75.45	86.28	60.40	0.00	0.00
vii. Publicity	0.70	63.41	44.39	50.75	35.53	0.00	0.00
viii. Monitoring and evaluation	0.20	6.34	1.27	5.08	1.02	0.00	0.00
ix. Protection	0.80	107.79	86.23	86.28	69.02	0.00	0.00
<b>Total</b>		<b>22648.46</b>	<b>18942.91</b>	<b>18128.99</b>	<b>15695.71</b>	<b>29667.65</b>	<b>24765.89</b>
<b>(2) Outputs</b>							
(agricultural and forestry products)	1.00	50831.53	50831.53	42185.59	42185.59	7543.97	7543.97

Source: Compiled and computed from Table 9 of Appendix 8.3 and Annexures 7.3-7.8.

**Table 12 Basic needs income (income effect) from the inputs and outputs of the projects in the Coastal Zone.**

Project's inputs and outputs	Factors for estimating the basic needs income generated from inputs and outputs	Agroforestry		Forestry		Agriculture	
		Financial cost of inputs and net benefits from outputs of project (Rs/ha)	Basic needs income (Rs/ha)	Financial cost of project (Rs/ha)	Basic needs income (Rs/ha)	Financial cost of project (Rs/ha)	Basic needs income (Rs/ha)
<b>(1) Inputs</b>							
<b>A. Direct inputs</b>							
i. Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ii. Labour	1.00	16891.66	16891.66	14507.79	14507.79	19167.81	19167.81
iii. Seeds	1.00	880.54	880.54	0.00	0.00	2316.92	2316.92
iv. Polythene bags	0.15	384.28	57.64	434.58	65.19	0.00	0.00
v. Fertilisers	0.19	3131.56	595.00	2099.60	398.92	3890.11	739.12
vi. Insecticides	0.19	844.01	160.36	213.40	40.55	1530.36	290.77
vii. Tools and Equipment	1.00	348.08	348.08	313.95	313.95	0.00	0.00
<b>B. Indirect Inputs</b>							
<b>a. Establishment</b>							
i. Salary and allowances	1.00	805.26	805.26	629.35	629.35	0.00	0.00
ii. Office expenses	0.33	201.31	66.43	157.34	51.92	0.00	0.00
iii. Vehicle	0.14	134.21	18.79	104.89	14.68	0.00	0.00
iv. Buildings	0.60	201.31	120.79	157.34	94.40	0.00	0.00
<b>b. Overhead</b>							
v. Research	0.20	33.55	6.71	26.22	5.24	0.00	0.00
vi. Training	0.70	114.08	79.86	89.16	62.41	0.00	0.00
vii. Publicity	0.70	67.10	46.97	52.45	36.72	0.00	0.00
viii. Monitoring and evaluation	0.20	6.71	1.34	5.24	1.05	0.00	0.00
ix. Protection	0.80	114.08	91.26	89.16	71.33	0.00	0.00
<b>Total</b>		<b>23969.85</b>	<b>20170.69</b>	<b>18733.62</b>	<b>16293.50</b>	<b>26905.20</b>	<b>22514.62</b>
<b>(2) Outputs</b>							
(agricultural and forestry products)	1.00	62062.14	62062.14	50986.02	50986.02	5056.63	5056.63

Source: Compiled and computed from Table 9 of Appendix 6.3 and Annexures 7.3-7.8.

## **Appendix 8.4**

### **Estimation of social costs of goods and income**

Based on the improvements suggested to Nair's approach in Chapter 4, the social costs of resources in the context of basic needs fulfilment are estimated in terms of forgone production of basic needs goods and foregone generation of basic needs income. The details of the resources used in the projects are given in Annexures 7.3, 7.4 and 7.5 and estimation of the social cost of each of them incurred in both the production of basic needs goods and generation of basic needs income are described below.

#### **1 Direct inputs**

##### **1.1 Land**

##### **1.1.1 Social cost of land incurred in the production of basic needs goods**

As stated in Appendix 8.2, land used in the projects falls under the category of degraded and wasteland owned by the Government of Orissa. Landless beneficiaries have been provided with such land free of costs. However, although land is free, its social cost has been estimated in terms of the production of basic needs goods foregone in its alternative use. The alternative use (i.e. existing use) of land was identified through the household survey and official information (OFD, 1993). About 30% of these lands were under use for grazing purposes prior to their diversion for the projects. The remainder were lying almost barren and degraded without any use.

In view of the above facts it is appropriate to estimate the opportunity cost of land in terms of forgone grazing benefits from the 30% of the land under use. However, because of the difficulties in obtaining the relevant data on forgone livestock productivity, it seems plausible to use the estimates of value of grass production instead.

The average annual value of grass produced per hectare after diversion of land for the project has been estimated from the questionnaire survey. The average annual value of grass production per ha after diversion of land for projects is Rs. 76.0 (see Annexure 7.18). Therefore with 30% utilisation, the wasteland would have produced grass worth Rs. 22.8 (76.00 x 30%) per ha per annum. In other words, the per hectare social cost of land for the project period under examination would be Rs. 205 (22.8 x 9). This forgone value of the grazing benefit is only an approximation to illustrate the true cost of the land.

Precise estimation would need detailed information on loss of productivity of livestock due to forgone grazing benefits which is not possible owing to time and resource constraints.

### 1.1.2 Social cost of land incurred in the generation of basic needs income

The land used under the three projects would generate no basic needs income in the absence of the projects because the owner of the land (the government) would not receive any payment. Hence the withdrawal of land for the project has not affected income generation to the government. However, its withdrawal has affected income of the graziers utilising part of the land. It is therefore appropriate to estimate the social cost of land in terms of the generation of basic needs income as 205 rupees being the estimated grazier income forgone.

## 1.2 Labour

Based on the methodology suggested in Chapter 4, the social cost of labour in the context of basic needs is estimated on the principle of the foregone marginal productivity i.e. in terms of the foregone marginal production of basic needs goods and foregone marginal generation of basic needs income.

### 1.2.1 Social cost of labour incurred in the production of basic needs goods

The National Sample Survey Organisation (NSSO) of India divides the total rural workers of Orissa by activity status into two main categories, main workers and marginal workers. Main workers are those who have worked more than 3.5 days in a reference week while marginal workers are those who have either worked less than or equal to 3.5 days or did not work at all in the week (Khan, 1993). Table 1 below gives the average estimates of these two types of workers on the basis of their average number of employment and unemployment days per week. This shows that main workers were unemployed for an average of 0.125 day, while marginal workers were unemployed for 3.20 days in a reference week.

**Table 1 Distribution of rural work force by activity status (all India).**

(based on Khan, 1993)

Activity status	Employed (days/week)	Unemployed (days/week)
Marginal worker	1.944	3.202
Main worker	6.726	0.125

Occupational status in the state of Orissa shows that out of the total working population (37.5% of total population), main and marginal workers constitute 32.7% and 4.8% respectively (GOO, 1992). Although it has been pointed out repeatedly that labour employed in social forestry project in Orissa is mostly drawn from marginal workers, it is plausible to assume that some 'main' workers are also employed (Sharma, 1990). Hence, It is assumed that the workers for social forestry will be drawn in proportion to the total labour days of unemployment from main and marginal workers as shown in Table 1. According to Khan (1993) the ratio of marginal to main workers can be estimated as:

$$\frac{\text{Marginal worker days}}{\text{Main worker days}} = \frac{\% \text{ of marginal worker} \times \text{average number of days unemployed for marginal worker}}{\% \text{ of main worker} \times \text{average number of days unemployed for main worker}}$$

$$= 4.8 \times 3.2 / 32.7 \times 0.12$$

$$= 15.36 / 4.08$$

$$= 3.79$$

This means, if the total labour days needed in social forestry are 4.79 then 3.79 labour days are withdrawn from the marginal workers and remaining 1 from the main workers. Accordingly the proportion of labour days withdrawn from main and marginal workers can be computed as

$$\text{main workers} = 1 / 4.79 = 20.8\% \text{ or } 21\%$$

$$\text{marginal workers} = 3.79 / 4.79 = 79.2\% \text{ or } 79\%$$

In other words, nearly 79% of the total labour days generated by social forestry in Orissa will go to the marginal workers and 21% to the main workers. These estimates closely match the estimate made by Khan (1993) as 80% and 20% for marginal and main workers respectively for the Social Forestry Project in Gujarat.

The NSSO report suggests that on average main workers were employed for 6.73 days and the marginal worker for 1.94 days. If the daily wage is taken as 'W' then the marginal product of main and marginal worker can be computed as

$$\begin{aligned} \text{Marginal product of main worker} &= \frac{\text{No of days employment for main worker in a week}}{\text{Total number of days per week}} \times \text{wage rate} \\ &= 6.76W / 7 \\ &= 0.96W \end{aligned}$$

$$\begin{aligned} \text{Marginal product of marginal worker} &= \frac{\text{No of days employment for a marginal worker in a week}}{\text{Total no of days in a week}} \times \text{wage rate} \\ &= 1.94W / 7 \\ &= 0.28W \end{aligned}$$

Hence, by employing one labourer for social forestry in Orissa, the weightage value or marginal product forgone by society (per worker day) would be

$$(0.21 \times 0.96 + 0.79 \times 0.28)W = 0.20 + 0.22 = 0.42 W$$

Thus 0.42W is the estimated shadow wage rate for Orissa. This closely matches the estimate made by Khan (1993) as 0.41W for Gujarat and by Kumar (1988) as 0.47 W for Karnataka states in India. This forgone marginal product for Orissa can be treated as the forgone production of basic needs goods because the labour employed in the projects is drawn almost entirely from the rural labour force who mainly contribute to semi-subsistence agricultural production. Thus 0.42W is the appropriate figure to be used as the social cost of labour for basic needs analysis.

### 1.2.2 Social cost of labour incurred in the generation of basic needs income

While estimating the basic needs income generated by employing labourers in the projects in Appendix 8.3, it was seen that the entire wages received by labour can be considered as basic needs income. However, the opportunity cost of labour in terms of forgone production of basic needs goods was estimated as only 42% of the wage. Thus it is reasonable to assume that 42% of the wage would also be forgone in the generation of basic needs income by employing the labourer in the project. Hence a factor of 0.42W has been estimated for computing the generation of basic needs income by employing labourers in the projects.

### **1.3 Seeds**

#### **1.3.1 Social cost of seeds incurred in the production of basic needs goods**

As stated in Appendix 8.2, seeds used in the project comprise both seeds for agricultural crops as well as for forestry crops. Although there is no shortage of supply of these seeds in the market, there is also no surplus in the market. The simplifying assumption is made here that, should further seeds be required, they would be collected for the purpose. The labour used for this would have been unemployed for part of the time. Hence a social cost factor of 0.42 is estimated for computing the social cost of seeds used in projects for production of basic needs goods.

#### **1.3.2 Social cost of seeds incurred in the generation of basic needs income**

As discussed in Appendix 8.3, the entire wages paid to labourers employed in the collection of seeds are treated as basic needs income. When we consider the diversion of these labourers from the traditional sector to the project it can be assumed that forgone basic needs income that a labour would have generated in the absence of the project would be their forgone earnings (i.e. 42%). Thus the social costs of seeds in terms of forgone basic needs income of labour would be 42% of the market costs of seeds. Hence a social cost factor of 0.42 is assumed to be appropriate for computing the social cost of seeds in terms of basic needs income.

### **1.4 Polythene bags**

Polythene bags are one of the most important inputs directly used in plantation activity. These are used to raise the seedlings stock for plantation. In order to cover the increasing area under plantations, the requirement for polythene bags in Orissa is increasing every year. To meet the increasing demands of polythene bags, production has increased substantially and is assumed to further increase to meet the needs of the projects. This means its diversion will not cause an adverse effect on its existing uses.

#### **1.4.1 Social cost of polythene bags incurred in the production of basic needs goods**

Since Appendix 8.3 shows the production of one rupee worth of polythene bags adds rupee 0.15 to basic needs income, it is assumed that these recipients only will

produce basic needs goods. However, this factor of 0.15 needs to be weighted by 0.42 to take account of likely unemployment. This gives a factor of 0.06 (i.e.  $0.15 \times 0.42$ ).

#### **1.4.2 Social cost of polythene bags incurred in the generation of basic needs income**

It was seen in Appendix 8.3 that the use of polythene bags worth rupee one generates a basic needs income of rupee 0.15. Hence the diversion of resources to produce polythene bags for the project would cause a 15% loss in generation of basic needs income weighted by the unemployment factor of 0.42. In other words the social cost of polythene bags in generation of basic needs income would be 6% of the total market value of the polythene cost, and hence a social cost factor of 0.06 (i.e.  $0.15 \times 0.42$ ) is used.

### **1.5 Fertilisers**

India has become almost self sufficient in the production of fertiliser. It is in heavy demand in the agricultural sector and during the peak season of agricultural operations its short term supply becomes almost inelastic. However, it is assumed here that the extra demand from within the project is met by extra production of fertiliser.

#### **1.5.1 Social cost of fertiliser incurred in the production of basic needs goods**

Extra fertiliser production will entail the diversion of resources from elsewhere. Given the information in Appendix 8.3, that one rupee spent on fertiliser would result in 0.19 rupee basic needs income, it can be assumed that these recipients would work wholly in the production of basic needs goods. However, since they may otherwise be unemployed, the figure of 0.19 is weighted by 0.42.

#### **1.5.2 Social cost of fertiliser incurred in the generation of basic needs income**

While estimating the basic needs income generated from the use of fertiliser in Appendix 8.3, it was found that one rupee investment in fertiliser generates a basic needs income of 0.19 rupee. This means a diversion of fertiliser to the project would also cause a loss in generation of basic needs income of 19% of its market value. However, since again basic needs income recipients may be unemployed, the figure is weighted by 0.42. Hence the social cost of fertiliser in the generation of basic needs income can be



assumed as 8% of total investment in fertiliser and therefore a social cost factor of 0.08 (i.e.  $0.19 \times 0.42$ ) is used.

## **1.6 Insecticides**

### **1.6.1 Social cost of insecticides incurred in the production of basic needs goods**

Because of the similarities between the markets for fertiliser and insecticides the extra production of insecticides can be assumed to cause a 8% loss in production of basic needs goods too. Thus a factor of 0.08 can be used for estimating the social cost of insecticides too.

### **1.6.2 Social cost of insecticides incurred in the generation of basic needs income**

Similarly the diversion of insecticides in the project can be expected to cause a 8% reduction in the generation of basic needs income and thus a social factor of 0.08 can also be used for estimating the social cost of insecticides.

## **1.7 Tools and equipment**

Tools used in the projects under study are mostly locally made and are in abundant supply in the market. The withdrawal of these tools would affect the production of basic needs goods and the generation of basic needs income via the diversion of resources into their production.

### **1.7.1 Social cost of tools and equipment incurred in the production of basic needs goods.**

Appendix 8.2 suggests a BNCF of tools and equipment as 0.71. Hence a factor of 0.71 is used in estimating the social cost in the production of basic needs goods.

### **1.7.2 Social cost of tools and equipment incurred in the generation of basic needs income.**

Appendix 8.3 similarly suggests a factor of 0.71 for the social cost incurred in the generation of basic needs income . Hence a social factor of 0.71 is used.

## 2 Indirect inputs

As with most of the direct costs, the use of indirect inputs in the projects is assumed to have entailed the diversion of resources from other uses. As a simplifying assumption the extent to which this has reduced the production of basic needs goods and receipt of basic needs income is computed directly in the line with the pattern of basic needs income detailed in Appendix 8.3. These figures have then been adjusted by a weighting factor of 0.42 to account for unemployment.

## 3. Government funds

The funds involved in the projects are met partly (40%) by the government of Orissa and partly (60%) by the Swedish International Development Agency (SIDA). The Government of Orissa has diverted the funds for the project from funds earmarked for rural development. Had these funds not been diverted to social forestry plantations, they would have probably been utilised for other rural development projects (Bose, 1994 and GOO, 1993). Rural development projects aim basically to meet the basic needs of rural poor and to generate employment to raise their income. It is estimated that nearly three-quarters of the rural development funds in Orissa are being utilised for basic needs fulfilment (Kumar, 1994). This means that the diversion of funds in indirect cost would cause nearly 30 % reduction in production of basic needs goods and generation of basic needs income. The use of the 60% of the funds provided by SIDA would not probably affect the production of basic needs goods and generation of basic needs income. This is because, in absence of the project the SIDA might not have given the funds and would not necessarily have been utilised in rural development in Orissa. However, the use of these funds in other projects would have also involved diverting resources from possible basic needs goods and income generation elsewhere. Therefore a factor of 0.30 has been adjusted by  $(1 - 0.42)$  giving a factor of 0.17 [i.e.  $0.30 \times (1 - 0.42)$ ] for computation of the social costs of the total investment made for goods production and income generation. A summary table showing the factor for each input for computation of social cost in goods production and income generation is presented below in Table 2.

Using the social cost factors for inputs (incurred in the production of basic needs goods and the generation of basic needs income) involved in the agroforestry, forestry and agriculture projects in three agro-ecological zones in Orissa have been computed and are presented in Tables 3, 4 and 5 respectively.

**Table 2 Factors for social costing of inputs incurred in the production of basic needs goods and generation of basic needs income.**

Input	Social cost factor for production of basic needs goods	Social cost factor for generation of basic needs income
<b>(A) Direct inputs</b>		
i. Land	0.00 <sup>+</sup>	0.00 <sup>+</sup>
ii. Labour	0.42	0.42
iii. Seeds	0.42	0.42
iv. Polythene bags	0.06	0.06
v. Fertilisers	0.08	0.08
vi. Insecticides	0.08	0.08
vii. Tools and equipment	0.71	0.71
<b>(B). Indirect inputs</b>		
<b>a. Establishment</b>		
i. Salary and allowances	0.42	0.42
ii. Office expenses	0.14	0.14
iii. Vehicles	0.06	0.06
iv. Building construction and repair	0.25	0.25
<b>b. Overhead</b>		
v. Research	0.08	0.08
vi. Training	0.29	0.29
vii. Publicity	0.29	0.29
viii. Monitoring and evaluation	0.08	0.08
ix. Protection	0.34	0.34
<b>c. Government Funds</b>		
	0.17	0.17

Note: <sup>+</sup> in case of land a lump sum social cost of Rs 205 is estimated and hence no factor like other inputs is provided.

**Table 3 Social costs of the projects incurred in the production of basic needs goods and generation of basic needs income in the Northern Zone.**

Input components	Factors for social costing of inputs in the production of basic needs goods	Factors for social costing of inputs in generation of basic needs income	Agroforestry			Forestry			Agriculture		
			Financial cost of project (Rs/ha)	Social cost in production of basic needs goods (Rs/ha)	Social cost in generation of basic needs income (Rs/ha)	Financial cost of project (Rs/ha)	Social cost in production of basic needs goods (Rs/ha)	Social cost in generation of basic needs income (Rs/ha)	Financial cost of project (Rs/ha)	Social cost in the production of basic needs goods (Rs/ha)	Social cost in generation of basic needs income (Rs/ha)
<b>(1) Inputs</b>											
<b>A. Direct inputs</b>											
i. Land *	0.00	0.00	0.00	205.00	205.00	0.00	205.00	205.00	0.00	205.00	205.00
ii. Labour	0.42	0.42	18453.40	7750.43	7750.43	15985.41	6713.87	6713.87	22728.91	9546.14	9546.14
iii. Seeds	0.42	0.42	1025.21	430.59	430.59	0.00	0.00	0.00	3385.57	1421.94	1421.94
iv. Polythene bags	0.06	0.06	384.28	23.06	23.06	434.58	26.07	26.07	0.00	0.00	0.00
v. Fertilisers	0.08	0.08	2787.61	223.01	223.01	2099.60	167.97	167.97	5298.44	423.88	423.88
vi. Insecticides	0.08	0.08	807.60	64.61	64.61	213.40	17.07	17.07	1583.11	126.65	126.65
vii. Tools and equipment	0.71	0.71	431.28	306.21	306.21	391.73	278.13	278.13	0.00	0.00	0.00
<b>B Indirect inputs</b>											
<b>a. Establishment</b>											
i. Salary and allowances	0.42	0.42	855.74	359.41	359.41	685.06	287.73	287.73	0.00	0.00	0.00
ii. Office expenses	0.14	0.14	213.93	29.95	29.95	171.27	23.98	23.98	0.00	0.00	0.00
iii. Vehicle	0.06	0.06	142.62	8.56	8.56	114.18	6.85	6.85	0.00	0.00	0.00
iv. Buildings	0.25	0.25	213.93	53.48	53.48	171.27	42.82	42.82	0.00	0.00	0.00
<b>b. Overhead</b>											
v. Research	0.08	0.08	35.66	2.85	2.85	28.54	2.28	2.28	0.00	0.00	0.00
vi. Training	0.29	0.29	121.23	35.16	35.16	97.05	28.14	28.14	0.00	0.00	0.00
vii. Publicity	0.29	0.29	71.31	20.68	20.68	57.09	16.56	16.56	0.00	0.00	0.00
viii. Monitoring and evaluation	0.08	0.08	7.13	0.57	0.57	5.71	0.46	0.46	0.00	0.00	0.00
ix. Protection	0.34	0.34	121.23	41.22	41.22	97.05	33.00	33.00	0.00	0.00	0.00
<b>C. Government funds</b>	0.17	0.17	25672.16	4466.96	4466.96	20551.94	3578.04	3578.04	32996.03	5741.31	5741.31
<b>Total</b>			<b>25672.16</b>	<b>14022.58</b>	<b>14022.58</b>	<b>20551.94</b>	<b>11427.14</b>	<b>11427.14</b>	<b>32996.03</b>	<b>17463.54</b>	<b>17463.54</b>

Note: \* Factor for estimating the social cost of land is not possible, hence a lumpsum amount (Rs. 205, see para 1.1 of Appendix 8.4) is estimated as the social cost of land.

**Table 4 Social costs of the projects incurred in the production of basic needs goods and generation of basic needs income in the Central Zone.**

Input components	Factors for social costing of inputs in the production of basic needs goods	Factors for social costing of inputs in generation of basic needs income	Agroforestry			Forestry			Agriculture		
			Financial cost of project (Rs/ha)	Social cost in production of basic needs goods (Rs/ha)	Social cost in generation of basic needs income (Rs/ha)	Financial cost of project (Rs/ha)	Social cost in production of basic needs goods (Rs/ha)	Social Cost in generation of basic needs income (Rs/ha)	Financial cost of project (Rs/ha)	Social cost in the production of basic needs goods (Rs/ha)	Social cost in generation of basic needs income (Rs/ha)
<b>(1) Inputs</b>											
<b>A. Direct inputs</b>											
i. Land *	0.00	0.00	0.00	205.00	205.00	0.00	205.00	205.00	0.00	205.00	205.00
ii. Labour	0.42	0.42	15776.71	6626.22	6626.22	13969.65	5867.25	5867.25	19608.92	8235.75	8235.75
iii. Seeds	0.42	0.42	918.08	385.59	385.59	0.00	0.00	0.00	4006.93	1682.91	1682.91
iv. Polythene bags	0.06	0.06	384.28	23.06	23.06	434.58	26.07	26.07	0.00	0.00	0.00
v. Fertilisers	0.08	0.08	3084.63	246.77	246.77	2099.00	167.92	167.92	4535.80	362.86	362.86
vi. Insecticides	0.08	0.08	792.54	63.40	63.40	213.40	17.07	17.07	1516.00	121.28	121.28
vii. Tools and equipment	0.71	0.71	284.61	202.07	202.07	285.63	202.80	202.80	0.00	0.00	0.00
<b>B Indirect inputs</b>											
<b>a. Establishment</b>											
i. Salary and allowances	0.42	0.42	760.87	319.57	319.57	609.04	255.80	255.80	0.00	0.00	0.00
ii. Office expenses	0.14	0.14	190.22	26.63	26.63	152.26	21.32	21.32	0.00	0.00	0.00
iii. Vehicle	0.06	0.06	126.81	7.61	7.61	101.51	6.09	6.09	0.00	0.00	0.00
iv. Buildings	0.25	0.25	190.22	47.56	47.56	152.26	38.07	38.07	0.00	0.00	0.00
<b>b. Overhead</b>											
v. Research	0.08	0.08	31.7	2.54	2.54	25.38	2.03	2.03	0.00	0.00	0.00
vi. Training	0.29	0.29	107.79	31.26	31.26	86.28	25.02	25.02	0.00	0.00	0.00
vii. Publicity	0.29	0.29	63.41	18.39	18.39	50.75	14.72	14.72	0.00	0.00	0.00
viii. Monitoring and evaluation	0.08	0.08	6.34	0.51	0.51	5.08	0.41	0.41	0.00	0.00	0.00
ix. Protection	0.34	0.34	107.79	36.65	36.65	86.28	29.34	29.34	0.00	0.00	0.00
<b>C. Government funds</b>	0.17	0.17	22826	3971.72	3971.72	18271.1	3179.28	3179.28	29667.65	5162.17	5162.17
<b>Total</b>			<b>22626</b>	<b>12215.28</b>	<b>12215.28</b>	<b>16271.10</b>	<b>10059.36</b>	<b>10059.36</b>	<b>29667.65</b>	<b>15768.76</b>	<b>15768.76</b>

Note: \* Factor for estimating the social cost of land is not possible, hence a lumpsum amount (Rs. 205, see para 1.1 of Appendix 8.4) is estimated as the social cost of land.

**Table 5 Social costs of the projects incurred in the production of basic needs goods and generation of basic needs income in the Coastal Zone.**

Input components	Factors for social costing of inputs in the production of basic needs goods	Factors for social costing of inputs in generation of basic needs income	Agroforestry			Forestry			Agriculture		
			Financial cost of project	Social cost in production of basic needs goods	Social cost in generation of basic needs income	Financial cost of project	Social cost in production of basic needs goods	Social cost in generation of basic needs income	Financial cost of project	Social cost in the production of basic needs goods	Social cost in generation of basic needs income
			(Rs/ha)	(Rs/ha)	(Rs/ha)	(Rs/ha)	(Rs/ha)	(Rs/ha)	(Rs/ha)	(Rs/ha)	(Rs/ha)
<b>(1) Inputs</b>											
<b>A. Direct inputs</b>											
i. Land *	0.00	0.00	0.00	205.00	205.00	0.00	205.00	205.00	0.00	205.00	205.00
ii. Labour	0.42	0.42	16891.66	7094.50	7094.50	14507.79	6093.27	6093.27	19167.81	8050.48	8050.48
iii. Seeds	0.42	0.42	880.54	369.83	369.83	0.00	0.00	0.00	2316.92	973.11	973.11
iv. Polythene bags	0.06	0.06	384.28	23.06	23.06	434.58	26.07	26.07	0.00	0.00	0.00
v. Fertilisers	0.08	0.08	3131.56	250.52	250.52	2099.60	167.97	167.97	3890.11	311.21	311.21
vi. Insecticides	0.08	0.08	844.01	67.52	67.52	213.40	17.07	17.07	1530.36	122.43	122.43
vii. Tools and equipment	0.71	0.71	348.08	247.14	247.14	313.95	222.90	222.90	0.00	0.00	0.00
<b>B Indirect inputs</b>											
<b>a. Establishment</b>											
i. Salary and allowances	0.42	0.42	805.26	338.21	338.21	629.35	264.33	264.33	0.00	0.00	0.00
ii. Office expenses	0.14	0.14	201.31	28.18	28.18	157.34	22.03	22.03	0.00	0.00	0.00
iii. Vehicle	0.06	0.06	134.21	8.05	8.05	104.89	6.29	6.29	0.00	0.00	0.00
iv. Buildings	0.25	0.25	201.31	50.33	50.33	157.34	39.34	39.34	0.00	0.00	0.00
<b>b. Overhead</b>											
v. Research	0.08	0.08	33.55	2.68	2.68	26.22	2.10	2.10	0.00	0.00	0.00
vi. Training	0.29	0.29	114.08	33.08	33.08	89.16	25.86	25.86	0.00	0.00	0.00
vii. Publicity	0.29	0.29	67.10	19.46	19.46	52.45	15.21	15.21	0.00	0.00	0.00
viii. Monitoring and evaluation	0.08	0.08	6.71	0.54	0.54	5.24	0.42	0.42	0.00	0.00	0.00
ix. Protection	0.34	0.34	114.08	38.79	38.79	89.16	30.31	30.31	0.00	0.00	0.00
<b>C. Government funds</b>	<b>0.17</b>	<b>0.17</b>	<b>24157.74</b>	<b>4203.50</b>	<b>4203.50</b>	<b>18880.47</b>	<b>3285.20</b>	<b>3285.20</b>	<b>26905.2</b>	<b>4681.50</b>	<b>4681.50</b>
<b>Total</b>			<b>24157.74</b>	<b>12981.15</b>	<b>12981.15</b>	<b>18880.47</b>	<b>10424.52</b>	<b>10424.52</b>	<b>26905.20</b>	<b>14342.84</b>	<b>14342.84</b>

Note: \* Factor for estimating the social cost of land is not possible, hence a lumpsum amount (Rs. 205, see para 1.1 of Appendix 8.4) is estimated as the social cost of land.

## Appendix 8.5

### **A copy of the spreadsheet in Quattro pro (V 4.0) showing the computation for the basic needs evaluation**

As stated in Chapter 8, the computations for basic needs evaluation of three projects have been carried out by using the spreadsheet (Borland Quattro Pro V 4.0). Unlike financial evaluation, only one spreadsheet has been developed which covers both the three agro-ecological zones and the three projects. This is because no individual plots were considered for basic needs evaluation due to analytical complexity (see Chapter 8). The factors for estimating the goods effects, income effects and social cost of the project's inputs as estimated in Appendices 8.2, 8.3 and 8.4 respectively are given in the top few horizontal rows of the spreadsheet. Multiplying these factors by their respective financial values (shown below in few horizontal rows), the basic needs value of goods and income and the social costs of resources in the production of basic needs goods and the generation of basic needs income have been computed. Next right to this is presented the details of the net goods effect and the net income effect. Moving further right, the computation for the net annual aggregated basic needs impacts of each project by agro-ecological zone are presented. The aggregation has been carried out by using the aggregation weights of 0.5 and 0.5 for the net goods effect and net income effect respectively. Finally, at the extreme right column of the spreadsheet, the percentage fulfilment of basic needs from 0.5 ha of project's plot has been computed and shown. A copy of the print out of the spreadsheet (spreadsheet 2) is provided in the pouch at the covering end of the thesis.

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**CONTAINS  
PULLOUTS**



SPREADSHEET - 1

A copy of the spreadsheet in Quattro Pro (v.0) showing computations for financial evaluations of agroforestry, forestry and agriculture projects in the Northern

NORTHERN ZONE (KONJHAR AND MAYURBHANJ DISTRICTS): 2.11 PLOTS.

RESULTS OF FINANCIAL EVALUATION

PRICE SCHEDULE

AGROFORESTRY PROJECT

FORESTRY PROJECT

AGRICULTURE PROJECT

ACTUAL COSTS IN AGROFORESTRY WITHOUT INFLATION

ACTUAL RETURN FROM AGROFORESTRY WITHOUT INFLATION

REAL COSTS IN AGROFORESTRY WITH INFLATION

REAL RETURN FROM AGROFORESTRY WITH INFLATION

Table with 4 columns: Item, Unit, Rate, Factor for indirect cost. Includes sections for Farm size, Discount rates, Annual rates of labour, Annual prices of agricultural products, and Annual prices of forest intermediate products.

Table with 5 columns: District, Village, Plot no., Area of plot, Survival percentage. Includes sections for NPV's at varying discount rates, IRR, and BCR for Agroforestry, Forestry, and Agriculture projects.

Table with 5 columns: District, Village, Plot no., Area of plot, Survival percentage. Includes sections for NPV's at varying discount rates, IRR, and BCR for Agroforestry, Forestry, and Agriculture projects.

Table with 5 columns: District, Village, Plot no., Area of plot, Survival percentage. Includes sections for NPV's at varying discount rates, IRR, and BCR for Agroforestry, Forestry, and Agriculture projects.

Table with 5 columns: District, Village, Plot no., Area of plot, Survival percentage. Includes sections for NPV's at varying discount rates, IRR, and BCR for Agroforestry, Forestry, and Agriculture projects.

Table with 11 columns: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, Total. Shows actual annual cost for each FFRP (Agroforestry) plot.

Table with 11 columns: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, Total. Shows actual annual return from each FFRP (Agroforestry) plot.

Table with 11 columns: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, Total. Shows real annual cost for each FFRP (Agroforestry) plot at 1992-93 prices.

Table with 11 columns: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, Total. Shows real annual return from each FFRP (Agroforestry) plot at 1992-93 prices.

Table with 11 columns: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, Total. Shows real annual return from each FFRP (Agroforestry) plot at 1992-93 prices.

7. Prices of final forestry products: a. Price of timber, b. Price of firewood, 8. Harvesting costs, 9. No. of planted Eucalyptus, 10. Year indicator.

Table with 4 columns: Item, Unit, Rate, Factor for indirect cost. Includes sections for Prices of final forestry products, Harvesting costs, and Year indicator.

Table with 5 columns: District, Village, Plot no., Area of plot, Survival percentage. Includes sections for NPV's at varying discount rates, IRR, and BCR for Agroforestry, Forestry, and Agriculture projects.

Table with 5 columns: District, Village, Plot no., Area of plot, Survival percentage. Includes sections for NPV's at varying discount rates, IRR, and BCR for Agroforestry, Forestry, and Agriculture projects.

Table with 5 columns: District, Village, Plot no., Area of plot, Survival percentage. Includes sections for NPV's at varying discount rates, IRR, and BCR for Agroforestry, Forestry, and Agriculture projects.

Table with 11 columns: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, Total. Shows actual annual cost for each FFRP (Agroforestry) plot.

Table with 11 columns: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, Total. Shows actual annual return from each FFRP (Agroforestry) plot.

Table with 11 columns: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, Total. Shows real annual cost for each FFRP (Agroforestry) plot at 1992-93 prices.

Table with 11 columns: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, Total. Shows real annual return from each FFRP (Agroforestry) plot at 1992-93 prices.

Table with 11 columns: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, Total. Shows real annual return from each FFRP (Agroforestry) plot at 1992-93 prices.

N.B.: ha is hectare, NPV is net present value, IRR is internal rate of return, R is base-cost ratio, D.R. is discount rate, FFRP is forest farming for rural poor (a plantation component under the Social Forestry Project of Orissa, India)

**DETAILS OF COMPUTATIONS FOR FINANCIAL EVALUATIONS**

**OM AGROFORESTRY WITH INFLATION**

**ANNUAL CASHFLOW FROM AGROFORESTRY**

**REAL COSTS IN FORESTRY WITH INFLATION**

**REAL RETURN FROM FORESTRY WITH INFLATION**

**ANNUAL CASHFLOW FROM FORESTRY**

**REAL COSTS IN AGRICULTURE WITH INFLATION**

**REAL RETURN FROM AGRICULTURE WITH INFLATION**

**ANNUAL CASHFLOW FROM AGRICULTURE**

**EACH FFRP (AGROFORESTRY)**

**PLOT AT 1992-93 PRICES**

**ANNUAL CASH-FLOW FROM EACH FFRP (AGROFORESTRY) PLOT AT 1992-93 PRICES**

**REAL ANNUAL COST FOR EACH FFRP (FORESTRY)**

**FORESTRY PLOTS AT 1992-93 PRICES**

**REAL ANNUAL RETURN FROM EACH FFRP (DENSITY FORESTRY) PLOT**

**AT 1992-93 PRICES**

**ANNUAL CASH-FLOW FROM EACH FFRP (DENSITY FORESTRY) PLOT AT 1992-93 PRICES**

**REAL ANNUAL COST FOR EACH AGRICULTURAL PLOT AT 1992-93 PRICES**

**REAL ANNUAL RETURN FROM EACH AGRICULTURAL PLOT AT 1992-93 PRICES**

**ANNUAL CASH-FLOW FROM EACH AGRICULTURAL PLOTS AT 1992-93 PRICES**

3	4	5	6	7	8	9	Total
0.00	233.84	233.22	187.50	175.88	0.00	41035.27	44327.41
0.38	214.80	183.54	167.50	219.00	0.00	42385.26	45406.42
0.74	98.42	223.56	207.50	186.66	0.00	9019.35	13071.71
0.24	98.42	223.56	227.00	295.48	50.00	35074.85	39216.23
0.88	98.42	338.79	236.00	196.66	250.00	44106.51	48173.32
1.24	74.74	391.23	289.25	186.66	190.00	46727.01	51311.21

0	1	2	3	4	5	6	7	8	9	Total
-2205.14	-2556.36	-1678.93	-693.01	233.84	233.22	187.50	175.88	0.00	38379.07	32107.88
-2205.14	-2565.48	-1814.53	-650.29	214.80	183.54	167.50	219.00	0.00	30645.07	31919.05
-2205.14	-2547.26	-1673.49	196.77	98.42	223.56	207.50	186.66	0.00	8431.97	2920.99
-2205.14	-2810.96	-1561.69	71.57	98.42	223.56	227.00	295.48	50.00	32915.03	27963.27
-2205.14	-2303.03	-1361.50	-709.05	98.42	338.79	236.00	196.66	250.00	41253.49	36764.64
-2205.14	-2239.33	-917.10	-721.77	74.74	391.23	289.25	186.66	190.00	43703.16	36731.70

0	1	2	3	4	5	6	7	8	9	Total
2715.58	2532.78	1598.83	444.25	0	0	0	0	0	2272.98	9583.83
2715.58	2532.78	1598.83	444.25	0	0	0	0	0	2429.01	9720.48
2715.58	2532.78	1598.83	444.25	0	0	0	0	0	1150.50	8441.95
2715.58	2532.78	1598.83	444.25	0	0	0	0	0	36193.89	40434.98
2715.58	2532.78	1598.83	444.25	0	0	0	0	0	3046.91	10338.36
2715.58	2532.78	1598.83	444.25	0	0	0	0	0	36761.01	40653.43

0	1	2	3	4	5	6	7	8	9	Total
0	22.36	42.93	203.13	437.46	256.25	68.56	0	35203.34	36224.03	36224.03
0	33.54	54.06	52.17	298.06	441.25	156.16	0	37746.78	36784.02	36784.02
0	22.36	64.40	378.14	550.82	351.25	156.16	0	17762.04	19284.97	19284.97
0	0.00	32.80	266.77	509.22	432.50	0.00	0	36193.89	40434.98	40434.98
0	33.54	42.93	127.28	528.54	426.25	0.00	0	47246.87	48405.41	48405.41
0	22.36	31.90	192.03	477.48	166.75	0.00	0	36761.01	40653.43	40653.43

0	1	2	3	4	5	6	7	8	9	Total
-2715.58	-2532.78	-1576.47	-401.32	203.13	437.46	256.25	68.56	0	32990.98	28690.20
-2715.58	-2532.78	-1565.29	-390.19	52.17	298.06	441.25	156.16	0	35319.75	29063.56
-2715.58	-2532.78	-1576.47	-379.85	378.14	550.82	351.25	156.16	0	18611.54	10843.02
-2715.58	-2532.78	-1598.83	-411.65	266.77	509.22	432.50	0.00	0	36677.87	30627.51
-2715.58	-2532.78	-1565.29	-401.32	127.28	528.54	426.25	0.00	0	44199.96	38067.05
-2715.58	-2532.78	-1576.47	-412.45	192.03	477.48	166.75	0.00	0	37180.03	30781.00

1	2	3	4	5	6	7	8	9	Total
2015.85	1756.98	1168.66	1050.00	964.82	1162.50	3313.52	1510.00	2530.00	18271.92
1956.50	1722.58	1168.65	1742.70	964.82	1162.50	3516.77	1510.00	2649.80	16393.92
1988.35	1774.18	1168.65	1684.98	949.44	1063.75	3329.87	1510.00	2461.00	15960.22
2211.30	1849.00	1168.65	1827.80	1012.23	1162.50	3229.22	1520.00	2571.40	16552.10
2306.85	1285.70	1840.43	1702.00	1088.13	2141.25	2728.53	1842.50	1399.20	18324.59
2375.10	1259.90	1721.17	1724.20	1101.93	2191.25	2637.03	1780.00	1398.40	16188.98

1	2	3	4	5	6	7	8	9	Total
1292.20	1978.00	1176.80	2960.00	2596.80	2150.00	1448.75	1890.00	2300.00	17762.35
1110.20	1978.00	1733.10	2479.00	2553.00	2506.25	1480.95	1580.00	2290.80	17671.50
1126.40	1960.80	1733.10	2479.00	1725.00	1808.25	1485.35	1570.00	2281.60	16188.50
1437.80	2279.00	1733.10	2479.00	2553.00	2150.00	1480.95	1580.00	2290.80	17943.65
1274.00	1978.00	1176.80	3589.00	1766.40	2968.75	2289.20	2020.00	1251.20	18293.15
1274.00	1376.00	1176.80	3063.80	2180.40	2968.75	2289.20	1895.00	1251.20	17254.75

1	2	3	4	5	6	7	8	9	Total
-723.45	221.02	7.95	1110.00	1802.18	987.50	-1864.77	380.00	-230.00	1490.43
-848.30	255.42	564.45	736.30	1598.98	1343.75	-2056.82	50.00	-358.80	1277.96
-859.95	186.82	564.45	794.02	775.56	712.50	-1844.52	60.00	-179.40	209.28
-773.50	430.00	564.45	651.20	1540.77	987.50	-1788.27	40.00	-280.80	1391.55
-1032.85	662.30	-963.83	1867.00	678.27	827.50	-459.33	177.50	-136.00	1968.56
-1101.10	116.10	-544.57	1339.40	1078.47	777.50	-367.83	-65.00	-147.20	1085.77





**IMPACTS OF PROJECTS ON GENERATION OF BASIC NEEDS INCOME (INCOME EFFECT)**

**FACTORS OF OUTPUTS FOR SOCIAL VALUATION OF GOODS IN TERMS OF BASIC NEEDS FULFILMENT**

Country products		
Final products (timber)	Final products (firewood)	
0.73	1	

**VALUATION OF BASIC NEEDS GOODS (BENEFITS OF OUTPUTS IN Rs./ha AT 1992-93 PRICES)**

Country products	Total benefits from goods		Net benefits from goods	
	Final products (timber)	Final products (firewood)	Final products (timber)	Final products (firewood)
2.56	68417.47	6274.58	6274.58	108788.73
14.94	83039.11	6026.81	6026.81	94694.71
0.00	0.00	0.00	0.00	36354.39
1.19	43027.07	5510.80	5510.80	73657.53
6.04	38957.21	5055.16	5055.16	60457.29
0.00	0.00	0.00	0.00	37211.62
7.64	52857.58	5733.18	5733.18	86220.18
1.73	45386.09	5529.86	5529.86	69866.49
0.00	0.00	0.00	0.00	32001.83
3.80	54767.37	5839.52	5839.52	89555.48
7.90	49127.47	5537.28	5537.28	75006.16
0.00	0.00	0.00	0.00	35189.28

**BASIC NEEDS INCOME GENERATED FROM THE INPUTS AND OUTPUTS OF THE PROJECTS**

Factors for estimation of basic needs income from inputs and outputs of the projects																Factor for estimation of basic needs income from outputs
Direct Inputs							Indirect Inputs									
Land	Labour	Seed	Plythene	Fertiliser	Insecticides	Tools	Salary	Office expens	Vehicle	Building	Training	Publicity	Research	Monitoring	Protection	1
0	1	1	0.15	0.19	0.19	1	1	0.33	0.14	0.6	0.7	0.7	0.2	0.2	0.8	

**BASIC NEEDS INCOME GENERATED FROM THE INPUTS INVOLVED IN THE PROJECTS (IN Rs./ha AT 1992-93 PRICES)**

Land	Direct Inputs															Total basic needs income from inputs	Income from outputs (In Rs./ha at 1992-93 prices)			Net basic needs income from outputs of the projects	Total basic needs income of projects (Inputs+ outputs)
	Establishment							Overhead									Total Income	Total costs	Net Income		
	Labour	Seeds	Plythene bags	Fertilisers	Insecticides	Tools and equipment	Salary	Office expenses	Vehicles	Buildings	Research	Training	Publicity	Monitoring and evaluation	Protection						
0.00	18453.40	1025.21	57.64	529.65	153.44	431.28	855.74	70.60	19.97	128.36	84.86	49.92	7.13	1.43	96.98	21965.60	108788.73	25672.16	83116.57	83116.57	105082.17
0.00	15985.41	0.00	65.19	398.92	40.55	391.73	685.06	56.52	15.99	102.76	67.94	39.96	5.71	1.14	77.64	17934.51	94694.71	20551.94	74142.77	74142.77	92077.28
0.00	22728.91	3385.57	0.00	1006.70	300.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27421.97	36354.39	32996.03	3358.36	3358.36	30780.33
0.00	15776.71	918.08	57.64	586.08	150.58	284.61	760.87	62.77	17.75	114.13	75.45	44.39	6.34	1.27	86.23	18942.91	73657.53	22826.00	50831.53	50831.53	69774.44
0.00	13969.65	0.00	65.19	398.92	40.55	285.63	609.04	50.25	14.21	91.36	60.40	35.53	5.08	1.02	69.02	15695.83	60457.29	18271.70	42185.59	42185.59	57881.42
0.00	19608.92	4006.93	0.00	861.80	288.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24765.69	37211.62	29667.65	7543.97	7543.97	32309.66
0.00	16891.66	880.54	57.69	595.00	160.36	348.08	805.26	66.43	18.79	120.79	79.86	46.97	6.71	1.34	91.26	20170.74	86220.18	24158.04	62062.14	62062.14	82232.88
0.00	14507.79	0.00	65.19	398.92	40.55	313.95	629.35	51.92	14.68	94.40	62.41	36.72	5.24	1.05	71.33	16293.50	69866.49	18880.47	50986.02	50986.02	67279.52
0.00	19167.81	2316.92	0.00	739.12	290.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22514.62	32001.83	26905.20	5096.63	5096.63	27611.25
0.00	17040.59	941.28	57.66	570.24	154.80	354.66	807.29	66.60	18.84	121.09	80.06	47.09	6.73	1.35	91.49	20359.75	89555.48	24218.73	65336.75	65336.75	85696.50
0.00	14820.95	0.00	65.19	398.92	40.55	330.44	641.15	52.90	14.96	96.17	63.58	37.40	5.34	1.07	72.66	16641.28	75006.16	19234.70	55771.46	55771.46	72412.74
0.00	20501.88	3236.47	0.00	869.21	293.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24900.76	35189.28	29856.29	5332.99	5332.99	30233.75

**SOCIAL COSTS OF INPUTS INVOLVED IN GENERATION OF BASIC NEEDS INCOME OF THE PROJECTS**

Factors for estimation of social costs of inputs involved in generation of basic needs income																		Aggregation weight for goods effect	Aggregation weight for income effect	Annual basic needs income estimated for an average family in the project's area
Direct Inputs								Indirect Inputs												
Land	Seed	Labour	Polythene	Fertiliser	Insecticide	Govt.fund	Tools	Salary	Office exp	Vehicle	Buildings	Training	Publicity	Research	Monitoring	Protection	0.5	0.5	9000 (In Rs)	
205	0.42	0.42	0.06	0.08	0.08	0.17	0.71	0.42	0.14	0.06	0.25	0.29	0.29	0.08	0.08	0.34				

**SOCIAL COST (IN TERMS OF THE FORGONE GENERATION OF BASIC NEEDS INCOME) OF INPUTS INVOLVED IN THE PROJECTS (IN Rs./ha AT 1992-93 PRICES)**

Land	Direct Inputs															Total direct social cost	Total social cost of govt.fund	Total costs of inputs in generation of basic need income	Net basic needs income from inputs of the projects	Net basic needs income from inputs and outputs of the projects	Net aggregated basic needs impact of the projects (net goods effect)	Net annual goods effect of the projects (In Rs/ha)	Net annual income effect of the projects (In Rs/ha)	Net annual aggregated basic needs impact of the projects (In Rs/ha)	Percentage of basic needs fulfillment from 0.5 ha plot of the projects
	Establishment							Overhead																	
	Labour	Seeds	Plythene bags	Fertilisers	Insecticides	Tools	Salary	Office expenses	Vehicles	Buildings	Training	Publicity	Research	Monitoring and evaluation	Protection										
205.00	7750.43	430.59	24.21	222.45	64.45	306.2088	9003.33	4466.96	359.41	29.65	8.39	53.91	35.64	20.97	3.00	0.60	40.73	14022.58	7943.02	91059.59	80260.33	7717.90	8817.81	8317.85	46.21
205.00	6713.87	0.00	27.38	167.55	17.03	278.1283	7408.96	3576.04	267.73	23.74	6.71	43.16	28.53	16.78	2.40	0.48	32.61	11427.13	6507.38	80650.15	70300.94	6661.30	7811.22	7236.28	40.20
205.00	9546.14	1421.94	0.00	422.82	126.33	0	11722.23	5741.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17463.54	9958.44	13316.80	16103.82	2098.98	1789.31	1944.16	10.80
205.00	6626.22	385.59	24.21	246.15	63.24	202.0731	7752.49	3971.72	319.57	26.36	7.46	47.94	31.69	18.64	2.66	0.53	36.22	12215.28	6727.63	57559.16	51543.64	5058.68	5727.07	5392.88	29.96
205.00	5867.25	0.00	27.38	167.55	17.03	202.7973	6487.01	3179.28	255.80	21.10	5.97	38.37	25.37	14.92	2.13	0.43	28.99	10059.36	5636.47	47822.06	41905.58	3998.79	4856.18	4327.48	24.04
205.00	8235.75	1682.91	0.00	361.96	120.98	0	10606.59	5162.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15768.76	8996.93	16540.90	18991.88	2382.54	2110.21	2246.37	12.48
205.00	7094.50	369.83	24.23	249.90	67.35	247.1368	8257.94	4203.50	338.21	27.90	7.89	50.73	33.54	19.73	2.82	0.56	38.33	12981.15	7189.58	69251.72	61470.35	5965.44	6830.04	6397.74	35.54
205.00	6093.27	0.00	27.38	167.55	17.03	222.9045	6733.13	3285.20	264.33	21.81	6.17	39.85	26.21	15.42	2.20	0.44	29.96	10424.52	5868.99	56855.01	49755.17	4739.48	5528.35	5133.92	28.52
205.00	8050.48	973.11	0.00	310.43	122.12	0	9661.14	4681.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14342.64	8171.97	13268.60	15463.89	1962.13	1718.21	1840.17	10.22
205.00	7157.05	395.34	24.22	239.50	65.01	251.81	8337.92	4214.06	339.06	27.97	7.91	50.86	33.62	19.78	2.83	0.57	38.43	13073.01	7286.75	72623.49	64424.77	6247.34	7158.31	6702.82	37.24
205.00	6224.80	0.00	27.38	167.55	17.03	234.61	6876.36	3346.84	269.28	22.22	6.28	40.39	26.70	15.71	2.24	0.45	30.52	10637.00	6004.28	61775.74	53987.23	5133.19	5988.58	5565.89	30.92
205.00	8610.79	1359.32	0.00	365.07	123.14	0.00	10663.32	5195.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15858.32	9042.45	14375.43	16853.20	2147.88	1872.58	2010.23	11.17