Orissa Tribal Empowerment and Livelihoods Programme

ASSESSMENT SURVEY FOR DESIGNING COMPREHENSIVE LIVELIHOODS STRATEGY

November 2007

KCSD, Bhubaneswar
Knowledge Trust, Bhubaneswar
NRMC, New Delhi

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Study conducted by:
KCSD, Bhubaneswar
Knowledge Trust, Bhubaneswar &
NRMC, New Delhi

The report was prepared by the resource persons of three organizations in a consortium mode. Responsibility for the content and presentations of findings and recommendations rests with the evaluation team. The view and opinions expressed in the report do not necessarily correspond to the views of DFID, IFAD, WFP & OTELP.

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FOREWORD

The tribal communities as the most underprivileged people are severely impacted by poverty and its manifestations, such as low levels of literacy and health care, hunger and malnutrition. They suffer social and political marginalization and remain vulnerable to exploitation. In order to redress this situation and to remove obstacles to their development, further amendments have recently been introduced in the Indian Constitution. This has created an enabling environment for promoting the interests of the tribal communities and for harnessing their untapped potential for overall social and economic development. Towards this end, action-oriented programmes and projects are required which specifically address the constraints and opportunities for sustainable livelihood and empowerment of the tribal communities.

Several development programmes have been undertaken for development of the tribals to reduce the critical gaps in the field of health, education, agriculture, horticulture, skill upgradation and rural connectivity at par with the developed areas of the State. OTELP has focused on empowering the tribals and enabling them to enhance their food security, increase their incomes and improve their overall quality of life through more efficient natural resource management based on the principles of improved watershed management, more productive environmentally sound agricultural practices, and through off-farm/non-farm enterprise development.

The OTDP evaluation has illustrated the crucial importance to the development process of the knowledge of the tribal people. The tribal people have survived in their environs for centuries without huge amounts of money being spent on their development by governments or others, and over the years they have developed and refined valuable knowledge and problem-solving strategies not only concerning agriculture, farming systems, natural resources management and biodiversity, but also in the areas of health and education, and social organization and mobilization (e.g. by forming associations and groups for credit and savings, water use, home economics). Their knowledge and experiences need to be tapped more systematically, and blended accordingly with "modern" technical knowledge suitable to the context and environment in which the tribal people live and operate.

The sustainable livelihood approach needs to be people-centred, holistic, dynamic and built on strength and assets with sustainability. Keeping all these in view the current study has been undertaken in 10 blocks of four project districts basically to analyze the livelihood opportunities, constraints, natural resource base and vulnerability basing on which the possible livelihood strategy has been developed. While doing so care has been taken to consider all the lessons learned from previous studies so as to provide various options for livelihood enhancement of the tribal community on a sustainable basis.

The current study has been undertaken in a consortium mode by involving the study team of KCSD, consulting team of Knowledge Trust and NRMC, New Delhi by taking stock of their earlier experience and expertise, besides outsourcing professionals on various subjects in tribal perspective.

Bhubaneswar, the 23rd August 2007 (Dr. A.K.Behera)

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(Dr. A.K.Behera)
Chairman, Knowledge Trust & Team Leader
& Team Leader of Study

Acronyms and Abbreviations

AP	Andhra Pradesh
APMC	Agricultural Produce Marketing Committee
ASHA	Accredited Social Health Activist
BGA	Blue Green Algae.
BPL	Below Poverty Line
BT	Bacillus Thuringensis
CBO	Community Based organization
CCT	Continuous Contour training
CF	Credit Fund
CIF	Community Infrastructure Fund
CIG	Common Interest Group
CLW	Community Link Worker
CRIDA	Central Research Institute for Dry land Agriculture
CYSD	Center for Youth and Social Development
Dangar	Sloppy forest land
DIC	District Industries Centre
DPEP	Directorate of Primary Education Programme
EIL	Economic Threshold Level
Ex situ	*Out side place*
FAO	Food &Agriculture Organization
FARD	Fisheries & Animal Resource Development
FFDA	Fish Farmers' Development Agency
FGD	Focus Group Discussion
FNGO	Facilitating Non-Government Organization.
FYM	Farm Yard Manure.
GOI	Govt. of India.
GP	Gram Panchayat
GVT	Gramin Vikas Trust
HH	Household
HYV	High Yielding Variety.
IAY	Indira Awas Yojana.
ICAR	Indian Council of Agricultural Research.
ICMR	Indian Council of Medical Research
ILDP	Integrated Livestock Development Project
In situ	*On the same place*
INM	Integrate Nutrient Management
IPM	Integrated Pest Management
IPNS	Integrated Plant Nutrient System
ITDA	Integrated Tribal Development Agency
ITK	Indigenous Technical Knowledge Trust
KL	Kendu Leaf (used for *bidi*)
LER	Land Equivalent Ratio.
LI	Livestock Inspector

LISA	Low Input Sustainable Agriculture.
MFP	Minor Forest Produce
MMA	Macro Management on Agriculture.
MP	Madhya Pradesh.
MPT	Multi Purpose Tree
MSSRF	M.S Swaminathan Research Foundation.
NCF	National Commission on Farmers.
NGO	Non-Government Organization
NHM	Natural Horticulture Mission
NPK	Nitrogen, Phosphorus, Potash
NPV	Nuclear Polyhydrosis Virus
NREGS	National Rural Employment Guarantee Scheme.
NRHM	National Rural Health Mission.
NRM	Natural Resource Management
NTFP	Non-Timber Forest Product.
ODR	Orissa Development Report
ORMAS	Orissa Rural Marketing Society
OTDP	Orissa Tribal Development Project
OTELP	Orissa Tribal Empowerment & Livelihood Programme
OUAT	Orissa University of Agriculture and Technology
Padar	*Unbunded high land*
PC	Producers Company.
PDS	Public Distribution System
PESA	Panchayat Extension to Scheduled Area Act
PET	Potential Evapo-Transcription.
PFM	Participatory Forest Management
PHC	Primary Health Center
PIP	Policies, Institutions & Processes
Podu	*Shifting cultivation or jhooming*
PR	Panchayati Raj.
PRA	Participatory Rural Appraisal
PRI	Panchayati Raj Institution
PSU	Project Support Unit
PVS	Participatory Variety Selection.
RCH	Reproductive Child Health
RF	Reserve Forest.
ROR	Record of Right
RRA	Rapid Rural Appraisal
SALT	Sloping Agricultural Land Technology
SC	Scheduled Caste
SGRY	Sampoorna Gamin Rozgar Yojana.
SGSY	Swarnajayanti Swarozgar Yojana.
SHG	Self Help Group
SLA	Sustainable Livelihood Analysis
SLF	Sustainable Livelihoods Framework
SSA	Sarva Sikshya Abhiyan.
ST	Scheduled Tribe
STD	Sexually Transmitted Disease
TOR	Terms of Reference
TPDS	Targeted Public Distribution System
VAV	Village Agricultural Volunteer

VAW	Village Agricultural Worker.
VDC	Village Development Committee
VDLP	Village Development Livelihood Plan
VVV	Village Veterinary Volunteer
WAT	Water Absorption Trench
WB	West Bengal
WDT	Watershed Development Team.
WORLP	Western Orissa Rural Livelihoods Project.
WUE	Water Use Efficiency

EXECUTIVE SUMMARY AND RECOMMENDATIONS

The document is an outcome of assessment survey for designing comprehensive livelihoods strategy for the Scheduled Tribes in the Orissa Tribal Empowerment & Livelihoods Programme area conducted from May 2007 to October 2007.

2. The study was conducted in 10 tribal blocks of Gajapati, Kalahandi, Koraput and Kandhamal districts of Orissa covered under Orissa Tribal Empowerment and Livelihoods Programme (OTELP). With an aim to identify the key issues relating to tribal's livelihoods and food security in the Programme area, the survey was designed to assess the current status of the household food and nutrition security, understand the appropriateness and adequacy of agriculture, horticulture, livestock, aquaculture and forestry activities and their constraints/ gaps to support and enhance livelihoods security of the tribal people. On the basis of assessment survey, location specific appropriate livelihoods strategies across the farm/ non-farm/ off-farm and NTFP sector have been developed. Guidelines and operational manual along with appropriate models for livelihoods enhancement have been developed for implementation in the Programme area. The current study has focused on primary survey in 36 sample villages from all the blocks and analysis of secondary data of 16 villages in four Programme districts, 10 blocks and operational area of 12 facilitating NGOs.

Key Findings

3. The average population of sample village is 282 of which more than 90% are Scheduled Tribes. The female: male ratio is 1029 per 1000 males. Nearly 67% of people are illiterate and 33% are literate with male literacy always more than the female literacy. Each family size is 5.81. The income level of average household is about 83% of the expenditure for which rural indebtedness is observed. Of the total expenditure, 59% goes towards food items, 10% for agriculture, 9% for health and education and remaining 22% is spent on clothing, festival, social function, house repair etc. The contributions of on-farm, non-farm and off-farm income to the family income are 30%, 21% and 49%, respectively. About 32% households are landless and 86% of the total landholders belong to small and marginal category. The landless families are engaged in shifting cultivation, share cropping and wage labour in addition to animal rearing and collection of NTFP.

4. The average size of landholding is 0.64 ha under settled cultivation and average area cultivated by each family under shifting cultivation is 0.53 ha. Upland is the predominant land type with 58% of total cultivated area followed by 25% and 17% under medium and low lands. About 15% land is irrigated with 85% depending on monsoon rains. Food grains include cereals such as rice, and coarse grains such as maize, jowar and millets like ragi, bajra, Gulji(*Panicum miliare*), Cheena (*Panicum maliaceam*), Suan (*Echinichloa frumentacea*), Kango (*Setaria italica*), Koda (*Paspalam scorbiculatum*) and pulses like pigeon pea (locally called Kandul), cow pea (locally called Barbati), rice bean (locally called Dangar Rani), green gram, black gram and beans. The oilseeds grown in the region are groundnut, rapeseed-mustard, niger, sun flower and sesame. Among the vegetables pumpkin, cucumber, ridge gourd, bitter gourd, snake gourd, okra, beans, radish, cauliflower, cabbage, onion, potato, brinjal and tomato and leafy vegetables are important .The average yield of the field crops is about 60-70% of the district average

and low crop yields are attributed to subsistence nature of farming , adoption of poor crop production technology and non-use of key agricultural inputs like HYV seeds, fertilizers, pesticides, farm implements, irrigation, and degraded natural resource base. Contribution of income from livestock production and NTFP collection is less than 20% which is gradually declining due to shrinkage of forest area. Almost in all the sample villages, the people (men and women) including children go to forest for collection of non-timber forest produce (NTFP), fuel wood, roots, tubers, leafy vegetables and medicinal plant species. In subsistence economies, animal husbandry constitutes a major source of livelihood. Cows and goats are seen grazing in the deforested mountain slopes. Agriculture provides engagement for 80 days in a year to households whereas wage labour provides engagement for 89 days, which has been possible after implementation of NREGS and other poverty alleviation schemes. Forest provides 104 days part-time engagement equivalent to 50 man-days. Shifting cultivation provides food security for 4-5 months (September-January).The landless people have food security for about 5 months which is 6-7 months in case of marginal and small farmers and about 10 months in case of big farmers. About 50-55% households have access to safe drinking water although provision for drinking water has been made for 86% of villages in the Programme area. Health measures and village sanitation are unsatisfactory in most of the villages.

Livelihoods Analysis

5. Tribal land alienation is the most important cause of the pauperization of the tribal people and their unsustainable livelihoods. The access of tribals to forests for their livelihoods has shrunk both because forests themselves have shrunk, and the regulatory regime continues to restrict tribals from collecting and processing non-timber forest produce for their livelihoods. Shifting cultivation has also been severely restricted. The tribals are systematically deprived of their cultivable holdings, by non-tribals and even by government for various projects and industries.

6. Non-Timber Forest Products (NTFP) form an important source of subsistence and livelihoods for the tribals as well as other forest dependent communities. Popular estimation strangely overlooks the strength of NTFPs in combating poverty and food crisis and poverty alleviation programmes have a land bias approach i.e., it aims at increasing the agricultural production and income generation activities around agriculture without giving due importance to occupations relating to collection, processing and marketing of NTFPs.

7. The focus of the cultivation undertaken by the tribal households is two fold, either to cultivate food grains for self-consumption or cultivate produce for the market, especially vegetables. Fruit trees (mango, citrus, jackfruit, banana, papaya, and cashew) are grown inside forests, common lands or on homestead lands. However, it is seen that there is tendency to grow rice either on ancestral lands or sharecropping farms, because they are more fertile and suitable to rice cultivation. Millets are grown more on '*Padar*' lands. Vegetables are cultivated on unbunded or bunded high lands (*Aat* or *Mal*). Most of the vegetables produced are sold in the local markets and nearby towns. About 40-50% of vegetables are consumed and rest is sold in the market. A portion of cereals including nutritious millets, pulses, oilseeds and fruits are sold in the market or to the traders and the money realized is supplemented by income from NTFP, livestock production and wage labour for family expenditure mostly to ensure food security. Agricultural extension in the tribal areas is constrained by limited staff, problems of reach out, poor

connectivity, location of isolated villages with sparse population, illiteracy of people, rigid costumes and norms, non-availability of required inputs and deficiency in monitoring and supervision.

8. The nature of the agriculture being practiced by the tribal households is not technology intensive, rather labour intensive. The outcomes of PRA exercise and primary survey indicate the relatively lower yield level of major crops in the tribal areas than the district and state average. The work in agriculture on one's own farm provides substantial employment to majority of the households studied. Since the tribal households do not have secure land tenure, agriculture is a dynamic activity, and various factors influence their engagement in this activity. This dynamic nature of agriculture implies that for most households, their livelihoods are not completely dependent on agriculture.

9. On an average each ST/SC family owns livestock population of 8.28. Data regarding the inventory of livestock as reported during survey shows that, not only do the tribal households own livestock, but they also adopt livestock rearing of both cattle and goats of others. In return for this service they are either offered one to two heads of cattle as remuneration, or they are offered bullocks for ploughing by the land-owning farmers. The goats and sheep are more valuable to them and they treat them as their family member. In many cases livestock management is a part time job and it does not provide full time employment as in case of agriculture and wage labour.

10. Over the years because of various developmental efforts tribal system has come under the domain of market economy. This has resulted in gradual degradation of their resource base i.e. their control and access over land, water and forest. In many places because of development projects and also due to the operation of formal as well as informal land markets, tribals have lost their control over land. In addition, their control over water resource is on decline. They have come to a situation where they are in possession of sloppy lands and the productivity of these lands is low and the agriculture is subsistence oriented. From the forest the tribals collect timber for house construction, fuel wood, wild roots tubers, mango kernels, fruits, leafy vegetables, mushrooms and different kinds of NTFPs including medicinal plants and plant parts. A part that is exchanged in the market for meeting the household requirements is normally made through at the doorstep or in the village *haat/*market. These commodities are exchanged for other essential commodities or sometime for cash. The merchants are petty traders at the village level, who pay unfair price to the households. In the whole process the tribals are treated as collector of these produces and do not enjoy ownership

11. Government is implementing various poverty alleviation and rural employment schemes through PR department and ITDA in the tribal areas. The schemes like Annapurna , TPDS, NREGS, IAY, SGRY, SGSY, OTELP and other schemes like SSA, NRHM etc. have become beneficial for the poor people, but transparency and accountability still needs improvement.

12. Access to credit indicates that 57% households avail credit. Of the total households availing credit 43.7% prefers moneylenders, 14.9% prefer SHGs, 17.9% prefer relatives and only 23.4% prefer commercial and cooperative banks. This shows that major source of credit still flows from the moneylender and other rich farmers. The major purpose for which credit was taken includes (a) agriculture, (b) wedding and purchase of assets, (c) illness, (d) business and food purchase, and (e) other purposes like education etc. This

shows that credit is accessed for a wide variety of purposes, but most of them are consumptive in nature.

Livelihoods Strategy

13. Providing employment opportunities and income generation on a regular basis through proper utilization of the land resources, i.e. by equitable distribution of wasteland among the tribals and development of wastelands through agro-forestry and silvi-pasture practices would help reduction of shifting cultivation. Cooperative efforts for carrying out forest-based activities, i.e. basket making, rope making, cane furniture making processing of minor forest produce, honey collection, etc. have to be made commercially viable by providing proper marketing facilities. Village Forest Committees for the protection and development of the degraded forests need to be formed .Generating employment opportunities during the lean season by forestry operations will also prevent tribals from shifting to other areas.

14. Keeping in view the recommendations of ICAR as well as World Bank the strategies which have been included are: (a) to promote forestry on upper reaches with silvi-pasture development. (b) to break middle slope length for annual or perennial fruit trees and inter-crop , and (c) to put lower slopes under agricultural crops . As an alternative to shifting cultivation, SALT 1, SALT 2 and SALT 3 are to be demonstrated on pilot basis.

15 .In order to ensure that tribals' livelihoods are supported by NTFPs, three inter-related issues, i.e. (i) how to increase NTFP production,(ii)how to improve access of the poor to NTFPs, and (iii)how to maximize their incomes through marketing. are considered vital. "Scientific" forestry should ensure that environmental functions, wild fruits, nuts, NTFPs, grasses, leaves and twigs become the main intended products from forest lands and timber a by-product from large trees like *mahua* and *sal* . Secondly, a government agency like the Forest or the Tribal Development Department assisted by civil society should be involved in informing tribals and gatherers about the prices prevailing in different markets, improve marketing practices, and act as a watch-dog. Government should encourage bulk buyers and consumers such as exporters of herbal medicines establish direct links with the villagers and address issues like creating proper marketing yard, market information system, storage space and minimum processing facilities at the local level. Simple processing activities such as broom making, leaf plate making, tamarind processing, mat and rope making etc. should be encouraged in the household sector or at SHG level.

16. There is a need for a village ecosystem planning for enhancement of total natural resource base of the village ecosystem, production of basic biomass needs of the village community on a priority basis and equity in distribution of biomass resources. Any village plan to be both sustainable and equitous would have to be matrix of solutions which keeps in mind the specific natural resource base of the village, its biomass needs and its social structure. For planning and management purpose, it is not enough to sub-divide the natural resource base merely on ecological terms. It will also have to be sub-divided in legal terms, that is, in ownership terms. The people must be educated to take care of both private and common lands for their livelihoods security.

17. Managing watersheds for rural development is concerned not merely with stabilizing soil, water and vegetation, but with enhancing the productivity of resources in ways that are ecologically and institutionally sustainable. The activities such as Continuous

Contour Trenching (CCT) and Water Absorption Trenching (WAT) undertaken on hill sides do improve the overall moisture regime and increase water levels in wells, but the benefits accrue disproportionately in favour of the people living in the valley portion. However, when the 'standard' methods are modified to include activities of direct relevance to tribal people, the degree of benefits received by them can change drastically.

18. From the tribal perspective some important strategies would receive immediate attention to boost the agricultural growth and reduce serious yield gap. While conversion of agricultural to non-agricultural land is an unavoidable concomitant of the development process, there is need to ensure that this does not put undue pressure on agriculture or lead to inefficient land-use, *e.g.,* loss of essential water bodies and speculative land purchase that reduces cultivation without any productive use for several years. Since land-use patterns *will* change, it is necessary to offset the loss of agricultural land by bringing more land under cultivation. There is a large amount of degraded land that can be reclaimed through watershed development. There is also a considerable amount of degraded land which can be brought back to cultivation with treatment. The scope for improving the quality of land that is currently being cultivated also needs further exploitation. Vast areas of cultivated land are acidic, where significant yield increases are possible through treatment using waste material from industry like lime sludge. More generally, the soils are relatively deficient in organic matter due to inadequate manuring and composting. In principle the organic base of such soils should be improved by continuous application of FYM/compost or through organic recycling.

19 .Crop diversification means the broadening of the base of the system, simply by adding more crops to the existing cropping system utilizing techniques such as multiple cropping techniques coupled with other efficient management practices. The other type of crop diversification is vertical crop diversification, in which various other downstream activities are undertaken. This could be illustrated by using any crop species, which could be refined to manufacture products, such as fruits, which are canned or manufactured into juices or syrups as the case may be. Vertical crop diversification will reflect the extent and stage of industrialization of the crop. In order to achieve the above benefits, the process of diversification should be changed from very simple forms of crop rotations, to intensive systems such as relay cropping and intercropping or specialization by diversifying into various crops, where the output and processing etc., could be different. The landless, women and vulnerable people could be engaged in vertical diversification either individually or in groups.

20 .Since the scope for horizontal expansion is limited due to shrinkage of land resources and decreasing land-man ratio, more area could be brought under cultivation by increasing cropping intensity, inter cropping and multi-tire cropping. During *Kharif*, non-irrigated upland could be covered by pulses (green gram, black gram, and pigeon pea), oilseeds (groundnut, sesame) and vegetables (brinjal, tomato) by substituting unremunerative paddy crop. Intercropping of maize+ cowpea, rice+ groundnut, rice+ pigeon pea etc. to further intensify the system with higher land equivalent ratio (LER) in rain-fed uplands can boost the crop productivity.

21. Some of the important initiatives that are needed for livestock development are promotion of appropriate crossbreeds while conserving indigenous breeds of livestock, establishment of livestock marketing system ,promotion of rural backyard poultry in a cooperative marketing, enhancing livestock extension services, encouraging private

veterinary clinic and standardizing ITKs , and provision of an insurance package to avoid distress.

22. Promotion of farming system approach to achieve triple goal of more food, more income & more livelihood, diversification of cropping & enterprises, bio-intensive & nutritious gardens in back yards, support for micro-enterprises supported by micro-credit, management of commons for enjoying usufruct rights etc. are various options for food and nutrition security at community level. Private investment on long lease of waste lands for production of raw materials for industry and contract farming need to be pursued vigorously. There is immense scope for backyard nutrition garden and back yard poultry with little bit of support to increase the physical availability of nutritious food, especially for poor and landless.

23. Evidence from all sources clearly indicates that women's wage are always less than what men earn. The technologies developed so far are male-oriented. There is a need to have gender-sensitive extension training and workshop for dissemination of technology and gender equity. The collective rights of tribal women to land, water and forests should be recognized and mentioned separately in government plans and policy documents guarantying their ancestral ownership and inheritance rights as per customary law. Allotment of CPRs to women SHGs for cultivation and dry land horticulture, adequate training to assume leadership roles in formal public, recognizing traditional women farmers' wisdom and experience related to biodiversity conservation and enhancement, seed selection and storage, water harvesting, risk minimizing agricultural practice and sustainable use of natural resources would enhance their livelihoods security . The women farmers in tribal area can be supported for construction of grain bank, horticultural programme, organic farming , seed production, preparation of planting materials, kitchen gardening, animal husbandry and agro-processing for substantial income generation and food security. The broad strategies to deal with vulnerability would be natural resource based, non-natural resource based and appropriate migration. All these require a village level vulnerability analysis, skill mapping, gap analysis and development of a micro level planning.

24. Lack of access to institutional and formal credit suitable to the needs of poor families is a major economic constraint that the OTELP will need to overcome. The needs of the poor are small, unpredictable, and urgent and consumption oriented and are not catered to by banks. As a result of this they have a high dependence on private moneylenders who extract high interest rates and also enforce other insidious conditions of repayment. Lack of credit also inhibits ability to invest in productive purposes hence poverty remains persistent among vulnerable groups such as tribals. OTELP may think of providing some seed money or revolving fund to the SHGs for timely internal lending among the members.

25 .Over the years tribal households have received assistance in cash and in kind, through several developmental programmes. Assistance rendered through these schemes has undoubtedly played a strategic role in improving the living conditions of tribes folk. The areas of assistance received are broadly classified as agriculture, animal husbandry, education, self-employment, and house construction. The FNGOs should coordinate with line departments so that the ongoing schemes are converged with OTELP. At the same time the people should be made aware and motivated to participate in all development schemes.

Capacity Building

26. Capacity Building needs of livelihoods enhancement have to look beyond the traditional top- down approach of enhancing skills and knowledge through training and provision of technical advice. It must focus on all aspects of NRM and sustainable livelihoods in the MWS, from planning to on-ground action. Therefore, the CB strategy should address transfer of technology and enhancing technical capability with focus on cohesion with the communities, and attempt to build both **human** and **social capital**.

27. The guiding principles for capacity building of stakeholders should ensure that the key stakeholders (primary and secondary) and priority issues are targeted to meet the priority livelihood system outcomes of the MWS, encourage partnership between stakeholders, value and build on existing capacity involving local expertise and indigenous knowledge ,be based on learning from each other through sharing resources, experience and mutual trust, encompass 'learning by doing' and other appropriate learning styles ,and be accessible to the entire community including landless and vulnerable.

Chapter 1. Introduction

A. Background

1.1 Of the total population of the State, Scheduled Caste and Schedule Tribes constitute 16.20% and 22.21%, respectively. Historically, tribal communities were characterized by a lifestyle distinct from agrarian communities. They subsisted on different combinations of shifting cultivation, hunting and gathering of forest products: all activities linked with forest. Their cultures celebrated and fostered this close bond with nature while also emphasizing communal ownership and consumption; closely- knit kinship structures and minimal hierarchies. After Independence, the tribals were accorded special rights and protection under Article 342 of the constitution with GOI's tribal development policy aiming to bringing the benefits of economic development without eroding their culture and identity (FAO). The Provision of the *Panchayat* (Extension to Scheduled Areas) Act 1996 (PESA) of GOI came into force from December 1996.The Act intends to enable tribal societies to access control over their own destine to preserve traditional rights over natural resources. PESA is unprecedented in that it gives radical self-governance powers to the tribal communities and recognizes its traditional community rights over natural resources.

1.2 The tribal population is among the poorest, most vulnerable and exploited groups in the state. The tribal economy in the state is primarily subsistence oriented and based upon a combination of agriculture, forestry and wage labour (ODR, 2002). In tribal dominated areas, ecological degradation, erratic rainfall and high risk of drought have resulted in food insecurity, increasing out-migration, periodic deaths and starvation. A small land base, low agricultural productivity and low-income levels led to rising indebtedness, trapping tribals into a vicious circle of exploitation. The life of tribals is increasingly vulnerable due to persistent lack of assured entitlements to their resource base. Land alienation has deprived them of their land; forest legislature has turned them into encroachers on land they have always used; and they have also been disproportionately affected by displacement due to mining operations, irrigation projects, wild life sanctuaries, industries etc. These have led to social discontentment and unrest.

1.3 The most important livelihood of tribals today is settled agriculture. However, tribal land alienation is the most important cause of the pauperization of tribal people, rendering their economic situation, which is extremely vulnerable at the best of times, even more precarious. Studies have indicated that in Orissa 54-56% tribal land has been lost to non-tribals over a period of 25-30 years through indebtedness, mortgages and forcible possession. What is more significant is

that tribals have lost possession over the most productive land, leaving them to cultivate poor quality land that makes their economy more vulnerable to natural calamities.

1.4 The fundamental reason for tribal land alienation is the fragile, and constantly shrinking economic base of tribals. As most Banks and Cooperative Societies are unwilling to provide consumption loans, moneylenders are the only source of consumption credit for them. Dependence on moneylenders on the part of the tribals keeps them in perpetual debt and results in the mortgaging and ultimate loss of land. Even the crop field is mortgaged from the stage of planting. The persistent problem of indebtedness among the tribals is one of the manifestations of poverty. Despite existence of legal/protective measures to curb the business of money lending in tribal areas and provision of debt-relief, the enforcement has been weak and inefficient. The tribal women are more sufferers, as they are triple burdened with production, reproduction and management of assets. Some of their laboures are passed on to the children resulting increased child labour in tribal areas at the cost of their education.

1.5 There is much evidence to show that tribal's access to forests for meeting their basic subsistence needs has deteriorated in the last 30 years and this is fairly widespread. Deforestation, preference for man-made plantations in place of mixed forests, regulatory framework on NTFP, diversion of forest land to industries and eviction of tribals from forest land are major reasons for such situation. Despite the prescription in the common minimum programme that eviction of tribal communities and other forest dwelling communities from forest will be discontinued, such eviction is likely to continue in wake of rapid industrialization and development of projects.

1.6 Though practice of shifting cultivation is hazardous to environment, it forms the basis of life for tribals. The tribals involved in shifting cultivation do not seem to have any emotional attachment to the land as an asset or property needing care and attention. Tribals merely believe in harvesting crops without putting any efforts. For the tribals their land means livelihood; their culture is built upon it. In interior inaccessible areas where sufficient land suitable for terracing is not available, shifting cultivation is the only system of cultivation which can be operated at the present stage of development, where tribals have no access to credit and extension. Shortening of cultivation cycle has taken place for a variety of reasons, such as tribal land being taken over by dominant peasantry as a result of which tribals are pushed or they themselves withdraw to more interior/higher areas which are generally more inhospitable. In Orissa 0.53 million ha is under active shifting cultivation on which 150 thousand households are dependent. The innumerable muddy rivers flowing in the region tell the story of heavy soil erosion that is going on in the region. Shifting cultivation is legally prohibited inside RFs and PFs of Orissa, but it is allowed in other unclassified forests with the permission of Revenue Department. However, the practice is quite prevalent even inside RFs and PFs despite initiation of punitive action by the Forest Department.

1. 7 Food security of tribals is intimately linked with forest. Comparison of two surveys conducted in 1985-86 & 1998-99 in tribal population showed that over time there

has not been any improvement in the food and nutrition intake as indicated from the following table.

Table.1.1 Average Intake of Foodstuff in g/day among Tribals.

Age group	Food grains in g/day		Depletion in consumption during 1998-99 (%)
	1985-86	1998-99	
1-3	200	169	15.5
4-6	294	242	17.7
7-9	355	300	15.5
10-12	431	354	179
13-15	489	426	12.9
>16	550	541	1.6

1.8 The scheduled areas cover nearly 45% of the state's geographical area and major portion of those areas are hill tracts covered with forest where NTFP forms an important source of livelihoods in tribal's life. According to one study about 15% of the forest dwellers accept NTFP gathering as their main occupation and about 34% take it as subsidiary occupation (Livelihood of Forest Dwellers and NTFP Policy Analyst of Orissa Drought Action Forum 1996). Current industrial utilization of NTFP has not directly benefited the tribal people.

1.9 Orissa Health Strategy 2003 has advocated for improving health status of tribals by reducing mortality and morbidity. Tribal people suffer disproportionately from malaria, sexually transmitted diseases (STD), tuberculosis, and genetically disorder like G6 PD deficiency, sickle cell anemia and also nutritional deficiency diseases. Infant mortality rate 82.4; under five mortality rate 126.6; child under weight 55.9; anemia in children 79.8; children with acute respiratory infection 22.4; children with diarrhea 21.1; and women with anemia 64.9 per 1000 are observed .A high incidence of malnutrition has also been documented in the tribal dominated districts of Orissa.[1] Food absorption as the third dimension of food security after availability and access is also detrimental in securing household food security in tribal areas. The wide spread poverty, illiteracy, malnutrition, absence of safe drinking water and sanitary conditions, poor maternal and child health services etc. have been found as possible contributory factors of dismal health condition prevailing amongst primitive tribes.

B. Programme Objectives and Strategies

1.10 The aim of the programme is to improve the quality of life of poor tribal households in remote areas through livelihood support and food security. The purpose of the programme is to ensure that the livelihoods and food security of tribal households are sustainably improved through promoting more efficient, equitable, self managed and sustainable exploitation of natural resources at their disposal and through off-farm/non-farm enterprise development. To achieve this the Programme will : (a) build the capacity of the marginal groups as individuals, and grassroots institutions; (b) enhance the access of poor tribal people to land, water and forests and increase the productivity of these resources in environmentally sustainable and socially equitable ways;

(c) encourage and facilitate off-farm enterprises development focused on the need of poor tribal households; (d) monitor the basic food entitlements of tribal households and ensure their access to public food supplies; (e) strengthen the institutional capacity of government agencies, PR institutions, NGOs and civil society to work effectively for participatory poverty reduction with tribal communities; (f) encouraging the development of a pro-tribal enabling environment through ensuring that legislation, governing control of, and access to, development resources by poor tribal households is implemented effectively and recommending other policy improvements; and (g) build on the indigenous knowledge and values of tribals and blend these with technological innovations to ensure a speedier pace of development.

1.11 The current study analysed the key issues as mentioned above in the project area and identify various options for livelihood and food security of the tribal communities along with conservation and judicious use of natural resources at their disposal.

1.12 The overall strategy of the programme focuses on empowering the tribals & enabling them to enhance their food security, increase their incomes & improve their overall quality of life through more efficient natural resource management based on the principles of improved watershed management & more productive and environmentally sound agricultural practices & through off- farm/non- farm enterprise development. A strong emphasis is given for involvement of community in designing, planning & implementation of the activities in participatory mode.

C. Purpose of Study

1.13 The purpose of this assignment was to assess the current status of the household food and nutritional security; understand the appropriateness and adequacy of agriculture, horticulture, livestock , aquaculture and forestry activities and their constraints/ gaps to support and enhance livelihood security; and analyse status of access to production resources, information technology, credit, input, NTFP, skills, infrastructures, support services, institutions and market for income generation in the tribal context .On the basis of such study, location specific appropriate livelihood strategies across farm/ off-farm/ non-farm, NTFP sectors have been developed.

D. Structure of the Report

1.14 The rest of the report is organized into eight chapters. Chapter 2 provides details of study design and methodology .Chapter 3 provides information on findings of the study covering socio-economic profile, description of the natural resources, and access to resource infrastructure, support service and technology. Chapter 4 deals with analysis of livelihoods, household food and nutrition security and market. Chapter 5 provides information on broad strategy for livelihoods enhancement, food and nutrition security and community empowerment with gender equity. Chapter 6 deals with guidelines on strategy for livelihoods enhancement and chapter 7 deals with capacity building plan for livelihoods enhancement. Chapter 8 deals with operational and technical manual supported by technical guidelines in Annexes 1 to 15.

[1]Orissa (ICMR Bulletin Vol. 33 No 10, Oct 2003)

Chapter 2. Study Design and Methodology

2.1 Programme area

The programme is to be implemented in three phases covering 30 backward blocks with tribal concentration in seven districts, namely Kandhamal, Gajapati, Koraput, Kalahnadi, Raygada, Nowangpur & Malkanagiri .Ten blocks of following four districts have been covered in the first phase (Table 2.1).

Table 2.1 Name of the Blocks/Districts Covered

District	ITDA	Block
Gajapati	Paralakhemudi	Rayagada Gumma Nuagada
Kalahandi	Th.Rampur	Th.Rampur Lanjigarh
Koraput	Koraput	Laxmipur Narayan Patna Bandhugaon
Kandhamal	Balliguda	Tumudibandha Kotagarh

2.2 Approach

The study focused on the current livelihood analysis of the tribal communities with reference to natural resources available in the area, constraints, opportunities, access to production resources, technology support service and marketing on the basis of which a sustainable livelihood strategy was developed. The study was undertaken in the project area as per requirements of Terms of References (TOR). The study also analyzed the three dimensions of food security (availability, access and absorption) prevailing in the area and impact of interventions already attempted in the area to attain household food and nutrition security. An initial social assessment was conducted to identify the focus groups representing indigenous and tribal people, landless, women, as well as other major stakeholders in the selected villages. Social analysis described the problems, needs, demands, absorptive capacity, skills, and participation in agriculture activities, income and poverty alleviating programmes of the groups.

2.3 Study design

Considering the objectives of the study, geographical spread of the programme area and time available, an in-depth and non-experimental social research

design was adopted with mix of census and sample survey approach with sufficient scope for structured interviews. The study was exhaustive and based on extensive fieldwork. Surveys of purposely sampled representative villages as well as household surveys were conducted using a questionnaire and focus group discussions. A structured questionnaire was used as the survey instrument for eliciting responses of the project beneficiaries and to avoid the possibility of omission of necessary information on different variables from same respondents. The questionnaire were close-ended with limited number of response in order to use coding to facilitate data processing, besides saving considerable time of interview and analyses. The Social Impact Assessment was meticulously designed to assemble information that seemed important to meet the major objectives of the project. The interviewers/enumerators were trained in the techniques of data collection and they were told about the purpose for which socio-economic survey was taken up.

2.4 Sampling

Four project districts and 10 Blocks covered by the Project formed the "Universe of the Study". There are 12 FNGOs implementing the project for which three villages from the area of each FNGO were selected. Thus 36 villages were taken for the study in consultation with the respective ITDA and FNGO. While selecting the villages the broad criteria like inaccessible villages with proximity to forest for accessing NTFP, inaccessible villages with predominance of shifting cultivation and accessible villages at least well communicated by Panchayat road within proximity to market and other infrastructures were considered.

Stratification of households was made by the villagers developing their own method satisfying the population to capture the information on dependence of cultivation, NTFP collection and other form of off-farm/ non-farm activities. In the above considerations the following 36 villages (Table 2.2) were selected for primary study. Further, 18 villages were selected using the same criteria from the implementing area of the FNGOs where the base line survey was completed for secondary study (Table 2.3).

Table 2.2 List of Villages Covered under Primary Study

District	Block	FNGO	Major dependence on NTFP	Majority of shifting cultivation	Proximity to market
Gajapati	Rayagada	SWWS	Langasahi	Lanjipadar	Madaba
	Gumma	CCD	S.Kolakote	Luara	Jangianglo
	Nuagarh	JKP	Libriguda	Attarsing	Aradi
		PEACE	Nidhigudi	Patangipadar	Puspanga
Kandhamal	Tumudibandha	PRADATA	Ramagiri	Nuamunda	Kadapana
	Kotagarh	Jagruti	Jangekpata	Pileri	Kupudamaha
Kalahandi	T.Rampur	Gram Vikas	Tal Amapadar	Jabanga	Sialipadar
		Antodaya	Teribhuguda	Amjhola	Ushamaska
	Lanjigarh	GVT	Jalkrida	Phuker	Bateripada
Koraput	Laxmipur	CYSD	Bhitarguda	Singaram	Minapai
	Narayanpatna	VIKAS	Jamadavasla	Dhaiguda	Pipalpadar
	Bandhugaon	RASS	Debodola	Boriput	Kupakhal

Table 2.3 List of Villages Covered under Secondary Study

District	Block	FNGO	Major dependence on NTFP	Majority of shifting cultivation	Proximity to market
Gajapati	Gumma	CCD	Bureising	Bugudisingh	Surubadi
	Nuagarh	JKP	Rubudising	-	-
		PEACE	-	Ramagiri	Bunduguda
Kalahandi	T.Rampur	Gram Vikas	Chulbadi	Kachelekha	Jatangpadar
		Antoday	Madanguda		
	Lanjigarh	GVT	-	Jiragaon	Usha Bahali
Koraput	Laxmipur	CYSD	Balingi	Jhodikanda	Karuguda
	Bandhugaon	RASS	Antamada	B.Guresi	Talapatesu

2.5 Methodology

Both qualitative and quantitative investigation methods were used to assess an array of factors as per TOR. The study used multi-pronged strategy to collect primary information by using standard PRA techniques like participatory mapping, ranking, scoring, transect, focused group discussion, livelihoods analysis, trend analysis and semi-structured interviews. Household survey was undertaken using a structured questionnaire. A smaller-in-depth survey of 10 households (or 10% of the households of the village) selected by the villagers as per specific criteria was undertaken in each village. Secondary data were collected from different reports, annual reports, and published journals etc. Stakeholder interview was conducted by consulting PRI representatives, local officials, NGOs, traders and project staff to obtain their views.

The relevant inputs for this study were gathered from the ST and SC development department. Land use data, census data and revenue data were collected from the department of agriculture, revenue and other line departments for capturing background information on the socio-economic condition of the project districts

Primary data collection using structured questionnaire format for household survey and focus group discussions with big farmers, medium farmers, small and marginal farmers, women cultivators, landless and vulnerable was done in all four districts in sample villages. The responses of the interviewee were recorded by the survey team.
Enumeration of socio-economic, demographical profile, level of poverty in the region, consumption patterns of households, extent of loss of property of affected people etc. was done using the structured questionnaire.

An analysis of demographic, poverty, land resources, and institutional profiles was made including the changes in population, sex ratio, literacy rate, composition of classified workers, land ownership, operational holdings, etc. in the region. Stakeholders need assessment was carried out to put forward the varied as well as special need of different stakeholders such as big farmer, medium farmer, small and marginal farmers and landless etc.

Focus was given on:

- Identification of the different social, ethnic and economic groups in the sample villages;
- Building a livelihood profile of each of these groups;
- Identifying issues and characteristics of poverty in these villages and identifying and profiling the vulnerable groups;
- Identify institutional, social and economic constraints towards poverty alleviation;
- Assess the status of agriculture and animal husbandry in the region, with special focus on natural resource management;
- Review the experiences of current programs and institutions designed to improve agriculture, animal husbandry, fisheries and other livelihoods through on-farm and off-farm incomes;
- Evaluate the effectiveness of the existing programs; and
- Consumption patterns of households, expenditure and affordability etc.

Primary data was analyzed and crosschecked with the secondary data. After the data (both primary and secondary) were interpreted, the draft report was prepared.

2.6 Limitations of the Study

The study did not cover certain aspects of the livelihoods of the tribal households due to constraints of time and human resources. Especially the non-economic aspects of the livelihoods such as the aspirations, concerns, their world of experience, perceptions about a secure and sustainable livelihood, coping mechanisms in the times of stress and shocks could not be included in this study. Qualitative research methods are appropriate to cover these aspects of life. This being so, the study loses out on certain aspects of their livelihoods. The village level workers of the NGOs were supposed to play a major role in contributing substantially in the process of study. However, as they could not contribute what was expected of them, the researchers were overburdened with the field-level responsibilities of motivating and monitoring the data recorders. This effectively reduced the time available with them, which could have been utilized for collecting the qualitative data. The FNGOs could not provide baseline information of all 36 villages on the basis of VDLP, for which only the available data of 18 villages were analysed.

Chapter 3. Findings of the Study

A. Short Profile of the Programme Districts

The socio economic profile of the four Programme districts is given in Table 3.1 while the profile of 10 Blocks is given in Table 3.2

Table 3.1 Socio-Economic Profile of the Programme Districts

District	Population ('000)				% of rural population to total population	Population density per sq km	Literacy%		SC population('000)		ST population ('000)	
	Male	Female	Total	Sex ratio			Male	Female	Male	Female	Male	Female
Gajapati	255	263	518	1031	89.81	120	54.7	28.4	19	20	129	135
Kalahandi	668	668	1336	1001	92.50	169	62.6	29.3	117	118	188	193
Kandhamal	323	325	648	1008	93.20	81	69.7	35.8	54	55	166	170
Koraput	591	590	1181	999	83.19	134	47.2	24.3	76	77	290	295
State	18660	18144	36804	972	85.01	236	75.3	50.5	307	300	406	407

District	No. of villages		Normal rainfall in mm	Land utilisation(' 000 ha)		Livestock population				
	Inhabited	Uninhabited		Forest area	Net sown area	Cattle	Goat	Sheep	Pig	Poultry birds
Gajapati	1512	107	1295	247	74	228385	104700	12139	24824	245958
Kalahandi	2099	137	1378	314	306	462935	223723	86946	6396	991343
Kandhamal	2379	167	1597	571	115	67335	214805	5666	46308	430278
Koraput	1922	106	1521	188	287	524975	158084	125251	51382	848582
State	47529	3820	1482	5813	5691	14187673	5973919	1758700	569533	18994753

District	Area covered in '000 ha							
	Rice	Total cereals	Total pulses	Total oilseeds	Vegetables	Sugarcane	Condiments& spices	Fibres
Gajapati	33.57	55.70	30.49	17.71	18.11	0.61	3.01	0.95
Kalahandi	287.83	302.57	173.92	50.17	19.91	1.37	4.12	17.44
Kandhamal	55.93	75.04	26.30	30.36	25.49	-	16.18	0.21
Koraput	137.83	234.54	35.40	49.41	29.44	7.28	9.43	1.23
State	4479.26	4909.65	1880.03	824.64	652.17	36.71	145.05	98.65

District	Yield rate of important crops in quintal per ha							
	Rice	Total cereals	Total pulses	Total oilseeds	Vegetables	Sugarcane	Condiments and spices	Fibres
Gajapati	21.22	12.49	5.41	4.63	108.54	823.68	13.52	8.09
Kalahandi	16.15	10.73	6.20	7.78	126.98	692.50	13.28	4.27
Kandhamal	19.57	12.91	3.74	3.58	129.58	-	21.74	3.26
Koraput	24.49	12.71	3.94	3.34	106.82	893.56	16.27	8.20
State	23.20	15.13	4.22	6.68	122.10	692.86	13.48	6.85

Source: Statistical Abstract of Orissa 2005
Districts at a Glance 2007, Orissa
Orissa Agricultural Statistics 2005-06

Table 3.2 Socio-Economic Profile of the Blocks

District	Block	Population as per 2001 census			Female : male ratio	ST Population		
		Male	Female	Total		Male	Female	Total
Gajapati	Rayagad	30953	33023	63976	1067	24272	26175	50447
	Guma	31478	33814	65292	1074	23223	25322	48545
	Nuagada	22774	24162	46936	1061	17453	18512	35965
Kalahandi	Th. Rampur	32483	33284	65767	1025	18543	19307	37850
	Lanjigad	37077	38068	75145	1027	17998	18699	36693
Koraput	Laxmipur	27452	27816	55268	1013	18745	19206	37951
	N. Patana	19173	18944	38117	988	15598	15498	31096
	Bandhugaon	24347	25653	50000	1054	18931	19918	38849
Kandhamal	T.Bandha	18803	19258	38061	1024	10628	11032	31660
	Kotagarh	20422	20438	40860	1001	11721	11744	23465

Block	Literacy %			Geographical area in ha	Forest area in ha	Net sown area in ha	Paddy area in ha	Paddy yield in kg/ha
	Total	Male	Female					
Rayagad	35.94	49.46	23.49	96151	2996	7275	4353	1743
Guma	29.49	42.78	17.44	144894	9868	8282	4179	2994
Nuagada	34.54	49.66	20.68	43969	22235	5410	3078	2158
Th. Rampur	28.06	44.38	12.09	34065	10177	10725	6948	1869
Lanjigad	28.85	43.16	14.95	40194	15338	19170	8834	1417
Laxmipur	27.71	39.29	16.28	31033	1014	7049	3622	2097
N. Patana	20.17	28.50	12.46	15700	2752	5718	1298	2058
Bandhugaon	19.85	26.85	13.26	22314	2098	6965	2743	1631
T.Bandha	31.76	45.48	18.56	25724	8534	5892	3389	1606
Kotagarh	33.58	48.27	18.93	32360	18085	3085	2364	2154

B. Socio-economic Profile of Villages

3.1 Population

The average population of the sample villages is around 282 with sex ratio of 1029 females per 1000 males (Table 3.3). On an average, each village is having 13 SC, 266 ST and 6 other caste populations which reveal that the ST population is around 93.4% of total population in the project area. The average population of villages where majority farmers are depending on shifting cultivation is 333 whereas the average population is 221 in villages where people are mostly dependent on collection of NTFP. The villages having access to market and other infrastructures are having average population of 294. It is apparent from the data that the livelihoods opportunities are more in the villages where there is scope for shifting cultivation and collection of NTFP.

Table 3.3 Average Population of Sample Villages

District	Shifting Cultivation		NTFP collection		Access to market		Total	
	M	F	M	F	M	F	M	F
Gajapati	1041	1030	596	495	705	718	2342	2243
Koraput	378	366	283	268	547	557	1008	1191
Kandhamal	253	255	167	128	233	212	653	595
Kalahandi	396	454	334	388	284	282	1014	1124
Average	**157**	**175**	**115**	**106**	**147**	**147**	**139**	**143**

3.2 Connectivity

Of the 36 villages surveyed 11 villages were connected by *pucca* road and 24 by *Kachha* road while one village was inaccessible (Table3.4). With the pace of development 97% villages have been connected by either *pucca* or kachha road. Among the three categories of villages, the villages having accessibility to market were well communicated. Among the districts, communication was relatively worse in Gajapati district and it was better in Koraput district than other three districts.

Table 3.4 Communication Link to Sample Villages

District	Accessible through Kuchha road	Accessible through pucca road	Inaccessible	Total
Gajapati	8	3	1	12
Kalahandi	7	2	0	9
Kandhamal	5	1	-	6
Koraput	4	5	-	9
Total	24	11	1	36

3.3 Utility Services

Among all 36 villages only one village in Gajapati district had Gram Panchayat office.

Two-thirds village had primary schools, which was more in Gajapati and Koraput district than other two districts. PDS shops are available in 33% villages in Gajapati district, 22% villages in Kalahandi and 11% villages in Koraput district. Kandhamal district had no PDS shop in any of the surveyed villages. Local “hat” was available in 8% villages in Gajapati, 16% villages in Kandhamal while no such village market was seen in any of the surveyed villages of Kalahandi and Koraput. Health sub-centres were seen in 22% villages with more in number in Gajapati and Koraput districts. There was no PHC in any of the surveyed villages.

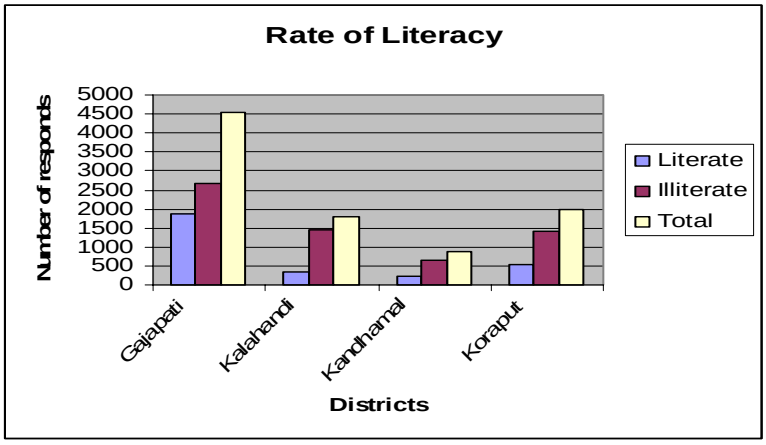
3.4 Education

Nearly 33% of population in the sample villages were found literate and 67% illiterate. Among the literate group 7% were in pre-school, 20% are up to primary level, 4% up to high school and 2% are above high school (Table3.5). Male literacy was more than the female literacy. Among the districts rate of literacy was more in Kalahandi and Gajapati than other two districts so far the study is concerned (Fig. 3.1)

Table 3.5 Educational Status of People

District	Literate				Illiterate	
	> High school	Up to High school	Primary school	Pre-school		
Gajapati	133	244	1219	259	2684	4539
Kalahandi	1	29	254	58	1439	1781
Kandhamal	5	26	91	91	655	868
Koraput	4	48	243	252	1419	1966
Average	36	86	451	165	1548	2287

Fig. 3.1 Rate of literacy in sample villages



3.5 Infrastructure

Electricity is available in 40% villages surveyed in Gajapati district whereas no electricity was found in the surveyed villages of other districts. Postal service was available in 8% villages of Gajapati and 11% villages in Kalahandi district only. Community centres are available in 44% villages whereas Anganwadi centres are available in 47% villages. Nearly 36% villages have grocery shops and only 11% villages have livestock aid centres in Koraput district. Nowhere banking facility was available. About 86% villages have drinking water facility whereas 14% villages still go without drinking water. The number of tube wells is more in Koraput district and Gajapati district. On an average each village is having 1 tube well in working condition.

3.5 Credit

Of the 36 villages covered under the study 11 villages have access to moneylenders, 11 to micro-credit through SHGs, and 2 have access to Banks, while 12 have access to multiple sources of credit. The current study indicates the influence of village moneylenders in 44% cases in spite of substantial improvement of micro-credit through self help groups. The tribal farmers receive credit for agriculture and household consumption from different sources. Most of the tribals prefer to access credit from money lenders as they face difficulty in getting consumption loan from the institutions. Even the tribals are apprehensive of the cumbersome procedure to obtain credit from commercial, rural and cooperative banks. The information collected through household survey gives a clear picture of source of credit and amount of credit availed by them (Table 3.6).

Table 3.6 Source and Amount of Credit Availed by Tribals

District	Source of credit availed by the households					Amount of credit availed in Rs per annum				
	Money lender	SHG	Commercial bank	Cooperatives	Relatives	< 1000	1000-2000	2000-5000	>5000	Number of reporting households
Gajapati	20	4	5	1	7	12	16	5	4	37
Kalahandi	22	7	2	1	5	19	10	8	-	37
Kandhamal	6	3	4	-	5	7	6	5	-	18
Koraput	8	5	13	4	6	10	12	11	3	36
Average in%	43.75	14.84	18.75	4.68	17.96	37.5	34.4	22.6	12	128

3.6 Household Expenditure

Data collected from the villages through focused group discussion (FGD) indicates that the average household annual expenditure is about Rs 16,536 (Table 3.7) under different items such as food, education, health, agriculture and other items including savings. On an average 59% of household expenditure goes towards food where as expenditure on education and health is around 2% and 7%, respectively. Expenditure on agriculture is about 10% whereas on other items (festival, house repair, loan recovery, clothing etc) it is 19%. Saving is hardly 3% of total income. Among the different types of villages food expense is comparatively more in villages having more of shifting cultivation, probably due to excess physical labour. Household expenditure is relatively more in Gajapati and Kandhamal districts than the other two districts.

Table 3.7 Household Annual Expenditure

District	Annual Expenditure in Rs						
	Food	Education	Health	Agriculture	Others (House repair, festival etc.)	Savings	Total
Gajapati	10109	738	1225	1603	3690	1256	18621
Kalahandi	8112	131	1005	1712	3060	209	14229
Kandhamal	11236	446	984	1403	2590	564	17223
Koraput	9788	186	1264	1640	2950	251	16079
Average	9811	375	1119	1589	3072	570	16536

3.7 Household Income

The household income is around Rs 15.926 (Table 3.8) which is earned from on-farm, non-farm and off-farm sources. On-farm sources give about 30% of income. Off-farm income is about 49% whereas non-farm sources give about 21% of income. The average household income and expenditure in sample villages is illustrated in Fig 3.2 & 3.3.

Table 3.8 Household Income

District	Annual income in Rs			
	On-farm	Non-farm	Off-farm	Total
Gajapati	6124	2782	9256	18162
Kalahandi	3864	4027	8706	16597
Kandhamal	4919	3138	6164	14421
Koraput	4116	3977	6382	14475
Average	4756	3493	7677	15926

Fig 3.2

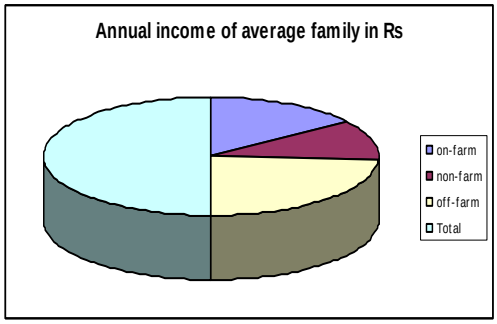
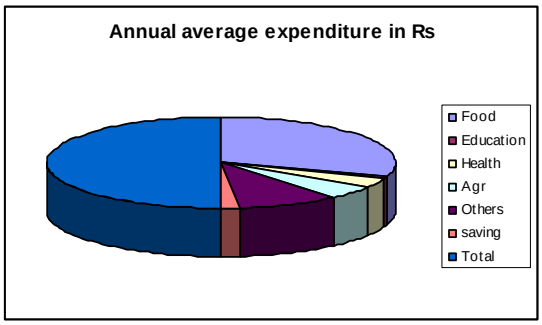


Fig 3.3



3.8 Household Characteristics

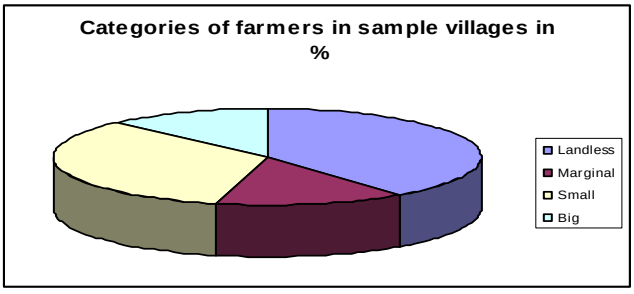
The average family size of the surveyed villages/households is 5.8. The small family size may be attributed, in part, to allotment of houses to them through IAY and the resultant emergence of nuclear families among them, which is about 69%. The government houses, however, have served as a major motivation for the tribals to acquire independent houses and set up independent households. Nearly 79% of households belong to BPL category. Around 31.82% of households are landless and 68.12% are landholders. Of the total landholders 63% are marginalized, 22.9% are small and 14.1% belong to big farmer category (Table 3.9). The percentage of big farmers is more in Koraput district than other districts. However, on an average 86% of landholders belong to marginal and small category. The categories of farmers found in the sample villages are displayed in Fig. 3.4

Table 3.9 Household Category (%)

Category	Gajapati	Kalahandi	Kandhamal	Koraput	Average
Landholders	52.25	72.09	74.90	73.47	68.2
Landless	47.75	27.91	25.10	26.53	31.8
Marginal (< 1 ha)	62.9	57.1	54.7	29.6	63.0
Small(1-2 ha)	25.8	30.8	28.2	37.0	22.9
Big farmers(> 2 ha)	11.3	12.1	17.1	33.4	14.1

As expected, landlessness is more (36.8%) in villages away from the forest and close to markets. Among the three categories of villages the number of marginal and small farmers is comparatively more (90%) in villages where shifting cultivation is mostly adopted by the farmers.

Fig. 3.4



3.9 Religion, Caste and Occupation

Of the 223 households surveyed 67.7% are found to be Hindu and remaining 32.3% are Christians. Among the caste category 10% are SC, 88% are ST and

2% belong to other castes. The people have different occupations which can be grouped as on-farm (farming, agricultural labourers),non-farm (allied agriculture, fisheries, animal husbandry) and off-farm (non-agricultural labour, service, household industry, trade).The findings of survey indicate that nearly 50.8% of members are engaged in some sort of occupation while 49.2% remain unemployed and engaged in household activities, and studies etc. Of the total population of the sample households 30.8% are engaged in on-farm activities, 11.2% are in off-farm activities and 8.8% are in non-farm activities (Table 3.10). It is evident from the table that in spite of inter-district variation in occupations, on-farm activities are the major source of livelihoods followed by off-farm activities and non-farm activities.

Table 3.10 Household Characteristics by Caste and Occupation (%)

Characteristics	Gajapati	Kalahandi	Kandhamal	Koraput	Average
Scheduled caste	-	25	14	5	10
Scheduled tribe	100	69	86	90	88
Other caste	-	6	-	5	2
On-farm activities	30.6	28.5	22.2	34.3	30.8
Off-farm activities	10.4	16.7	11.6	7.5	11.2
Non-farm activities	8.2	11.8	9.8	6.6	8.8
Unemployed	50.8	43.0	50.3	51.6	49.2

C. Assets

3.10 Household Profile of Assets

On an average one household has 8.28 livestock and consumer durables worth Rs 2152. Average household income per year comes to Rs 13,780 against the yearly expenditure of Rs. 16,558. To meet the deficit expenditure an average family borrows about Rs 2778 as loan, either from financing institutions, SHGs or from the moneylenders. The structure of households and profile greatly vary with the districts (Table 3.11). On an average per capita expenditure was 4% more than the per capita income.

Table 3.11 Comparative Profile of Households

Household Characteristics	**Gajapati**	**Kalahandi**	**Kandhamal**	**Koraput**	**Average**
Mean household size	6.21	5.53	5.63	5.58	5.81
Family structure (%)					
Nuclear	59.7	69.2	75.8	76.7	68.6
Joint	40.3	30.8	24.2	23.3	31.4
Holding size in ha	0.68	0.69	0.64	0.76	0.68
Gross cropped area per family in ha	1.1	1.39	1.45	1.94	1.47
Landless families (%)	47.75	27.91	25.10	26.53	31.82
Area under shifting cultivation/household	0.71	0.71	1.50	0.60	0.78
Cattle owned/ HH	2.9	2.54	2.83	2.09	2.59
Goat and sheep owned	2.23	1.45	0.95	2.12	1.98
Pigs owned	-	0.22	2.30	0.31	0.44
Poultry birds owned	2.57	3.31	4.72	3.52	3.27
Per capita annual income (Rs)	2929	3319	2575	2584	2738
Per capita annual expenditure (Rs)	3003	2601	3075	2871	2850

Source : Sample Survey 2007

3.11 Human Capital

Human capital refers to the labour available to the households: its education, skills, and health (Carney D, 1988). Human capital is increased by investment in education and training as well as by the skills acquired through one or more occupations. One of the most important determinants in the livelihood strategy of a household is its status. This will greatly influence the diversification of livelihood resources and augmentation of assets. Of the several constraints to diversify livelihood sources and augmentation of assets, the most serious is illiteracy and ignorance .The tribes, unless given proper guidance and information, would continue with subsistence nature of farming and cannot adopt new technologies. This obstacle could be, to a large extent, removed by giving them the right type of education. Education has a higher pay-off for peasants in a changing, modernising environment than in a traditional society (Schultz, 1964).

Against this backdrop the study reveals that nearly 90% of the heads of the households are illiterate. Educational status of the household does not show much of an inter-district difference (Table 3.12). The educational level of other members cannot be ignored as they also have a key role in decision-making. The educational level of households observed during primary study (Table 3.13) indicates that the current level of education cannot easily change the decision-making process.

Table 3.12 Distribution of Household Members According to Education (%)

Education level	Gajapati	Kalahandi	Kandhamal	Koraput
Illiterate	53.5	76.04	65.64	68.66
Primary	22.16	16.32	18.40	18.50
Middle	11.40	4.17	9.20	8.06
High school	10.00	3.47	4.91	4.48
Intermediate	2.35	-	1.23	-
Graduate/PG	0.59	-	0.61	0.30

Table 3.13 Educational Level of Sample Households

District	Education level of households surveyed								
	Neo-literate	Primary	Middle	High school	In term-mediate	Graduate	Post-graduate	Illiterate	Total
Gajapati	52	113	58	51	12	3	0	221	510
Kalahandi	42	47	12	10	0	0	0	177	288
Kandhamal	24	30	15	8	2	0	1	83	163
Koraput	27	62	27	15	0	1	0	203	335
Average	36.25	63	28	21	3.50	1	0.25	171	324

3.12 Physical capital

The livelihood approach (Carney D, 1998) places a lot of emphasis on physical assets, especially on the identification of assets possessed by the rural poor and can be utilised or built upon to increase the resilience and security of their livelihoods. There has been a lot of improvement in the housing structure of tribes owing to the direct support from government-sponsored projects. It does not mean, however, that there is an all-round progress in the construction of houses for all tribes. The study indicates that 2% of households have *pucca* houses (casted and cement floored) whereas about 90% houses are having tiled/ tin roofing. The house condition is comparatively better in Gajapati district (4.78% *pucca* house) than the other districts.

As expected, 97% of sample households rely on open latrines. Almost 95% households depend on river, stream, and ponds for bathing. Modern types of toilets are seldom found in the tribal houses (Table 3.14).

Table 3.14 Household Condition of Tribals (%).

House structure	Gajapati	Kalahandi	Kandhamal	Koraput
Type of roof Concrete Thatched/ Tiled	 4.78 95.22	 - 100	 - 100	 0.7 99.3
Toilets	12.00	-	-	0.16
Open toilet	89.02	100	100	98.3
Access to safe drinking water	53.65	57.7	50.0	56.6

Consumer durables such as utensils, bi-cycle, motor cycle, radio, television, furniture, electricity appliances etc. are indicators of standard of living in rural areas. Ownership of consumer durables was better in Gajapati district than other districts (Table 3.15)

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Table 3.15 Availability of Consumer Durables (% Households)

Consumer durable	Gajapati	Kalahandi	Kandhamal	Koraput	Average
Electrical lights	41.6	-	-	-	-
Motor cycle	11	0.6	3	8	5.5
Bi-cycle	61	32	32	23	37
Radio	27	36	26	16	26
Television	8	2	4.5	3	4.3
Steel utensils8	8	2	4	6	5

3.13 Natural capital

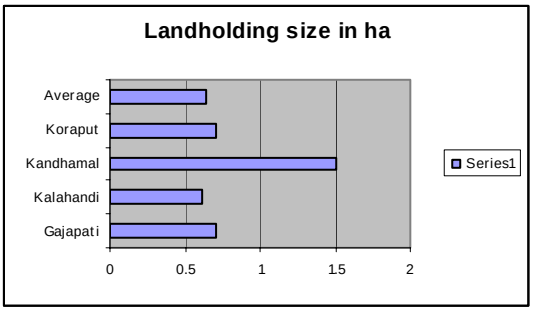
Natural capital comprises land , water and forests and other biological resources. Land is the major determinant of the asset status of households and hence a strategic factor determining their livelihood. The current study indicates that 31.82% of households are landless (but having access to shifting cultivation and encroachment of government land) while 68.18% are landholders. Around 63% of households possess less than 1 ha of land (marginal) and 22.9 % are having 1-2 ha of land (small). The land ownership is comparatively better in Kalahandi, Koraput and Kandhamal than Gajapati district (Table 3.9).

On an average each landholder family is having 0.64 ha of land under settled cultivation as per village data (Table 3.16). It is also found during the study that the average landholding in the villages where shifting cultivation is practiced is about 1.00 ha whereas it is 0.44 ha and 0.83 ha in the villages having potential of NTFP and market access, respectively. The study villages are heterogeneous in the sense people from various caste groups reside. The landholding pattern is skewed and there are a substantial section of landless households in these villages. Fig. 3.5 illustrates the land holding pattern in sample villages of project districts.

Table 3.16 Size of Landholding

District	Average landholding in ha
Gajapati	0.71
Kalahandi	0.60
Kandhamal	1.50
Koraput	0.71
Average	0.64

Fig. 3.5 Size of the landholdings

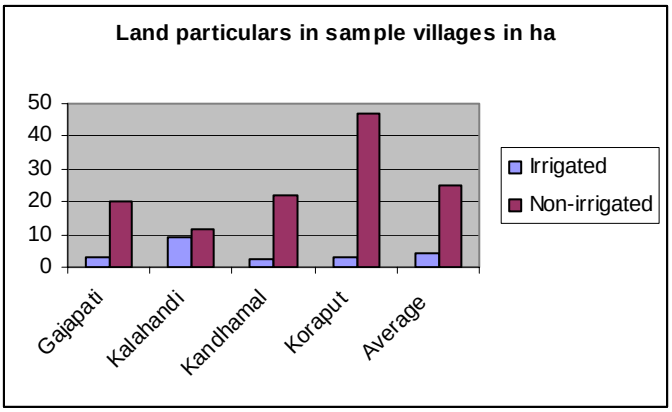


The extent of upland is 55%, while that of medium and lowland are 30% and 15%, respectively. It was found during survey that 15% of cultivated area in the sample villages is irrigated whereas 85% area is rain-fed. The extent of area under different categories of land in the sample villages is indicated in the Table 3.17 and displayed in Fig.3.6

Table 3.17 Land Particulars in Sample Villages (in ha)

District	Upland		Medium land		Lowland		Total	
	Irrigated	Non-irrigated	Irrigated	Non-irrigated	Irrigated	Non-irrigated	Irrigated	Non-irrigated
Gajapati	0.17	9.76	0.51	8.15	2.52	3.53	3.20	20.40
Kalahandi	3.00	8.28	5.67	2.99	0.53	0.59	9.20	11.86
Kandhamal	-	17.27	-	2.45	2.57	2.26	2.57	21.98
Koraput	0.52	27.16	-	15.73	2.80	3.80	3.32	46.69
Average	0.92	15.62	1.54	7.33	2.10	2.29	4.56	25.24

Fig 3.6 Land particulars



D. Livelihoods

3.14 Shifting Cultivation

Shifting cultivation is an age-old practice which is locally known as the *podu* cultivation. Each household takes about 0.68 ha of forest land under shifting cultivation which provides food security for 4-5 months (September-January).Sowing of seeds begins in the month of May. Harvesting takes place in September. As the maturity period is different for each crop, harvesting is carried out successively starting from September to December. Generally, after the third year, the tribals abandon this land and shift to new land. On the abandoned land, natural regeneration starts from the available root stocks and seed bank. Bamboo comes up naturally; and *kendu (Diospyros melanorylon)*, *mahua (Madhuca indica)*, *Terminalia (Asan, Arjun, Bahera, Harida)* along with certain other climbers also regenerate. Generally, this land is not cultivated for the next 3-5 years.

The data collected from secondary sources indicate that the shifting cultivation is more in Kandhamal district (Table 3.18). During PRA exercise and field study most of the households reported annual coverage of 0.40 to 0.80 ha under shifting cultivation.

Table 3.18 Area under Shifting Cultivation by Households (Ha)

District	Area under shifting cultivation per HH	Type of crops grown
Gajapati	0.52	Millets, pumpkin, pulses
Kalahandi	0.47	Millets and pulses
Kandhamal	0.60	Millets, pulses, turmeric, vegetables
Koraput	0.55	Millets, pulses, pumpkin

3.15 Collection of NTFP

Almost in all the sample villages the people (men and women) including children go to forest for collection of non-timber forest produce (NTFP), fuel wood, roots, tubers, leafy vegetables and medicinal plant species. Some of the primitive tribes also go for hunting. The food security of tribals is not solely agricultural dependent and it is partly forest dependent. In fact forest provides them food, fodder, materials for shelter (wood and *channa)* and medicines for human and animal treatment. Depending on the forest density and forest cover the people gain access to forest resources in the districts (Table 3.19).

Table 3.19 Access to Forests (% of families)

Particulars	Gajapati	Kalahandi	Kandhamal	Koraput
Access to forest	8.3	19.3	14.9	19.0
Access to NTFP	6.7	4.2	6.1	7.8
Value of annual collection of NTFP/ family (Rs)	1220	692	887	1136
Value of household income from other forest activities (Rs)	1514	3202	2143	2758
Days engaged in forest activities/ year	89	104	105	120
Value of per day income from forest (Rs)	30.71	37.44	28.85	32.45

The findings of the study reveal that dependency on forest is more in villages where people are mostly depend on shifting cultivation. The villagers remaining near the market area are reluctant to go to forest for collection of even honey and medicinal plant parts. The forest dependency greatly varies with districts and location of the villages. The current study indicates that 6.2% families have access to NTFP collection in sample villages whereas 15% families have access to forests for both collection of NTFP and shifting cultivation. This indicates that there has been substantial loss of forest cover in recent years, which has probably affected the livelihoods of the tribes. The dependency of forest and NTFP shows inter-district variation (Table 3.19) and per day income from forest is the highest in Kalahandi possibly due to higher market price and accessibility.

The data reveal that income per day from forest activities is always less than the prevalent wage rate in the area (Rs 40-50). NTFP not only supports their consumption requirement but also play a crucial role in providing employment and income during the lean season. The following are the major findings of the study with respect to NTFP.

- The contribution of NTFPs to the poorest households income range between 8% (Gajapati) to 19% in Kalahandi and Koraput).
- In all the villages it was observed that NTFP collection was a major economic activity for the households below poverty line.
- However, simultaneously it is observed that the income from two major NTFPs i.e. Mahua flowers and Char increases with the size of landholdings. This is because the large landowners are able to harness these produces from the trees in their private lands.
- A significant fact is that in terms of income covered from NTFPs women's role is more compared to men as women do most of the NTFP collection.
- Another important finding is that amongst the major NTFPs like Mahua flower/seeds, *Char, Tola*, Mango available in the study villages KL plays the most important role in supporting household income particularly that of landless and marginal farmers.

3.16 Agriculture

Gajapati and Kandhamal districts come under North Eastern Ghat Zone, which is characterized by hot, moist and sub-humid climate. The mean annual rainfall of

the zone is 1597 mm and more than 75% of rainfalls received during monsoon period (June- September) . The soils are brown forest, red and red laterite with sandy to clay loam in texture. Kalahandi district comes under Western Undulating Zone, which is characterized by hot, moist and sub-humid climate with 950-1617 mm. The altitude is 450-900 above mean sea level. The soils are red, mixed red and black. Koraput district comes under Eastern Ghat Highland Zone, which is characterized by warm and humid climate with mean annual rainfall of 1347 mm. The highland constitutes about 58% while medium and lowland constitute 25% and 17%, respectively. The soils are red, black forest and sandy loam. The hill slopes are called "*Dangar*" land, the hill tops being called as "*Dangar* I", mid hills as "*Dangar* II" and foothill as "*Dangar* III" land. The low lands, which are wide, terraced valley bottoms, are called "*Jhola*" lands endowed with perennial water flow (Production Constraints and Research Prioritization Orissa, OUAT). The soils of these districts are mostly acidic in reaction and low to medium in available nitrogen, phosphorus and potassium (Table 3.20).

Table 3.20 Soil Reaction and Nutrient Status

Block	Soil reaction (%)			Available nutrients		
	Acidic	Neutral	Alkaline	Nitrogen	Phosphorus	Potassium
Guma	62	33	5	1.2	1.3	1.3
Nuagad	68	25	3	1.3	1.3	1.3
Raygad	66	28	6	1.4	1.5	1.4
Th. Rampur	44	49	7	1.35	1.90	2.00
Lanjigarg	37	56	7	1.44	2.10	2.10
Tumudibandha	69	27	4	1.11	1.30	2.33
Kotagad	82	18	0	1.12	1.35	2.45
Laxmipur	86	10	4	1.84	1.45	2.06
Narayanpatna	88	12	0	1.67	2.10	1.88
Bandhugaon	88	12	0	1.54	2.08	1.94

Source: Macro and Micro Nutrient Status Soils of Orissa

NB: Low means < 1.5, medium means 1.5-2.5

3.17 Cropping Pattern

The focus of the cultivation undertaken by the tribal households is two fold, either to cultivate food grains and vegetables for self-consumption or cultivate to produce for the market, especially vegetables. Food grains include cereals such as rice, and coarse grains such as maize, jowar and millets like ragi, bajra, Gulji(*Panicum miliare*), Cheena (*Panicum maliaceum*), Suan (*Echinichloa frumentacea*), Kango (*Setaria italica*), Koda (*Paspalam scorbiculatum*) and pulses like pigeon pea (locally called Kandul), cow pea (locally called Barbati), rice bean (locally called *Dangar* Rani), green gram, black gram and beans. The oilseeds grown in the region are groundnut, rapeseed-mustard, niger, sun flower and sesame. Among the vegetables pumpkin, cucumber, ridge gourd, bitter gourd, snake gourd, okra, beans, radish, cauli flower, cabbage, onion, potato brinjal and tomato and leafy vegetables are important. The data on cropping pattern adopted in sample villages are indicated in Table 3.21.

Table 3.21 Cropping Pattern Adopted in Sample Villages (Area in Ha Per Village)

District	Situation	Kharif crops					Rabi crops			
		Paddy	Millets	Vegetables	Pulses	Oilseeds	Pulses	Oilseeds	Vegetables	Paddy
Gajapati	C-1	32.5	18.2	-	5.4	1.5	1.75	0.25	0.2	-
	C-2	21.2	-	2.75	-	-	-	-	0.38	-
	C-3	16.1	9.0	-	3.25	-	2.2	-	-	-

Kalahandi	C-1	30.7	15.3	-	-	6.6	0.3	10.9	3.7	-
	C-2	27.7	19.0	-	5.1	5.6	0.3	15.8	2.3	-
	C-3	24.4	11.0	-	1.3	-	2.7	0.1	0.5	-
Kandhamal	C-1	17.8	1.8	-	12.9	-	-	-	-	-
	C-2	8.1	3.1	-	-	-	0.8	1.5	-	-
	C-3	5.0	5.7	-	10.0	1.0	-	-	-	-
Koraput	C-1	7.3	16.0	-	-	0.6	1.1	1.1	0.3	-
	C-2	38.3	9.3	-	2.0	-	-	2.2	-	2.0
	C-3	15.0	15.0	-	-	6.6	-	-	-	1.3

NB: C-1 = Predominantly Shifting Cultivation
C-2= Predominantly NTFP collection, C-3= Access to market

The sample household data reveals that about 73% of farmers are adopting single crop whereas 27 % adopt double cropping, where irrigation is available (Table 3.22)

Table 3.22 Cropping Patterns Adopted by Households

District	Total households reporting	Households reporting single crop	Households reporting double cropping	Households reporting both single and double cropping	% of households taking single cropping	% of households taking double cropping
Gajapati	80	64	9	7	80	20
Kalahandi	60	32	16	12	53	47
Kandhmal	25	21	2	2	84	16
Koraput	46	35	7	4	76	24

Each household cultivates about 1.70 ha of different crops under settled and shifting cultivation which varies from 1.09 to 2.44 in the project districts (Table 3.23)

Table 3.23 Annual Cropped Area in Ha

District	Cropped area in ha					
	Cereals	Pulses	Oilseeds	Vegetables	Fruits	Total
Gajapati	0.85	0.18	0.02	0.03	0.01	1.09
Kalahandi	1.00	0.18	0.12	0.07	-	1.37
Kandhamala	1.87	0.27	0.19	0.11	-	2.44
Koraput	1.56	0.33	0.02	0.01	0.01	1.93
Average	1.32	0.24	0.09	0.05	-	1.70

The average yield obtained from different crops is found to be very low when compared to the district and state average (Table 3.24)

Table 3.24 Average Crop Yield Per Ha in Quintal

District	Paddy	Millets	Pulses	Oilseeds
Gajapati	14.52	5.42	1.44	1.16
Kalahandi	10.52	9.40	1.22	1.12
Kandhamal	12.62	4.53	1.80	0.73
Koraput	28.60	13.70	1.88	1.14
Average	16.57	8.26	1.58	1.04

An attempt was made during primary survey to ascertain the average production per household and the quantity of marketable surplus. The results indicate that the average production of different commodities per family comes to 14.56 quintal of which the family consumption was 5.09 quintal and marketable surplus was 9.57 quintal which fetched the price of Rs 8357 (Table 3.25). The average

investment of Rs 4445 was reported on agricultural and horticultural activities annually (Table 3.26)

Table 3.25 Household Production, Consumption and Value of Marketed Surplus

District	Average production in quintal	Family consumption in quintal	Annual surplus in quintal	Rate per quintal (Rs)	Value of produce sold (Rs)
Paddy	7.52	3.80	3.72	500	1862
Millets	1.37	0.42	0.95	500	475
Pulse	2.09	0.19	1.90	1500	2850
Oilseeds	1.77	0.19	1.58	1500	2370
Vegetables	1.30	0.40	0.90	600	540
Fruits	0.61	0.09	0.52	500	260
Total	14.66	5.09	9.57		8357

Table 3.26 Investment on Agriculture and Horticulture by Households (In Rs)

District	Agriculture				Horticulture			
	Kharif	Rabi	Summer	Total	Kharif	Rabi	Summer	Total
Gajapati	1677	741	666	3094	430	520	921	1871
Kalahandi	2083	504	470	2974	282	458	250	990
Kalahandi	1220	554	950	2724	378	432	1153	1963
Koraput	1900	517	275	2692	391	664	188	1243
Average	1720	579	590	2889	370	518	628	1556

3.18 It was revealed from the study that the agriculture is mostly subsistence type and the tribal farmers have not yet used fertilizers and plant protection chemicals for scaling up the crop yield. Consumption of biofertiliser and biopesticide was not reported from any sample households. Fertliser use was reported from Gajapati and Koraput district as a result of which the crop yield was better than other districts. The tribal farmers located in Koraput district and Gajapati district are very close to their counterparts of Andhra Pradesh, which has been responsible for such change. With the intervention of OTELP the tribal farmers have started using high yielding paddy varieties through seed exchange programme. It can be summarized that the use of certified high yielding seeds, fertilizers, pesticides and machinery/implements for precision farming is totally neglected in the region, which has attributed to poor crop yield and low profitability in all cases.

3.19 Livestock & Fishery

In subsistence economies, animal husbandry constitutes a major source of livelihood. Hordes of cows and goats are seen grazing in the deforested mountain slopes. Tribes keep cows and chicks for their own household purposes of milk and eggs. The only exception is rearing of goats and sheep which they do mainly for the market. In times of difficulty they sell their livestock at distress prices, mainly to settlers and their middlemen (Table 3.27). Most of the tribals are not accustomed in drinking cow's milk or preparing any by-product out of cow's milk. Pig is mostly preferred by tribals and SC people due to its quick multiplication rate and more live weight. The average number of livestock owned by households is indicated in Table 3.27.

Table3.27 Population of Livestock with the Households (No. per household)

District	Cattle	Goat/sheep	Pig	Poultry birds	Total
Gajapati	2.93	2.23	0.06	2.57	7.79
Kalahandi	2.54	1.92	0.22	3.31	7.99
Kandhamal	2.83	0.96	2.30	4.72	10.81
Koraput	2.10	2.14	0.31	3.52	8.07
Average	2.59	1.98	0.44	3.27	8.28

During the course of study fishery activity was not reported from any village which indicates that probably fishery will not be feasible in tribal areas, except in created water bodies. The annual household income from livestock production and collection of NTFP was reported as Rs 2600 per annum (Table 3.28).

Table 3.28 Average Household Income Allied Agriculture and NTFP Collection (Rs)

District	Livestock production	NTFP	Total
Gajapati	1516	1835	3351
Kalahandi	763	1118	1881
Kamdhamal	1238	1182	2420
Koraput	1120	1627	2747
Average	1160	1440	2600

3.20 Basing on the natural resource base as well as human , physical and financial capital, the livelihoods of different categories of people has been different. In the entire four programme districts the major livelihoods have been agriculture, collection of NTFP, wage labour and animal husbandry with limited options for petty business and service. In Gajapati district agriculture, collection of NTFP, wage earning, migration and agro-processing have been the major livelihoods. In Koraput district agriculture, wage earning, NTFP collection, animal husbandry, business and seasonal migration are major livelihoods for the tribals. In Kandhamal district wage labour, agriculture, collection of NTFP and animal rearing are the important livelihoods. Agriculture followed by collection of NTFP, wage labour, animal husbandry and business are major source of livelihoods of tribals of Kalahandi district. By agriculture we mean settled cultivation, shifting cultivation, cultivation on common property resources and sharecropping. The primary survey indicates different preferred livelihoods for different categories of farmers (Table 3.29)

Table 3.29 Pattern of Livelihoods of Different Farmers

District	Marginal/ Small	Big farmer	Landless
Gajapati	Agriculture, NTFP, wage	Agriculture, NTFP	Wage, NTFP, sharecropping
Kalahandi	Agriculture, wage, NTFP	Agriculture, NTFP	Wage, sharecropping, NTFP
Kandhmal	Agriculture, share cropping, wage	Agriculture, share cropping , NTFP	Wage, Share cropping, NTFP
Koraput	Agriculture, NTFP, wage	Agriculture, AH	Wage, Share cropping, NTFP

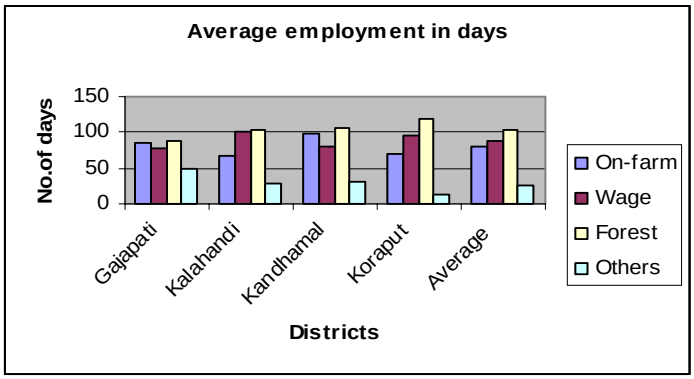
3.21 Wage employment

Agriculture provides engagement for 80 days in a year to households whereas wage labour provides engagement for 89 days, which has been possible after implementation of NREGS and other poverty alleviation schemes. Forest provides engagement for 104 days part-time engagement equivalent to 50 man-days. The households surveyed in sample villages reported 300 day's engagement (both full and part-time) as displayed in Table 3.30 and illustrated in Fig 3.7

Table 3.30 Average Period of Engagement

District	On-farm activity	Wage employment	Forest activities	Migration	Small enterprises	Others	Total
Gajapati	85	78	89	26	1	23	302
Kalahandi	68	102	104	14	-	15	314
Kandhamal	98	80	105	16	-	15	314
Koraput	70	96	120	2	5	5	298
Average	80	89	104	14	1	12	300

Fig 3.7 Days of employment



The existing wage rate was observed to be hardly Rs 40-50 (except for the period of engagement in NREGS) per day irrespective of sex against the minimum wage rate of Rs 70 per day fixed by the government. In agricultural sector the male gets Rs 40/day for 6 hours whereas the female worker gets about Rs 30-40 per day for similar hours of work. The landless families are mostly benefited by NREGS which was verified from the job cards provided to them.

E. Food security

3.21 Food security is linked with availability, access and absorption. Agriculture does not only provide food for the tribals, in most cases it is forest dependent. During the course of primary survey it was observed that the tribal households ensure food security for 4- 12 months depending on the asset base. The food deficit is met with the targeted PDS, special schemes under food safety net and rural development schemes like SGRY, NREGS etc. The existing food security as assessed from household survey is displayed in Table 3.31.

Table 3.31 Period of Food Security

District	Number of months secured in food by category of farmers				
	Landless	Marginal	Small	Medium	Large

Gajapati	7	9	9	10.5	12
Kalahandi	3.5	5.5	6	8	11
Kandhamal	5	6	6	8	10
Koraput	5	6.5	8	9	10
Average	5	6.5	7	9	10.5

The PRA outputs indicate that the food security period ranges from 5-8 months in Kalahandi, 6-11 months in Koraput, 7-10 months in Kandhamal and 5-10 months in Gajapati district. The baseline information provided by the FNGOs indicate the food secured period of 5-10 months in Kalahandi, 4-11 months in Koraput, 3-9 months in Kandhamal and 4-10 months in Gajapati district. From the data collected from various sources it can be said that the food security period ranges from 4-12 months in different districts.

3.22 Health and sanitation

Of the 36 villages surveyed, drinking water is available in 86% villages and in 14% cases people are using pond or stream water for drinking. Government has made provision for safe drinking water by installing tube wells in almost all the tribal villages, but some of those are already defunct. Table 3.32 indicates that there is about one functional tube well (in 86% villages) which is the major source of drinking water. In absence of tube wells, the women and girl children take the burden of carrying water from distant places to meet the family requirement. The household survey indicates that 52.4% have access to safe drinking water (Table 3.33).The livestock usually depend on streams, rivers and ponds for drinking and bathing. In absence of toilets almost all villagers take their bath in ponds and streams, and even near the tube wells. Village drains are not available in most of the villages although there are some drains constructed along with concrete road inside the village. But such drains are not well maintained. Due to lack of consciousness the platforms of the tube wells are used for washing clothes and utensils making it unhygienic. *Anganwadi* centers are available in 47% villages surveyed whereas livestock aid center is available in one village out of 36. During focused discussion with the villagers and PRA it was noticed that access to health facilities were unsatisfactory in all cases as a result of which communicable diseases, skin diseases, malaria and other sexually transmitted diseases were mostly seen. Casualty due to malaria was more than other diseases. Of the total 223 households surveyed, 11 households reported using community and individual latrines whereas 95% household use open fields as latrine. For rearing domestic animals 38% households have constructed separate animal sheds away from dwelling house and 27% households have constructed cattle sheds adjacent to dwelling houses. In other cases no animal shed was available.

Table 3.32 Source of Drinking Water in Sample Villages

District	Villages having drinking water	Source-wise drinking water			
		Well	Tube well	Pond	Stream/river
Gajapati	11	15	39	6	12
Kalahandi	8	2	7	-	6
Kandhamal	4	4	4	1	6

Koraput	8	-	14	-	7
Total	31	21	65	7	31

Table 3.33 Source of Drinking Water for Households

District	Source-wise drinking water availability						
	Stream	Tube well	Sanitary well	Open well	Pond	Tap water	Total
Gajapati	12	21	3	26	-	20	82
Kalahandi	17	29	1	5	-	-	52
Kandhamal	16	-	-	12	1	-	29
Koraput	16	34	-	1	-	9	60
Total	61	84	4	43	1	29	223

3.23 Migration

Detailed study on migration was beyond the scope of the study. However, related data on migration in the context of food security was collected from the villagers and sample households. It was revealed from the study that scarcity of food, low income and unemployment were the driving forces for such migration to AP, Maharastra, Gujurat and Karnatak states. The details of findings are displayed in Table 3.34.

Table 3.34 Periods of Migration and Causes

District	HH surveyed	HHs reporting migration	Reasons for migration			Period of migration		
			Better income	Food shortage	Employment	Up to 3 months	4-5 months	>5 months
Gajapati	82	17	1	9	7	4	8	5
Kalahandi	52	10	1	6	3	6	1	3
Kandhamal	29	5	1	4	-	-	3	2
Koraput	60	5	-	2	3	5	-	-
Average%		16.6	8	57	35	40	33	27

F. Women's empowerment

3.24 Of the 223 household surveyed, 62% women participated in *Panchayat* election and 37% have been elected (Table 3.35). Interestingly those who have been elected speak about positive side of PRI whereas those who have not been elected speak the negative side. In most of the villages the women have formed SHGs and started some income generating activities along with credit and thrift. They have now earned courage to come to the front and participate in-group discussion. Some of the women farmers are found to be real decision makers in farming, which is more prevalent in Gajapati district.

Table 3.35 Women's Participation in Panchayat Election

District	Total households reporting	Women participated in Panchayat election	Women got elected
Gajapati	82	43	39
Kalahandi	52	30	22
Kandhamal	29	19	10
Koraput	60	30	30
Total	223	140	83

Chapter 4. Livelihoods Analysis

4.1 A livelihood is 'sustainable' when it can cope with, and recover from stresses and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities to the next generation: and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term" (Chamber, R; Conway, G 1992). With this perspective the simplified conceptual framework developed for the study comprises three key basic concepts. They are (a) livelihood resources and capabilities, (b) livelihood activities, and (c) outputs obtained from performing activities for fulfilling the livelihoods needs of rural people.

4.2 Household livelihood system as analyzed from the basic needs of the supply system and production subsystems that operate at the household level is depicted in Table 4.1

Table 4.1 Household Livelihood System-Diagnostic Results

Basic needs supply system	*Production subsystem (components of basic needs subsystem)*
Direct needs (output consumed directly by the household)	
Food	**Crops, livestock, fish, NTFP, purchased foods**
Energy	Firewood from forest, crop residues etc.
Shelter	Timber, NTFPs, purchases
Medicines	Medicinal plants, purchased medicines
Cash	**Short term cash crops, livestock, NTFPs, cottage industries +**
Saving/investment	**Long term saving, investment in livestock, trees, banks, farm improvements +**
Indirect need (major inputs for producing outputs that are consumed by the household)	
Feed for livestock	**Grasses, forage, crop residues, feed crops**

Raw material for cottage industry	NTFPs, timber, crops, purchased material

Adapted from NAFRI (Livelihood analysis: A checklist)

A. Land and Indebtedness

4.2 Land was the major livelihood source for tribes before the intervention of people from the plain lands to tribal areas. However, the entry of outsiders to the tribal region disturbed the livelihood settings of the tribes. The majority of the new settlers are peasant cultivators who have displaced the original inhabitants, the tribes from the best quality lands. Traditional tribal cultivation was primitive subsistence agriculture of the "slash-and-burn" type (shifting cultivation). The livelihood was mainly obtained from subsistence farming and collection of minor forest produce. In the course of time, the area under shifting cultivation dwindled considerably due to a variety of reasons including restrictions on extensive cultivation imposed by the government beyond certain slope. The two types of cultivation, shifting cultivation, based on tribe's indigenous technology and settled cultivation (peasant agriculture), are now in practice by the tribes in the project area and elsewhere in similar situation in the area resulting in livelihood activities restricted to limited forest area.

4.3 A minimum land area of 4.00 acre (1.60 ha) is required for meeting the family requirement of food grains, oilseeds and vegetables of a standard tribal family comprising six members (5 adult equivalent). [2] The findings of the current study reveal the average landholding of 0.64 ha under settled cultivation and 0.53 ha under shifting cultivation, which is 30% less than the actual requirement. The majority of farmers belonging to marginal and small category have still less area under their possession and landlessness is observed in 32% households.

4.4 Tribal land alienation is the most important cause of the pauperisation of tribal people and their unsustainable livelihoods. The access of tribals to forests for their livelihoods has shrunk both because forests themselves have shrunk, and the regulatory regime continues to restrict tribals from collecting and processing non-timber forest produce for their livelihoods. Shifting cultivation has also been severely restricted. The tribals are systematically deprived of their cultivable holdings, by non-tribals and even by government for various projects and industries.

As the tribals have an innate fear based on bitter past experience as well as cumbersome procedure of commercial banks, cooperative institutions and other government sources of credit, they prefer to borrow from the rural moneylender at usurious interest rates. Further, most banks and cooperative institutions are unwilling to provide consumption loans, and moneylenders are the only sources of consumption credit. A combination of these factors led to an extreme dependence on moneylenders on the part of the tribal, keeping him in perpetual debt and resulting in the mortgage and ultimate loss of his land. Very often the crop is mortgaged from the sowing period and all the produce is taken away by the moneylender for a petty sum.

B. Shifting Cultivation

4.5 Shifting cultivation is an age-old practice, which is locally known as the *podu* cultivation. About 5298 sq km area annually is under this primitive agriculture practice in Orissa. Shifting cultivation is prevalent in Kalahandi, Koraput, Kandhamal and other southern and western districts, covering 119 blocks.
The tribal communities, viz. *Kondha*, *Kutia Kondha*, *Dongaria Kondha*, *Lanjia Sauras*, *Paraja*, *Godaba*, *Koya*, *Didayi*, *Bonda*, *Jhang* and *Pauri Bhuyan*, *Peranga* and *Erenga Kolha* are involved in this practice. Many festivals and other such rituals revolve around the *podu* fields, because the tribals view *podu* cultivation not just as a means of their livelihood, but as a way of life.

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[2] The requirement of cereals, pulses, oilseeds and vegetables has been calculated as 1450 kg, 190 kg, 260 kg and 625 kg respectively for 5 adults including seed and loss, which can be produced from 6 acre of land with single and double cropping according to current level of productivity in tribal areas. In addition, each family has to keep one milch cow and 5 poultry birds to meet the annual diet requirement (112 litre of milk, 574 eggs and 43 kg meat).

4.6 As different from settled cultivation, shifting cultivation involves traditionally established conventionality and rituals. The shifting cultivation is generally practiced in the following sequence:

- Selecting a forest patch and clearing the vegetation normally in December and January
- Burning of the vegetation (without stumps and roots) in February and March
- Sowing of seeds, by dibbling, generally of cereals, vegetables and oil seeds in April–May
- Continuing cultivation for a few years
- Abandoning the cultivated site and shifting to other forest sites
- Returning to the former site, and once again practice shifting cultivation on it.

4.7 Sowing of seeds begins in the month of May. The soil is not disturbed much by way of 'preparation' for sowing seeds. Instead, seeds are just dibbled into holes. Women take small pits on the ground for sowing pigeon pea (*Cajanus cajan*)] and field beans (*Dolichos lablab*)]. Afterwards, in May itself, the seeds of *ragi* (*Elusine coracana*), *suan* (*Panicum miliaceum), koda (Paspalam scorbiculatum*) and *gulji* (*Panicum miliare*) are mixed together and broadcast. During the pre-monsoon, *suan*, *kangu (Setaria italica)* and ginger are also planted. Generally, turmeric is planted with *kangu* and *suan*: turmeric forms the underground crop having economic value, and *kangu* and *suan* form the overland crops for consumption. At many places ginger is raised as the pure crop. When the plants have grown up to about one foot height, weeding work begins (by June) and it continues till August. Weeding is done to the barest minimum required with fear of soil erosion. Harvesting takes place in September and continues up to December. As the maturity period is different for each crop, harvesting is carried out successively starting from September to December, which ensures household food security. Generally, after the third year, the tribals abandon this land and shift to new land. On the abandoned land, natural regeneration starts from the available rootstocks and seed bank. The tribals collect roots, tubers and fuel wood from this land during this period.

4.8 With reduction in *podu* cycle from 20–30 years to 3-5 years, the land under shifting cultivation looses its nutrients and the topsoil. With reduction in crop yield, the families start moving to other virgin areas. Frequent shifting from one land to the other has affected the ecology of these regions, declined the area under natural forest, caused fragmentation of habitat and disappearance of native species including invasion by exotic weeds. The area having *podu* cycle of 3 and 5 years is more vulnerable to weed invasion compared to *podu* cycle of 15-20 years. Reduction in the cycles of *podu* adversely affected the recovery of soil fertility, and the nutrient recycling by the ecosystem. Repeated short-cycle *of podu* has created forest-canopy gaps, which can be seen as thin forests from a distance.

4.9 In shifting cultivation once the fertility of the land declined, it is abandoned and another area is selected for clearing and farming. The former area is reverted to forests and remained uncultivated for years together. Though the tribal agro-ecosystems are well satisfied in shifting cultivation and efficiency of shifting cultivation in terms of energy and economy is superior to that of settled agriculture provided it is done in 15-20 year cycle. *Podu* cultivation in short cycle has been detrimental to the ecosystem. During field study shifting cultivation on the hill slopes with reduced shifting cycles was found to be prevalent. This has led to degradation of hillside vegetation, increasing soil erosion and scarcity of forest products. According to villagers, the degradation of hillsides has affected both the quality and quantity of water flow. In absence of fertilizer usage, the lowland as well as medium land depends on the nutrient flow from hillsides and villagers pointed out that there is reduction of "*rasa*" (nutrient content) in water due to hillside degradation The streams also carry more coarse silt, which affects the *Jhola* land through sand casting. Another externality caused due to degradation of hillsides is non-availability of suitable small timber and wood for house-construction, agriculture implements and non-timber forest products including wild foods.

4.10 Incentive and assistance provided by ITDA and Agriculture Department prompted the tribals to go for settled cultivation. The seeds and seedlings received by them were planted in their plots nearby their homestead land without receiving sufficient technological backup. As a result, many of these crops remained unproductive or yielded very low levels of output. Cultivation of *ragi*, and other cereal crops did not fetch adequate income to meet the cash requirements of most of the tribal households. They were motivated to shift to cash crops like cotton, vegetable and groundnut, which has short period of waiting for receipt of return. This has affected their traditional agriculture and food security.

C. Collection of NTFP

4.11 Non-Timber Forest Products (NTFP) form an important source of subsistence and livelihoods for the tribals as well as other forest dependent communities at a time when agricultural output fluctuates from year to year along with frequent droughts and other natural calamities. Popular estimation strangely overlooks the strength of NTFP's in combating poverty and food crisis and poverty alleviation programmes have a land bias approach i.e., it aims at increasing the agricultural production and income generation activities around agriculture without giving due importance to occupations relating to collection, processing and marketing of

NTFPs. Now looking at the macro economic profile of the State, the per capita availability of cultivated land, which was 0.39 hectare in 1950-51 has declined to 0.16 hectare in 2001. In such situation Forest Produce and NTFPs in particular has all along been a vital source of subsistence and livelihoods for the rural poor and tribals in the State. According to one study, about 15% of the forest dwellers take NTFP gathering as their main occupation and about 34% take it as a subsidiary occupation.[3]

4.12 The current study indicates that 6.2% families have access to NTFP collection in sample villages whereas 15% families have access to forests for both collection of NTFP and shifting cultivation. This indicates that there has been substantial loss of forest cover in recent years, which has probably affected the livelihoods of the tribes.

4.13 Among all NTFPs *Kendu* leaf (KL) plucking is one of the most important sources of livelihood for the poor particularly in the tribal areas. The tribal districts are affected by recurrent droughts with high degree of migration, food insecurity and even alleged starvation. During the summer months in the absence of other employment sources, KL is one of the few sources of ready cash for the poor. KL generates about ten million person days of work during the lean summer months for lakhs of tribals and Dalits .[4]

A detailed study on the impact of KL on the livelihoods of the tribal people was beyond the scope of the study. However, substantial income from KL plucking during summer was reported in some sample villages.

The NTFP policy of the State was revenue based and control oriented. The State to protect its revenue interest had taken complete command over certain commodities like Bamboo, KL and *Sal* seeds. For the rest NTFPs it was giving lease to Private parties/Corporations and in the process created monopoly interest. As a result of strong criticism against such policy orientation and concerted efforts by the people at different levels the NTFP policy was changed in March 2000.

4.14 The new policy is a significant departure from the old one in the sense that it recognizes the critical importance of NTFPs in the livelihood of tribals and the rural poor, and seeks to give primacy to welfare of forest dependent poor over revenue objectives of the State.

Further, it seeks to decontrol NTFP trade and encourage competition for NTFP procurement by conferring rights over 67 NTFP items to Gram *Panchayat* as opposed to the erstwhile policies of monopoly leasing. Again, the Policy document says that such changes have been brought about in pursuance to the provisions of PESA. The State covertly makes the distinction between minor forest produce and NTFP and uses the unilateral definition to deny the forest dependent poor of their rights over the MFPs. Moreover, the definition has been kept open; to include products as the State might decide from time to time in future. Thus, as the commercial value of other products currently in the MFP list increase, the govt. can bring it under its fold.

4.15 *Gram Panchayat* has been denied rights over NTFPs from reserve forest areas and customary rights of natural inhabitants of areas coming under Wild Life Sanctuaries and National Parks have been totally ignored. The resolution

mentions that Gram Panchayats would not be able to lease out NTFPs from Reserve Forest (RF), Protected Forest, but does not specify if the Forest Department would have the rights to allocate procurement rights for NTFPs in R.F. Under PESA right of NTFP has been given to *Gram Sabha.*

4.16 The resolution is silent about bamboo, *Kendu* leaves and *Sal* seeds, presently Nationalised NTFPs. These have been kept outside the purview of the resolution in the pretext that well-laid down policies exist for these. As a consequence of these "well-laid-down policies" the solvent extraction plants in the state have been closed down, sal seed prices have been depressed for years; and Orissa *Kendu* Leaf pluckers get lowest wages/ remuneration as compared to other states, despite our leaves being of better quality.

[3] Livelihood of Forest Dwellers & NTFP Policy in Orissa – A study & Policy analysis of Orissa Drought Action Forum, 1996.

[4] Potential of KL collection and poverty alleviation in Orissa, Vasundhara, 1998

4.17 *Kendu* Leaf (KL) collection is an important source of livelihood for about 20 lakhs KL gatherers in the State. Majority of the KL pluckers are women, and most subsist below the official poverty line. Major parts of the profits from the KL trade are retained by the State at the costs of fair incomes to the poorest of the State.

4.18 The policy talks about sustainable harvest of NTFP items such as Tassar Cocoons, *Sal* leaves that can have adverse impacts on the tree-health without taking the livelihood interest of poorest into account. The policy also doesn't talk about Lac as it is a restricted item. Though the policy aims at providing fair prices to the people it talks little about the mechanism. The State puts the responsibility on the *Panchayat* institutions without developing a frame and even caring to build their capacity. As regard to price fixation policy it is wage labour oriented. The price fixation mechanism has no provision to consult the actual gatherers of NTFPs who in fact are the owners of these produces. Though the policy says that *Panchayats* are the owners of the NTFPs but in reality they have been given rudimentary role with regard to the trade of NTFPs i.e. registration of traders on payment of specified fee. From the field observations it is found that many *Panchayats* are not able to discharge their responsibilities in a fair manner. Rather in situations their role has run in favour of the traders. This has caused distress sale of gathered NTFP by the tribals and even by SHGs.

D. Agriculture

4.19 The focus of the cultivation undertaken by the tribal households is two fold, either to cultivate for self-consumption or for the market, especially vegetables. Food grains include fine cereals such as rice, and coarse grains such as maize and jowar and millets like *Gulji* (*Panicum miliare*), *Cheena* (*Panicum maliaceum*), *Suan* (*Echinichloa frumentacea*), *Kango* (*Setaria italica*), *Koda* (*Paspalam scorbiculatum*). The four crop types mainly grown by the tribals are cereals (rice, ragi, maize and millets), vegetables (cucurbits, brinjal, tomato, okra, radish, cauli flower, cabbage, onion, root and tubers), pulses (pigeon pea, green gram, black gram, rice bean, chick pee, field pea, cow pea, beans), oilseeds (groundnut, niger mustard, sesame) . Fruit trees (mango, citrus, jack fruit, banana, papaya, cashew) are grown inside forests, common lands or on homestead lands. However, it is seen that there is tendency to grow rice either on ancestral lands

or sharecropping farms, because they are more fertile and suitable to rice cultivation. Millets are grown more on '*Padar*' lands. Vegetables were cultivated on unbunded or bunded high lands (*Aat* or *Mal*). Most of the vegetables produced are sold in the local markets and nearby towns. About 40-50% of vegetables are consumed and rest is sold in the market. A portion of cereals including nutritious millets, pulses, oilseeds and fruits are sold in the market or to the traders and the money realized is supplemented by income from NTFP, livestock production and wage labour for family expenditure mostly to ensure food security.

4.20 Seeds are an important input for agriculture. The tribal farmers mostly depend on their own preserved seeds and often exchange seeds among themselves. OTELP has started a seed exchange programme, which encourages the tribal farmers to obtain certified seeds in lieu of their own seeds and use for better yield. These seeds can be used for three generations, after which their productivity is expected to decline sharply requiring replacement. The indigenous method of seed storage in bamboo and straw bins, small containers and even polythene bags has led to poor germination resulting low plant population in the field. One of the major causes of poor crop yield is use of low yielding cultivars. It is argued that the indigenous seed varieties have greater adaptation to the harsh ecologies prevalent in the forest area and the current high yielding varieties cannot compete with those in identical situation. This has to be tried through field trials and established. The tribal farmers never practice treating the seeds with fungicides to protect the seeds from seed borne pathogens. Strong motivation is in favour of practicing seed treatment is the felt need.

4.21 During the primary survey it was noticed that the tribals used a small quantity of fertilizer in rice crop in Gajapati and Koraput district whereas no chemical was used in Kalahandi and Kandhamal. In Bandhugan block of Koraput the tribal farmers apply 50 kg of nitrogen per ha whereas in Laxmipur Block the farmers use 30 kg of nitrogen and 20 kg of phosphorus per ha. In Guma Block of Gajapati the tribal farmers used 20-25-12 kg of NPK per hectare. In spite of use of such low dose of fertilizer, the yield of paddy has been doubled depicting quick response of the crop to fertilizer application. Data on district-wise consumption of fertilizer in terms of plant nutrients indicate the consumption of 35, 48. 4 and 28 kg/ha in Gajapati, Kalahandi, Kandhamal and Koraput, respectively. [5] But the consumption is not relevant to the tribal belts of these districts. In such a dismal situation the only option left is organic recycling in a scientific manner, green manuring *in situ* and *ex situ*), oil cakes and use of biofertilisers in conjunction with a small dose of fertilizers.

4.21 The tribal farmers are not in habit of using plant protection chemicals except using some indigenous methods for control of insect pest, pathogens and noxious weeds. It is often argued that the traditional farming without application of chemicals (fertilizer and pesticides) will favour organic farming in the area.

Although technically it looks sound, practically it is not tenable as it cannot meet the food security of the tribal farmers and certification for organic produces is not feasible in foreseeable future due to technical and reach out constraints.

4.22 The *Jhola* systems are bit sophisticated in terms of water management systems in which terracing, leveling and channeling of perennial stream-flows provide

sufficient water and nutrients (leachates from upper catchments) for paddy cultivation, mostly without fertilizer. Almost all agriculture land in the study area is rain-fed, and irrigation is primarily through diversion of perennial streams through the *Jhola* systems or small diversion weirs. Loss of vegetation on slopes and upstream areas also make the *jholas* and medium lands vulnerable to sand casting and crops being washed off in intense rains. In *Jholla* paddy crop during *Kharif* is followed by another paddy crop during summer. Recently the tribal farmers have started using high yielding rice varieties like Khandagiri, Parijat , Lalat and Swarna in such lands, but without using any chemical fertilizer and pesticides. During field survey it was noticed that there is continuous surface and sub-surface flow of water from field to field, which restricted the tiller number and thus the yield.

4.23 Of the total arable land nearly 55% is upland (*Dangar* and *Padar*), 30% is medium and rest 15% is lowland. Irrigation is available to 15% area and mostly confined to *Jholla* lands. ITDAs have constructed some water harvesting structures and check dams for irrigation purpose. But the farmers are yet to make best use of such precious water (Jabanga and Baterpada in Kalahandi) . There is hardly any intervention on groundwater exploitation. Limited irrigation not only limits the scope for double cropping but also restricts the *Kharif* yield.

4.24 Agricultural extension in the tribal areas is constrained by limited staff, problems of reach out, poor connectivity, location of isolated villages with sparse population, illiteracy of people, rigid costumes and norms, non-availability of supporting inputs and deficiency in monitoring and supervision. The OTELP has made separate provision for posting of watershed development team in each micro-watershed to facilitate the FNGOs and provide handholding support to the farmers. It appears that there is no close linkage between the WDT and field functionaries of agriculture and horticulture department.

4.25 With the high dependence on natural resources for livelihoods, subsistence agriculture, hilly and rugged topography, unabated degradation of resources and high potential for natural resource based development, watershed development has emerged as an important development strategy in the tribal areas. The watershed development project looks at treatment of common lands (state owned or *Panchayat* lands), private agricultural land, drainage line treatments and creation of irrigation infrastructure. In watershed development projects, plantations of cashew and forest species, dry land horticultural trees etc. and soil and moisture conservation activities like contour ditches, continuous contour trenches, contour bunds and trenches for moisture conservation, gully plugs for water harvesting, etc. are being taken up in state lands. Silvi-pasture is also being taken up on *gochars* (land settled as grazing areas). Private land treatment includes support for earthen and vegetative bunds, gully control, provision of horticultural planting material and improved seeds, crop demonstration and other agricultural extension support.

In the study area, there has been a concerted effort for crop diversification, seed exchange including cultivation of vegetables, banana and other horticulture crops. Drainage line treatments include gully plugs, small weirs and check dams, percolation tanks etc. Irrigation infrastructure is created through diversion weirs on streams to provide irrigation along higher contours, and water harvesting structures.

4.26 The discussions in the above paragraphs clearly indicate that the nature of the agriculture being practiced by the tribal households is **not technology intensive**, rather **labour intensive**. The outcomes of PRA exercise and primary survey indicate the relatively lower yield level of major crops in the tribal areas than the district and state average. The yield gap is more than 50% which suggest that a well defined strategy has to be developed to reduce the existing yield gap to the minimum.

4.27 The work in agriculture on one's own farm provides substantial employment to majority of the households studied. However, easy entry into, and exit from this activity is also evident. This shows that since the tribal households do not have secure land tenure, agriculture is a dynamic activity, and various factors influence their engagement in this activity.

[5] Orissa Agricultural Statistics 2005-06, DA&FP, Orissa

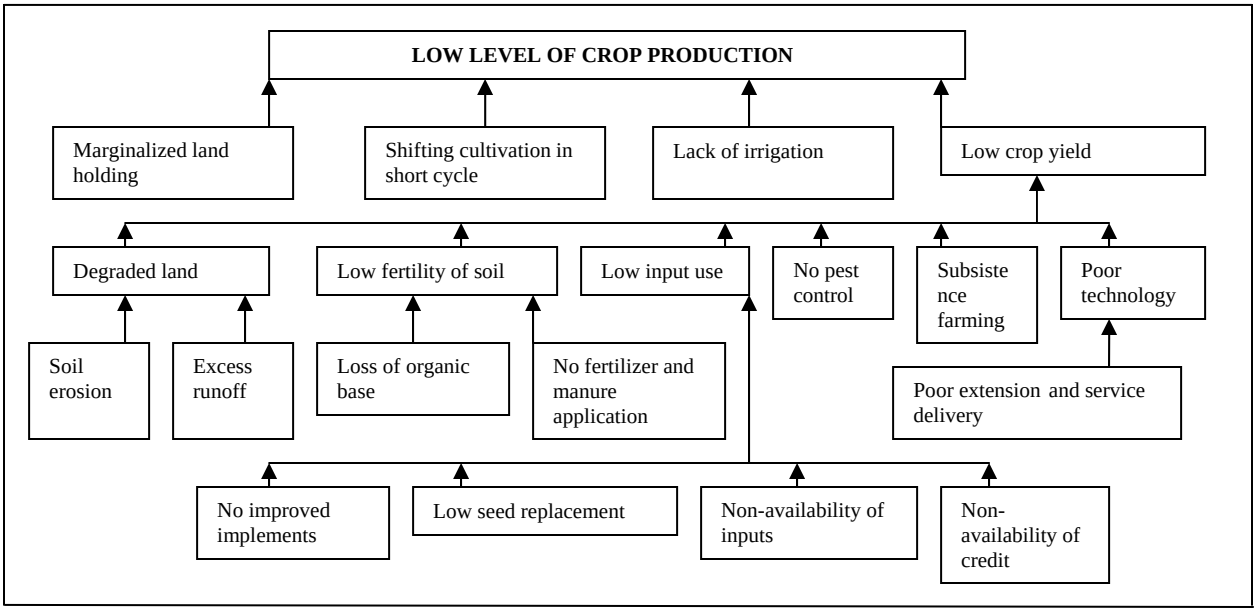
Spatial factors and the status of the natural resources in the vicinity of the hamlets, and access to irrigation are two important factors in the choice of engaging in this activity.

4.28

4.29 This dynamic nature of agriculture implies that for most households their livelihoods are not completely dependent on agriculture. Men and women are both engaged in this activity. Rice and vegetable cultivation is quite labor intensive, and often households exchange labor mutually among the community members. Agricultural work involves different type of work, which changes depending upon the nature of the land cultivated and crops cultivated. On an average most of the tribals are engaged for 70-98 days in the year in agricultural activities, which is nearly one-third of the yearly engagement in various activities. Annual investment on agriculture and horticulture ranges from Rs 2700 to Rs 3100 per household.

4.28 The major earning from agriculture includes food grains. A few households also earn cash by selling agricultural produce, which mainly consists of vegetables and oilseeds and in a few cases surplus grains. From PRA exercise the food security through agricultural output for 5-8 months was assessed. Though the tribal people try to access land with great difficulty, and invest their labor in cultivating it, the output does not appear to be commensurate with the work put in, or with the risk involved in the process of accessing land through encroachment or sharecropping. The low level of agricultural production was assessed during PRA which are illustrated in Fig 4.1.

Fig 4.1 Problem Tree: Agricultural Production



E. Animal Husbandry

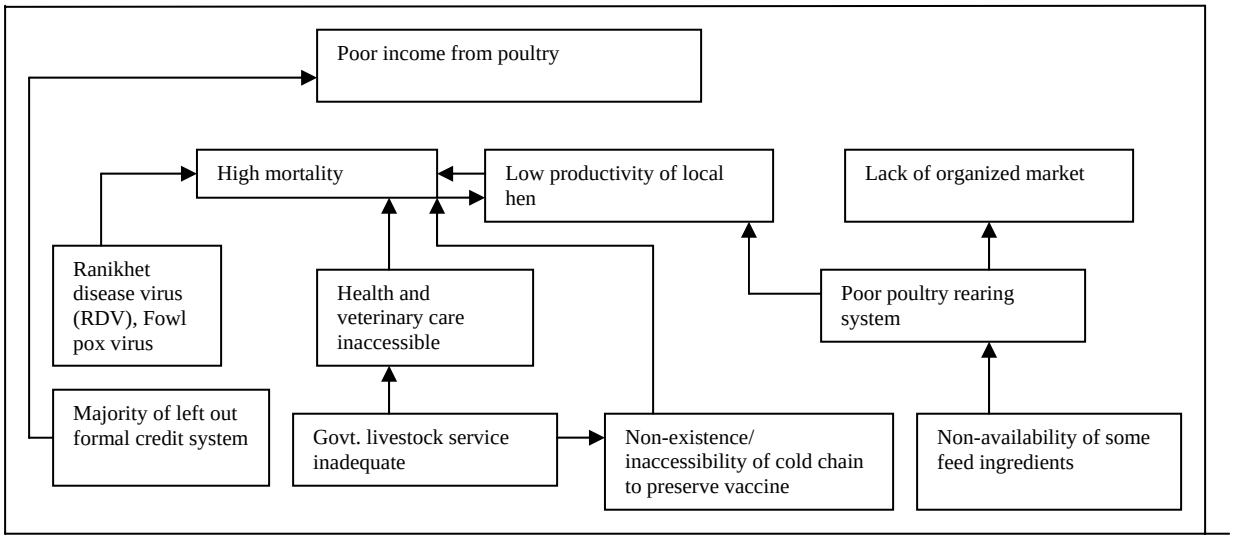
4.29 On an average each ST/SC family owns livestock population of 8.28 (Table 3.23). Data regarding the inventory of livestock as reported during survey shows that, not only do the tribal households own livestock, but they also adopt livestock rearing of both cattle and goats of others . In return for this service they are either offered one to two heads of cattle as remuneration, or they are offered bullocks for ploughing by the land-owing farmers. These observations have been recorded in the informal discussions during the survey. Nearly 41% of animal sheds are constructed separately for the livestock whereas 30% animal sheds are found adjacent to the dwelling houses of the families and no animal shed was provided in 29% cases. In some cases the goats and sheep, though kept outside sheds during day time are accommodated in the same room where the people sleep at night, in fear of attack of beasts. This indicates that the goats and sheep are more valuable to them and they treat them as their family member. In many cases livestock management is a part time job and it does not provide full time employment as in case of agriculture and wage labour.

Hence, the employment rates of this activity are not comparable with that of wage labor, or on-farm agriculture. Grazing of animals is mostly taken care by the women and girl children. Since the animal husbandry is not a full-time work, it is amenable to women, whereas the wage labour work involves eight or more than eight hours of work and is male dominated. Within the household, it is seen that it is the son, wife, and daughter who contribute substantially to this activity. Field observations suggest that in spite of rearing the animals, in-house consumption of meat is almost negligible. The tribal households prefer to earn cash by selling the animals, and look upon the animals as a reserve for emergency situations. Cow's milk is not used by most of the tribes and they are reared mainly for producing cow dung and producing future bullocks. Some of the tribal and SC families prefer to keep pigs as each pig can give birth to 12-16 pig-lets in a year in two six-monthly intervals and each pig can weigh about one quintal after one year. It was also observed that the kid mortality rate is high in

goats as a result of which one doe gives birth to 4 kids in a year in six-monthly intervals out of which the survival rate is only 50%.

4.30 The tribals are in habit of keeping a few animals of more than one species, i.e., cattle, buffalo, sheep, goat, pig, poultry and duck. Each species has multiple functions in the household. The focus of the poor is on small animals like goat, and poultry birds. The prolificacy of goat, pig and poultry, and the higher level of resistance of sheep compared to goat, are the influencing factors in livestock production system because of quick return. During field study it was invariably noticed that the upkeep and maintenance of animals are very poor. Regular vaccination, balance feeding, sanitation, animal hygiene and deworming are never practiced except in few cases. SWWS in Gajapati has introduced regular checking of animals by deploying one livestock inspector. Poor breed, and poor health and nutrition leading to high mortality and low yield are the main reasons for the status of sheep and goat in the project districts. High mortality has been identified as the main constraint in poultry rearing. The Fig.4.2 explain the problems of poultry while Fig.4.3 explains the problem of goatery in Koraput district .[6]

Fig 4.2. Problem Tree: Poultry at Village/Family Level



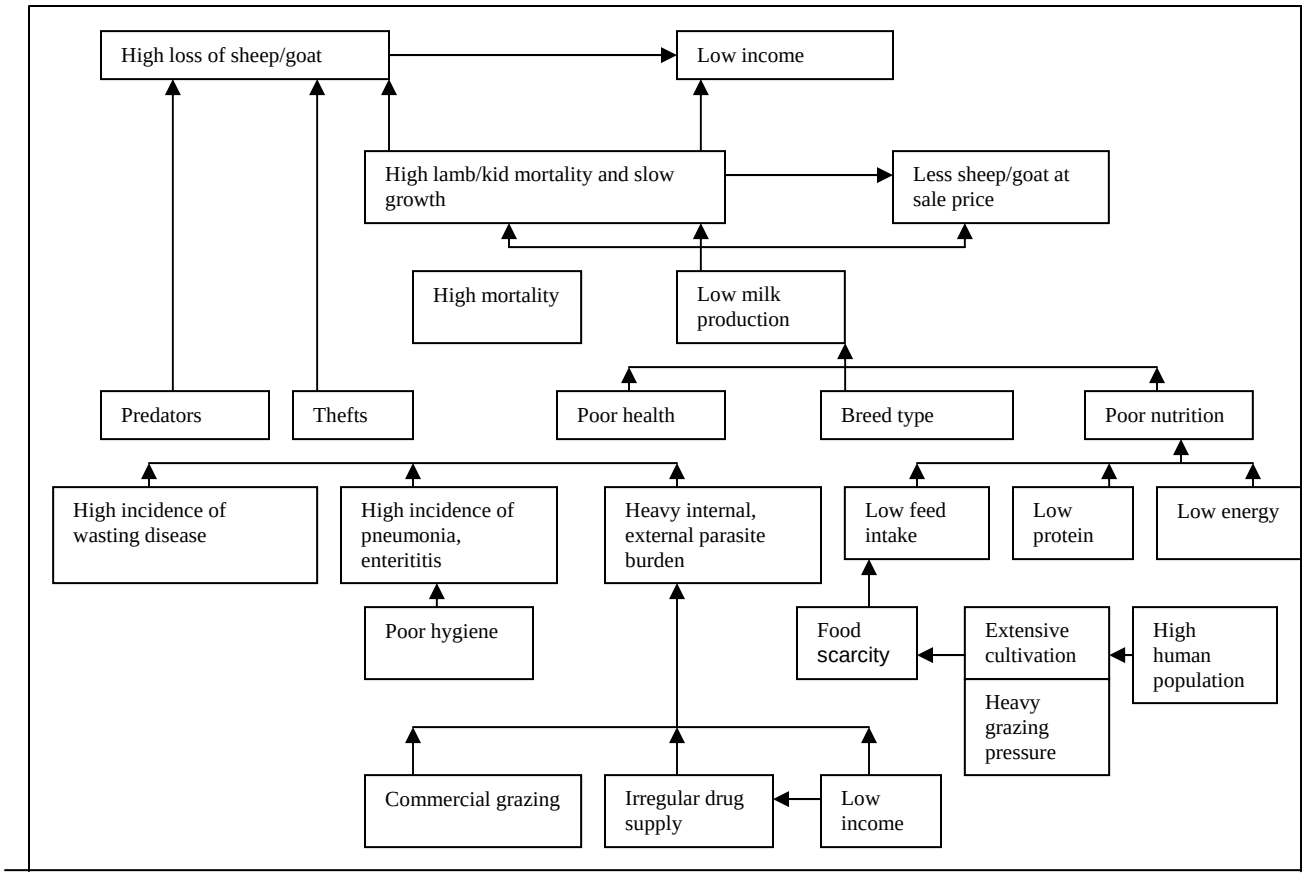


Fig.4.3 Problems of Goatery / Sheepery

Das, Kornel Integrated Livestock Development Project in Koraput District of Orissa, Indo-Swiss Natural Resource Management Programme

F. Livelihood support system

4.30 The tribal livelihood is primarily dominated by natural economy, where market plays a minimum role. But over the years because of various developmental efforts tribal system has come under the domain of market economy. This has resulted in gradual degradation of their resource base i.e. their control and access over land, water and forest. In many places because of development projects and also due to the operation of formal as well as informal land markets, tribals have lost their control over land. In addition, their control over water resource is on decline. They have come to a situation where they are in possession of sloppy lands (most of the situation it is viewed as encroachment though they are enjoying these lands for quite a long time). The productivity of these lands is low and the agriculture is subsistence oriented. The tribal socio-economic system is close to forest. Their culture as well as livelihood support system is closely linked with forest. From the forest the tribals collect timber for house construction, fuel wood, wild roots tubers, mango kernels, fruits, leafy vegetables, mushrooms and different kinds of NTFPs including medicinal plants and plant parts. Definitely a part of them is exchanged for meeting the cash requirement of the household but most importantly a major portion is used for consumption purpose. The part that is exchanged in the market for meeting the household requirements is normally made through at the doorstep or in the

village *haat/*market. These commodities are exchanged for other essential commodities or sometime for cash. The merchants are petty traders at the village level, who pay unfair price to the households. In the whole process the tribals are treated as collector of these produces and do not enjoy ownership. The state (forest department) is viewed as the owner of forest and its produces. Keeping this spirit in mind the state introduced various mechanisms, which have limited the access and control of tribals on forest. It is estimated that in tribal areas more than 60 % of the households depend on forests and nearly 26% of household income comes from forest collections. The Roy Burman Committee, that was set up by the Planning Commission on Forests and Tribals in India has recommended that collection of Minor Forest Produce (MFP) for food and cash income should be conceded as the right of the tribal families without restriction.

4.31 In certain *Panchayats*, traders have come forward to register themselves. Such registration has occurred for a few products, which have demand in the market, like Mahua, Tamarind, *Aonla* (Amla), Broomstick, Char, *Tola* (Mahua fruit) etc. At the village level multiple buyers system has failed to come up. The old traders and their networks still continue in the NTFP trade. Thus in most situations the primary gatherers are left with little option to sell their produce, which has resulted distress sale. In the market there is a dominance of unregistered buyers and the registered buyers are very few in number. In fact, in most cases the buyers are part of the old network in the trade. In certain Panchayat's registration system has been used to the advantage of the buyers like the registered buyers are not buying and at the same time not allowing others to enter the market. This is creating a glut in the market and forcing the price downward. In the whole season the prices of most of the NTFPs has remained below the minimum procurement price (MPP). In this situation the *Panchayat* as per the provision of the policy should have intervened and cancelled the registration of the traders. But nowhere such cases have been noticed. Alternatively*, Panchayats* do not have the resources to invest and buy from the primary gatherers. One positive effect of this policy is the slow but steady involvement of SHGs in trading NTFPs.

4.32 On the whole it can be concluded that though NTFP has a major role in supporting the livelihood system of the rural poor till date the orientation of the policy is towards revenue collection. On 9th July 2001 the Govt. of Orissa has abolished the State price fixation committee through its Resolution No. 20665/SSD/BBSR, 9th July 2001 by SC & ST Development Department and has empowered the Collectors to fix the Minimum Procurement Prices of 67 NTFPs in consultation with district representatives of various govt. departments. This seems to be an interim arrangement till proper amendments are made into the Orissa *Gram Panchayat* Act, 1960 and Orissa Timber & Other Forest Produce Transit Rules, 1980. After doing so the GP will be given the responsibility to fix the prices. It may be noticed that the market price is always remaining below the minimum procurement price fixed up by the State and the exercise of fixing MPP has become meaningless and unsustainable. There is need for development of proper enabling mechanisms so that the control of buyers in the market is reduced and the primary gatherers get their genuine price. One such option is introduction of Minimum Support Price with budgetary support for the NTFPs. The others could be focusing on developing processing, storage and marketing facilitation at grass root level.

4.33 It is well established that the tribal communities as anywhere else in the country are among the most vulnerable and marginalized groups. In various forms they face social adversity, oppression and economic hardships. They have to be content with unequal and insecure access to productive resources and share poor participation in governance. Tribal areas and communities largely remain underserved through public systems - both on account of supply (resources fail to reach the target or programs fail to bring long term change) and demand factors (poor ability to demand and elicit resources and services). Poor educational achievements, a vulnerable health status and an insecure livelihood base increasingly dependent on exploitative wage labour has kept these groups to the margins of development in the project area.

4.34 Given the low asset base in terms of land and livestock and few options for self-employment, wage labour forms an important component of the tribal's economy. The overwhelming source of wage labour for tribal is agriculture operations. In addition forestry, mining and quarrying, and construction are the other important consumers of tribal labor. Labor arrangements and practices vary across the districts but are uniformly pitted against the poor. In most cases these are governed by traditional exchange relations dominated by the upper caste landholding elites and merchant classes. Economic relations based on social control are highly exploitative and have sustained in the light of credit dependence of the tribal poor on the peasant castes forcing them into virtual bondage in many places. The quest for wage labour has guided the tribal poor to urban centers and regions of high agriculture production, which provide opportunities for wage labor. Young women also migrate (though in lesser numbers) alongside adult men leaving behind the elderly and children in homesteads. Employment is available in agriculture, public works, and construction. The wage labor available is casual and completely determined by vagaries of market forces. None of the labour laws are applied to this mode of employment. Active participation by women in manual labour is a feature of tribal society, which is unhindered by caste, taboos that place restrictions on women's mobility for wage labor. It is common to find tribal women going out on their own for wage labour on public works and to towns. While men folk cut and gather fuel wood, it is often the women who bring it into urban centers for sales. Finally, children enter the workforce early in tribal society. The women’s work burden is partly passed on to the girl children in the family. In spite of announcement of minimum wage of Rs 70/ day from May 2007, the existing wage never exceeds Rs 40-50 (except in NREGS) for a work period of 6-7 hours. In agriculture sector it ranges from Rs 30-40/ day for work period of 6 hours. The study reveals that the landless families get employment through wage labour for 100-120 days in a year whereas others get about 80 days of employment. On an average 33% of household income comes from wage employment.

4.34 Sales of farm produces, animal products, forest collection products, and liquor offer sources of cash income for the tribal households. Data collected in primary survey and PRA exercise indicate that the contribution of agriculture, forestry, wage employment and other sources to annual family income is 32%, 26%, 33% and 9%, respectively. Sale of liquor is another source of income for selected families. In festivals liquor is offered free of cost to the villagers. However, brewing liquor consumes a considerable amount of fuel wood, which is collected from the forest. Hence, this shows that tribal households do depend on the

surrounding natural resources to a considerable extent not only for satisfying their direct consumption needs, but also for producing or collecting products for sale in the local markets to earn cash.

G. Consumption Expenditure, Barter, and Borrowing Pattern

4.35 In this study, data on consumption expenditure were collected on monthly basis. On an average the expenditure on food items is 59% whereas expenditure on education and health is around 2% and 7%, respectively. Expenditure on agriculture is 10% and expenditure on other items (clothing, house repair, alcohol, festival and loan recovery, saving etc.) is 22%. The tribal households also resort to barter and borrowing to fulfill their daily needs. Occurrence of barter of grain for grain, fish or meat for grains and grains for NTFP is also observed. It is also observed that households, which report higher cash expenditure, also report that a greater portion of this expenditure is on food. These are usually households, which are more dependent on wage labor, and purchase food from the market. The low spending households, usually source food either from farm or forest, and spend little money on other items. On an average each household meets the deficit of Rs 610 through borrowings. Among the institutional sources of credit moneylender is mostly preferred due to easy access.

H. Access to Basic Amenities and Social Support

4.36 **Health:** Malnutrition, protein deficiency, skin diseases, malaria and STD and unsafe delivery of women are major health problems in the project area. Safe drinking water reduces the vulnerability of several diseases to a great extent. During FGD it was recorded that most of the women rely mainly on elderly women from the hamlet for delivery. With the introduction of ASHA and TBA the situation has shown some improvement. Services of private doctors, or government doctors and nurses are rarely sought as a result of which tribal folk healers and village quacks get the advantage.

4.37 Drinking Water: Data in Table 3.11 shows that of the 54% households have access to safe drinking water. Still some tribes believe in consuming only freshly fetched water from springs and streams. Also in some households, they do not have the means to store large quantity of water. Almost none of the households are using boiled water or filtered water to make it safer.

4.38 **Possession of Ration Cards: '**Ration Cards' issued by the Government, provide the means to purchase subsidized food grains from designated shops. Possession of ration cards is an important resource for poor households. The BPL cardholders have ration cards and use to get rice and kerosene on monthly basis from PDS shops. Due to non-finalisation of current BPL list in the state some families are deprived of TPDS. OTELP has introduced a system of giving 2.5 kg rice, 200 g dal and Rs 9.00 in lieu of wage for man-day to reporting individual adult for manual work.

4.39 Access to and Benefit From Government Poverty Alleviation Schemes:
Government is implementing various poverty alleviation and rural employment schemes through PR department and ITDA in the tribal areas. The schemes like Annapurna , TPDS, NREGS, IAY, SGRY, SGSY, OTELP and other schemes like

SSA, NRHM etc. have become beneficial for the poor people, but transparency and accountability still needs improvement.

4.40 Access to Rural Credit: Access to credit as displayed in Table 3.5 indicates that 57% households avail credit. Of the total households availing credit 43.7% prefer moneylenders, 14.9% prefer SHGs, 17.9% prefer relatives and only 23.4% prefer commercial and cooperative banks. This shows that major source of credit still flows from the moneylender and other rich farmers. The major purpose for which credit was taken includes (a) agriculture, (b) wedding and purchase of assets, (c) illness, (d) business and food purchase, and (e) other purposes like education etc. This shows that credit is accessed for a wide variety of purposes, but most of them are consumptive in nature.

4.41 Sources of Social Support: The PRA exercise indicated various forms of support sought in the times of difficulties by the households. It was reported that when it comes to dealing with the difficulties related to government functionaries or the government machinery people tend to approach the NGOs to solve the problem. However, many respondents replied that they cannot visualize who will help them in various problems and these problems are related to the issue that is critical in the lives of the tribal people.

4.42 Intra-Household Distribution of Domestic Work: With respect to intra-household distribution of domestic work, with only exception of fuel wood collection, female members of all age group perform most of the domestic work. The male members in all age groups shoulder insignificant part of the domestic work. The data in the sample clearly indicates towards gender-based division of labour with respect to domestic responsibilities. The tribal women are triple burdened with production, reproduction and maintenance of household assets. In case of fetching water, cooking, cleaning the house, washing clothes, cleaning utensils, and taking care of children. More than 90 percent of the responses indicate that these work are done by female member of the household, which includes the middle aged women, old women, and young girls. Among these three, a major share of the work is done by the middle-aged women, but shared with the older and younger women. Women do all other domestic work, except in a few cases where men also contribute.

I. Food security

The mean energy requirement per adult in developing countries is 2070 kcal which can be increased by 140 kcal more in moderate working conditions and 350 kcal more in heavy working conditions (Food and Nutrition Handbook). Energy requirement as per WHO Technical Report Series 724 indicates the following requirement per person per day (Table 4.2).

Table 4.2 Energy Requirements in Kcal

Age group in year	Male	Female
0-4	1320	1250
5-9	1980	1730
10-14	2370	2040
15-19	2700	2120
20-59	2460	1990

60+	2010	1780
Pregnant		+285
Lactating		+500

The balanced diet suggested by the Nutritional Expert Group (1968) of ICMR is shown in the following Table (4.3)

Table 4.3 Balanced Diet for Moderate Working Adults in g/day

Diet	Adult male		Adult female		Additional for women	
	Veg.	Non-veg.	Veg	Non-veg	Pregnant	Lactating
Cereal	475	475	350	350	50	100
Pulse	80	65	70	55	-	10
Leafy veg.	125	125	125	125	25	25
Other veg.	75	75	75	75	-	-
Roots& tubers	100	100	75	75	-	-
Oil/Fat	40	40	35	40	-	15
Fruits	30	30	30	30	-	-
Milk	200	100	200	100	125	125
Meat/Fish	-	30	-	30	-	-
Sugar	40	40	30	30	10	20

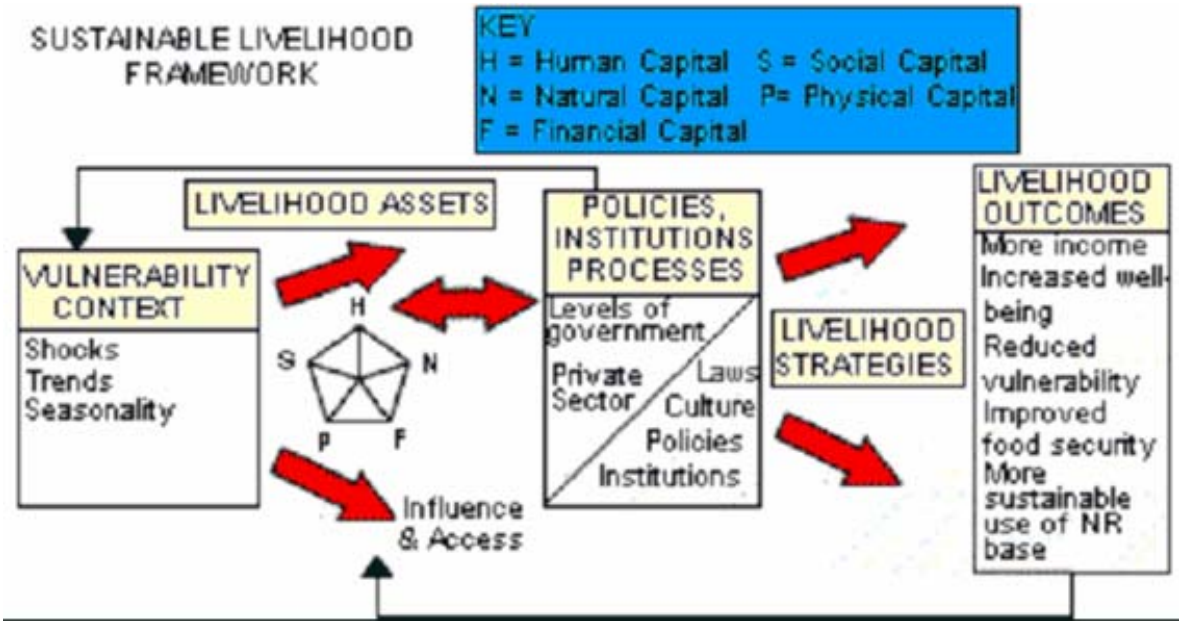
In consideration of the above recommendations it was observed that the tribal's food security was considered from availability of food grains only as a result of which there was protein deficiency and malnutrition leading to anemia. The study along with PRA outputs indicated that food security period ranged from 5-8 months (in term of food grain only) and different coping mechanism was adopted for the remaining months. Forest played a major role in ensuring household food security in tribal areas.

Chapter 5. Broad Livelihoods Strategies

5.1 Livelihood strategies comprise the range and combination of assets and choices that people undertake in order to achieve their livelihood goals. Livelihood outcomes are the achievements of lively strategies, such as more income (e.g., cash), increased well being (e.g., non-material goods like self-esteem, health status, access to services, sense of inclusion), reduce vulnerability (e.g. better resilience through increase of asset status), improved food security (e.g., increased financial capital in order to buy food or to produce more food), and more sustainable use of natural resources (e.g., appropriate property rights and their management). Livelihood security encompasses food security, social security and psychic security. Each one of them has basic minimum threshold levels to achieve and maintain and also must be pursued in a balanced way.

5.2 Sustainable livelihoods Framework (SLF) forms the sustainable Livelihoods approach (SLA) and serves as an instrument for the investigation of poor people's livelihoods, whilst visualizing main factors that influence (Fig 5.1). Like all models the SLF is a simplification and does not represent the full diversity and richness of the livelihoods, which can only be understood by qualitative and participatory analysis at the local level.

Fig 5.1 Sustainable Livelihood Framework (DFID)



A. Shifting Cultivation

5.3 Shifting cultivation in short cycles has ecological problems in the forest ecosystem, which needs to be reduced by various strategies. Providing employment opportunities and income generation on a regular basis through proper utilization of the land resources, i.e. by equitable distribution of wasteland among the tribals and development of wastelands through agro-forestry and silvi-pasture practices would help reduction of shifting cultivation. Cooperative efforts for carrying out forest-based activities, i.e. basket making, rope making, cane furniture making processing of minor forest produce, honey collection, etc. have to be made commercially viable by providing proper marketing facilities. This will not only discourage tribals from practicing shifting cultivation but will also strengthen their socio-economic condition.

5.4 Village Forest Committees for the protection and development of the degraded forests need to be formed. Besides, providing suitable incentives to the tribals after the time of harvest can divert some of the tribals away from the shifting cultivation. Generating employment opportunities during the lean season of forestry operations will also prevent tribals from shifting to other areas. Employing the tribals for collection of *kendu* leaves and *sal* seeds and also

involving the tribals in the various rural employment schemes is also the need of the hour.

5.5 Due to shifting cultivation practice on slopes, down-stream siltation of the water bodies is apparent in many districts. Protection and repair of drainage basins for conservation of ecological resources including water need large amounts of financial input. Due to splash forces generated from the raindrops, the erosion of precious topsoil occurs influenced by major factors like rainfall, the topography of the terrain, and the kind of vegetation and soil conditions. The mountain eco-systems with shifting cultivation practice have to be made ecologically sustainable. Formulating an eco-development plan for the area for environmental sustainability, could consider completely replacing agricultural practice with farm forestry. Agricultural practices are at the cost of loss of biodiversity resources indicate that one unit of energy in agronomic production costs loss of greater energy from the forests. Loss of energy from the forests per unit of agricultural production may be far greater in shifting-cultivation areas. Farm forestry may be one of the solutions to redress this loss. The advantages of farm forestry are:

- The protective values of trees are far greater than those of annual crops
- Unlike annual crops which require frequent ploughing, tree plantations cause minimal soil disturbance
- Net above-ground primary productivity of forests is notably greater than that of agricultural crops and grassland.

5.6 In view of the extent of the area and population affected by shifting cultivation the State Government have made several attempts in the past .The colonization programme was introduced during the sixties in the problem areas to divert the primitive tribes to settled agriculture by providing cultivable land, necessary inputs and residential accommodation. During the first four plan periods, a number of colonies have been established in the tribal areas. Besides the colonization scheme, the State Government through Soil Conservation Department has taken up the programme of rational land use on watershed basis. The programmes included (a) providing land to the tribals who was willing to give up cultivation on steep slopes. (b) Plantation of economic species useful for tribal community. (c) Introduction of conservation farming to allow tribal people to obtain higher production from cropland, and (d) utilization of steep slopes for production of timber. Under the above scheme a suitable watershed in the shifting cultivation area was selected and rational land use programme was executed on the existing catchment. A schematic land classification of watershed management units together with land use programmes was recommended for watershed areas for rationalization of shifting cultivation. The above programme was first started in selected catchments of Koraput district on pilot basis and then it was extended to other problem areas in Phulbani, Kalahandi and Keonjhar districts. However, these programmes were inadequate in view of the vast population and the area affected by shifting cultivation.

5.7 Keeping in view the recommendations of ICAR as well as World Bank in the proposed Model, the strategies which have been included are (a) to promote forestry on upper reaches with silvi-pasture development. (b) to break middle slope length for annual or perennial fruit trees and inter-crop , and (c) to put

lower slopes under agricultural crops . Under this scheme a number of programmes were proposed to be implemented during the 8th plan period for control of shifting cultivation with the assistance of Central Government. The programmes are, Land/*Jhola* land Development, Development of Irrigation, Agriculture Development, Raising of orchards and Horticulture Plantations, Raising of plantation crops, Forest Plantation, Pasture development, Animal Husbandry, Development of Pisciculture, Owner's subsidiary occupation, construction of village path, soil conservation works, training programmes, other works. Though Slopping Agricultural Land Technology (SALT) involving ten steps is an ideal measure to substitute shifting cultivation needs to be successfully demonstrated in Orissa.

5.8 The benefits of legally secure land tenure are evident from the OTDP experience. From an agricultural point of view, the allocation of parcels of lands and the provision of land titles has reduced shifting cultivation practices, which has consequently promoted relatively sound environmental management practices and helped restore agro-ecological balance. It has also substantially increased the productivity of these lands. From a socio-economic point of view, when land titles are registered in the names of both spouses, the social and economic status of women is enhanced, providing them with greater security, confidence and independence. It has also provided them with more opportunities for income-generation through activities such as vegetable gardening and small livestock rearing. The ownership of even a small piece of land has improved the economic conditions of those concerned. Very recently GOO has taken a decision to provide legal assistance to tribals as per 1956 Act regulations. It has been decided to issue *patta* to owners of land prior to 1980.

B. NTFP

5.9 It was observed during the study that tribals' access to NTFPs for meeting their basic subsistence needs has deteriorated. Among others, deforestation, preference for man-made plantations in place of mixed forests, regulatory framework, diversion of NTFPs and forests to industries, nationalization of NTFPs, and exploitation by government agencies and contractors in marketing of NTFPs are the major causes of such deprivation. In order to ensure that tribals' livelihoods are supported by NTFPs, three inter-related issues, i.e. (i) how to increase NTFP production,(ii)how to improve access of the poor to NTFPs, and (iii)how to maximize their incomes through marketing are considered vital. "Scientific" forestry should ensure that environmental functions, wild fruits, nuts, NTFPs, grasses, leaves and twigs become the main intended products from forest lands and timber a by-product from large trees like mahua and sal. Secondly, a government agency like the Forest or the Tribal Development Department assisted by civil society should be involved in informing tribals and gatherers about the prices prevailing in different markets, improve marketing practices, and act as a watch-dog. Government should encourage bulk buyers and consumers such as exporters of herbal medicines establish direct links with the villagers and address issues like creating proper marketing yard, market information system, storage space and minimum processing facilities at the local level. Simple processing activities such as broom making, leaf plate making, tamarind processing, mat and rope making should be encouraged in the household sector or at SHG level. Price support combined with timely buying can certainly improve gatherers' incomes, but it becomes difficult to sustain it over a long period. Government corporations make huge losses, and therefore the

entire operation requires continuous subsidy from the government. While such subsidies can be justified easily as a part of the poverty alleviation programmes, continued subsidies can result in subsidizing inefficiency and corruption. There is a need for public-private-community participation in this endeavour.

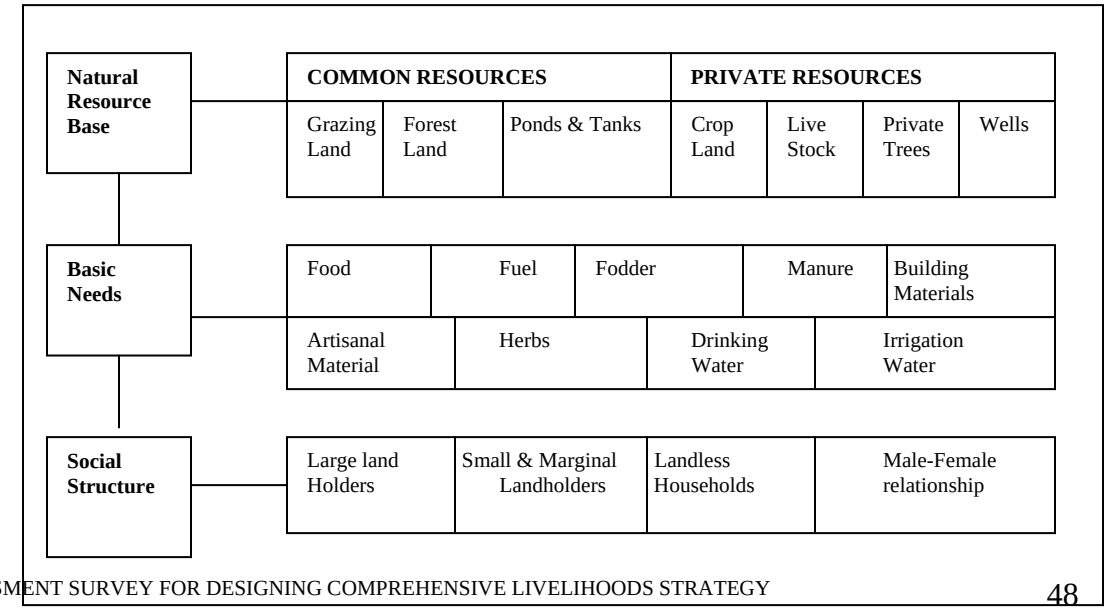
5.10 For the poor, plucking of *kendu* leaf (*Diospyros melanoxylon*) represents a major source of income and employment especially during the lean season. KL generates 150 million person days of employment during the agricultural lean season in Orissa including labour involved in making *bidis*. Looking at such man power generation *the* collection prices should be hiked so that returns from plucking are at least equivalent to the minimum wages fixed for unskilled agricultural work by the states .Village level KL pluckers' SHGs and cooperatives should be gradually given the responsibility of managing collection centres, and their maintenance etc. At present petty contractors manage these, with long experience in this line. Mechanisms for linking quality of KL with purchase prices should be explored. Uniform pricing of *Kendu* leaves, irrespective of their quality, does not inspire the pluckers to procure leaves of better quality. Therefore payment should be related to the quality of leaves. Delayed payments should carry an interest of 9 per cent per annum.

C. Natural Resource Management

5.11 There has been serious degradation of natural resources affecting the livelihoods of the tribals. In a village ecosystem the natural resources may be viewed as one amongst different components (Fig 5.2) which are interrelated with each other. There is a need for a village ecosystem planning for enhancement of total natural resource base of the village ecosystem, production of basic biomass needs of the village community on a priority basis and equity in distribution of biomass resources. Any village plan to be both sustainable and equitous would have to be matrix of solutions which keeps in mind the specific natural resource base of the village, its biomass needs and its social structure.

For planning and management purpose, it is not enough to sub-divide the natural resource base merely on ecological terms. It will also have to be sub-divided in legal terms, that is, in ownership terms. The people must be educated to take care of both private and common lands for their livelihoods security.

Fig. 5.2 Components of a village ecosystem and management plan



A success story of village-level planning has been displayed in Box 5.1

Box 5.1Village-level planning in watershed management in Kakannur, Andhra Pradesh

Kakannur village, in Mahabubnagar district of Andhra Pradesh, is an example of what successful village-level planning in watershed management with the help of the local community can achieve in a short span of time. Assisted by a non-governmental organisation called VASORD, it has successfully stopped migration of people even during the non-harvesting season.

The village has doubled the yield of its principal crop castor seeds and has also added 300 acres of land under cultivation, besides adding to income generation in terms of higher wages and higher crop productivity. The watershed development programme has ensured that water is now available at 70 ft below the ground, where three years ago the groundwater was not available even at 150 ft.

The process began with the formation of "Kakannur watershed association" which worked towards contouring, bund making, creating check dams and 'gully' controls.

With the creation of Department of Land Resources in 1999, Govt. of India focused on enabling rural people to arrest and reverse degradation of life-supporting system, particularly land and water, so as to produce biomass in a sustainable and equitable manner. Managing watersheds for rural development is concerned not merely with stabilizing soil, water and vegetation, but with enhancing the productivity of resources in ways that are ecologically and institutionally sustainable. The activities such as Continuous Contour Trenching (CCT) and Water Absorption Trenching (WAT) undertaken on hill sides do improve the overall moisture regime and increase water levels in wells, but the benefits accrue disproportionately in favour of the people living in the valley portion. However, when the 'standard' methods are modified to include activities of direct relevance to tribal people, the degree of benefits received by them can change drastically.

5.12 Critical evaluation of watershed development programme implemented during last 2-3 decades in India has shown that in majority of cases, where such technologies have been used the farmers have reverted to their earlier practices after the withdrawal of project support. Realizing the above, a number of researchers have started examining indigenous innovations to see the role these could play in improving natural resource management. Indigenous Technologies are based upon different principles and perceptions in order to meet additional requirements, which are specific to small holding situations. [7]

The indigenous technologies are based on the principle of:

- Enhancement of productivity, besides conservation of land resource focus is on short term as well as long-term increase in productivity due to which the motivation among farmers and the cost effectiveness of these technologies are relatively higher.
- Smaller size of group action for conservation of land resource makes it easier not only to implement the measures but also to carry out subsequent maintenance.
- Indigenous technologies are based upon the concept of concentration of land resource (at appropriate place) rather than conservation of this resource at the original place. Example of one indigenous technology has been shown in Box 5.2. All these suggest prioritizing indigenous instead of standard practices.[8]

5.13 Watershed rehabilitation is essentially a resource-based approach to livelihood enhancement. In principle all the watershed management programmes in the country have become participatory.

The pre-requisites for participatory approach should be:

- Organization of community into a new institutional set up. Use of Participatory Rural Appraisal Tools in project management.
- Preparation of action plan through written proposal from the users.
- lexibility in modification of action plan during implementation phase
- Contributory approach for each developmental work
- Group action and conflict resolution for community oriented activities.

7.Extension Digest on Watershed Management, MANAGE

[8] Preparations for participatory approach under watershed programme, MANAGE

- Equity for poor and women for each component under the project
- Redesigning of steps and procedures for preparation of action plan.
- Replication of community led success stories.
- Building upon Indigenous innovations, initiatives and ideas.
- Direct funding for the community against the approved action plan.
- Small size of unit watershed
- Social auditing and transparency at the village level.

Box 5.2 Indigenous rainwater harvesting system in Rajsthan

The people of Lapodia village in Dudu block of Jaipur district, of Rajasthan have regenerated their degraded pasturelands through an ingenious system called "chauka" which relies on storing rainwater in dyked pastures. Trenches advocated by the Soil Conservation Department were found inadequate and ineffective as they do not spread water on pasturelands. The chauka is divided into two equal rectangles. Dykes 1.5 metres high are built along three sides on the periphery of the rectangle that lies towards the lower part of the land along the gradient. Trees are planted on dykes for additional support to withstand rain. Rain that falls in the chauka is collected towards the lower half that is dyked. As water level rises it flows into the neighboring chauka and so on. It spreads water evenly over a large area. The system also promotes recharge of groundwater. The credit for this initiative goes to Gram Vikas Nava Yuvak Mandal, an organisation which has emerged from within the village community. *(ASIAN*

5.14 In watershed development there is a need to move from conventional soil conservation approach to safe disposal of run-off to rain water harvesting and conservation based on indigenous systems and practices. The watershed development must ensure that the minimum basic water needs of the rural communities in the project area are met. Therefore, the rain water management should encompass the multiple use of water namely, drinking water for people, livestock and wild life, domestic use, life saving and pre-sowing irrigation of crops, natural regeneration of flora and other uses in this order of priority. Refocusing the watershed programs towards tribal livelihoods enhancement could go a long way in improving the lives of the poorest people in the state.

D. Agriculture

5.15 One of the prominent areas in which assistance is required to improve the living conditions of the tribes is agriculture. The importance of agricultural growth arises not only from the need to provide adequate food production and a broader base of income generation but because of the increasingly important role that rural demand will need to play in order to support non-agricultural growth from the demand side. Much of this demand will be for non-agricultural products produced in rural areas, which will also generate non-agricultural employment. The crisis of stagnation in agriculture needs urgent attention. This sector still provides livelihood to nearly two-thirds of our people and remains vital for food security. As pointed out by the National Commission on Farmers, we need a *new deal* that rebuilds *hope* about farming. This of course involves finding larger public resources. But even more it requires policy makers, particularly at the State level, to make a renewed effort to understand farmers' problems and identify the critical areas of support and reform that will make farmers themselves sufficiently confident about the future of their occupation to put in greater effort and undertake more investment.

5.16 The 11th Plan strategy to raise agricultural output embarks on the following elements:

- Double the rate of growth of irrigated area;
- Improve water management, rain water harvesting and watershed development;
- Reclaim degraded land and focus on soil quality;
- Bridge the knowledge gap through effective extension;
- Diversify into high value outputs, fruits, vegetables, flowers, herbs and spices, medicinal plants, bamboo, bio-diesel etc., but with adequate measures to ensure food security;

- Promote animal husbandry and fishery;
- Provide easy access to credit at affordable rates;
- Improve the incentive structure and functioning of markets;
- Refocus on land reforms issues.

5.17 From the tribal perspective some important strategies would receive immediate attention to boost the agricultural growth and reduce serious yield gap which has been observed during primary survey. While conversion of agricultural to non-agricultural land is an unavoidable concomitant of the development process, there is need to ensure that this does not put undue pressure on agriculture or lead to inefficient land-use, *e.g.,* loss of essential water bodies and speculative land purchase that reduces cultivation without any productive use for several years. Since land-use patterns *will* change, it is necessary to offset the loss of agricultural land by bringing more land under cultivation. There is a large amount of degraded land that can be reclaimed through watershed development. There is also a considerable amount of degraded land which can be brought back to cultivation with treatment. The scope for improving the quality of land that is currently being cultivated also needs further exploitation. Vast areas of cultivated land are acidic, where significant yield increases are possible through treatment using waste material from industry like lime sludge. More generally, the soils are relatively deficient in organic matter and are suffering from inadequate manuring and composting. Some attempts have been done by FNGOs (e.g., CYSD in Laxmipur block) to produce improved compost including vermi-compost, which needs to be further encouraged. The tribal farmers need to be taught about right type of compost preparation and its application in the cropping system.

5.18 The National Commission on Farmers (NCF) has drawn attention to the knowledge deficit that exists at present and explains much of the difference between yields realised in experiments and what farmers actually get. In the current study huge yield gap has been observed between the district yield and the yield in the tribal areas of the project districts. One reason for this is the virtual collapse of extension with 40-50% of positions vacant and subsequent deployment of VAWs in Gram Panchayat as Executive Officers. This ample suggests for an alternate extension system such as engaging Community Link Workers, which has been successful in WORLP.The government of Orissa has already taken a decision to appoint Krishi Sahayak (Agriculture Assistant) at each Gram Panchayat Level from the coming year. While this will ameliorate the current situation, an alternate extension may be required as the villages are located at isolated pockets with limited households. The committed NGOs are probably the ideal choice for this intervention.

5.19 Rapid agricultural growth will require diversification into higher value crops, e.g. horticulture, floriculture etc. This is partly because demand patterns are shifting in that direction and in many cases this is the most efficient way to increase incomes of farmers from their limited land and water resources. Macro-Management in Agriculture (MMA) provides the main central support to almost all other crop activity. The NHM allocation is large because this not only requires significant new interventions within agriculture, e.g. to ensure sufficient amounts of quality planting material suitable for different crops in different regions, but also preparation for structural changes in the relation between agriculture and non-

agriculture. Diversification into perishable commodities requires an institutional structure, which is conducive to developing effective marketing linkages from farms to ultimate buyers.

5.20 The main form and the commonly understood concept is the addition of more crops to the existing cropping system, which could be referred to as horizontal diversification. For instance, cultivation of field crops (non-rice) in rice fields or growing various types of other crops in uplands has been defined as crop diversification. However, this type of crop diversification means the broadening of the base of the system, simply by adding more crops to the existing cropping system utilizing techniques such as multiple cropping techniques coupled with other efficient management practices. The other type of crop diversification is vertical crop diversification, in which various other downstream activities are undertaken. This could be illustrated by using any crop species, which could be refined to manufacture products, such as fruits, which are canned or manufactured into juices or syrups as the case may be. Vertical crop diversification will reflect the extent and stage of industrialization of the crop. It has to be noted that crop diversification takes into account the economic returns from different crops. This is very different to the concept of multiple cropping in which the cropping in a given piece of land in a given period is taken into account. In order to achieve the above benefits the process of diversification should be changed from very simple forms of crop rotations, to intensive systems such as relay cropping and intercropping or specialization by diversifying into various crops, where the output and processing etc., could be different.

5.21 Government of Orissa has taken all possible steps for crop diversification (from paddy to non-paddy and horticultural crops) during last two decades as result of which there has been some achievement. To give a further fillip the government of Orissa has already taken the initiatives to involve the PP for input management and marketing and legalized the contract farming to facilitate diversification. Legalization of contract farming and encouraging private marketing by amending the APMC Act is expected to encourage diversification. Although government gives lot of emphasis of crop diversification, substantial progress has not been made, as the interventions have been limited to farmers' awareness building, training and exposure visits which are participated by a small number of farmers. The diversification strategies for diversification process is explained in Table 5.1

Table 5.1 Strategy for Planning and Implementation of Diversification Processes

General activity areas	Specific elements
Diversification feasibility	SWOT analysis, including evaluation of consumer demand, available agronomic resources and off-farm employment opportunities
Policy environment	Land and water policy, food security, price support and input subsidy policies, policy environment that is crop neutral, equality of access to assets, vulnerability management, economic and market liberalization and decentralization
Input market, infrastructure and market access	Systems for marketing quality and safety requirements, investment in processing and value addition, options for contract farming, credit, market, venture capital, fertilizer, seed, irrigation and drainage
Private sector participation and supply chain coordination	Cooperation with NGOs, private seed investment, community participation and risk management
Research, extension and training	Integrated management systems, conservative tillage, site specific

General activity areas	Specific elements
	research for increasing productivity, natural resource management, resource use efficiency, intensification for market and technology
Natural resource Management	Sustainable land and water management, protection of biodiversity, biosecurity, and government regulated appropriate technology for conservation of environment.

(*Source: Sorby and Siegel 2003*)

5.22 The possibilities for increasing agricultural production can be achieved by expanding the area for planting crops (horizontal expansion), by raising the yield per unit area of individual crops (productivity) or by growing more crops per year in time and/or in space (intensification). Since the scope for horizontal expansion is limited due to shrinkage of land resources and decreasing land-man ratio, more area could be brought under cultivation by increasing cropping intensity, inter cropping and multi-tire cropping. During *Kharif*, non-irrigated upland could be covered by pulses (green gram, black gram, and pigeon pea), oilseeds (groundnut, sesame) and vegetables (brinjal, tomato) by substituting unremunerative paddy crop. Intercropping of maize+ cowpea, rice+ groundnut, rice+ pigeon pea etc. to further intensify the system with higher land equivalent ratio (LER) in rain-fed uplands.

5.23 Besides providing for direct public investment in marketing infrastructure, NHM incentives and amendment of APMC Acts will enable larger private sector participation in marketing and processing. Diversification also means that the produce must meet the specific requirements of the different markets being serviced, and these requirements vary depending on whether the market is domestic consumption, agro-processing or exports. Producers' co-operatives are one way of achieving these linkages. Contract farming is another way of attracting corporate investors to help establish these linkages and also provide farmers with necessary inputs, extension and other advice. Producers' company is another alternative, which has been successfully been demonstrated by PRADAN in other states (Box 5.3). The 3-M model of MART involving **micro finance**, **micro markets** and **micro planning** may be attempted in the area for effective marketing.

Box 5.3 **PRODUCERS' COMPANY (PC)**

The GoI amended section 581 of the Companies' Act in 2002 that enabled Producer' Companies to be set up. The Rules, under the Act, were not formulated till 2005; hence Producers' Companies could be registered only after 2005.

PRADAN has demonstrated a PC, working with farmers in Vidisha district of MP under the WB supported District Poverty Initiatives Programme (DPIP), which has been scaled up by the MP government.

A PC is allowed membership, i.e. stakeholders, of individuals (farmers) of registered bodies or of informal groups such as SHGs. It is managed by professionals reporting to a board of directors, who would be from the stakeholders and subject matter experts. There is no government representation in the board.

The PC could deal with a number of products. It provides service to the members, at a price. The service could range from purchasing bulk inputs (fertilizer, seeds etc.) access government services and facilities such as soil testing or research and extension establishments (like KVK) and undertaking bulk marketing. Unless the product is catering to a niche market, the regular markets find their way, once the commodity offered reaches a certain volume, until then, bulk marketing is the viable approach. The PC undertakes the marketing during this period. It is relatively efficient to channelize training, information etc. through such a body.

A critical element for a PC to succeed is the strong ownership of the farmers in the company. Thus systems and processes at a grass-root level that builds this sense of ownership in the share-holding farmers, is important. Business plans prepared through involving them has a greater chance of success. The cost structure, the margin at each level, etc. have to be determined in consultation with the farmers. The company undertakes a participatory crop planning process taking into consideration water availability, soil condition and the market demand.

5.24 Access to financial resources enables the poor to enhance investment opportunities, reduces their vulnerability to shocks and promotes economic growth. But lack of credit at reasonable rates is a persistent problem and the tribals have innate fear for institutional credit in most cases. The failure of the organised credit system in extending credit has led to excessive dependence on informal sources including rural moneylenders usually at exorbitant interest rates. This is one of the important causes of farmer distress reflected in excessive indebtedness. Problems of the long-term credit structure have hardly been addressed and the large increase in commercial bank credit does not appear to have significantly improved access in either poorly banked regions or for small/marginal farmers and tenants. The best alternate at the moment is micro credit through group organization. The tribal farmers may form commodity interest groups and initiate collect buying and marketing with the help of micro-credit. Very recently GOO has taken a bold decision to open 500 agriculture cooperative societies in tribal areas. It has been decided to form one SHG in every village to reduce the influence of rural moneylenders.

5.25 Original pasturelands or stipulated are encroached upon, or used for other purposes. Bio-diesel (Jatropha) planting is being promoted through some agencies without seeing all the consequences such as blocking the migration routes of animals and encroaching upon herd-passing pathways. It is vital to ensure that the commons are protected and women, who make up a substantial portion of the workforce in this sector, are given control over them. This will prevent their use for other purposes. Such lands can be developed into a dry land horticulture orchard for livelihood security of women and vulnerable. The initiative has been successful in WORLP in Bolangir district. Tuber crops like yam and sweet potato can be intercropped in these orchards for food security.

5.26 The traditional system of seed production and storage are not helpful for higher crop production. It is well recognized that quality seed alone can increase the crop yield by 10-15%. Looking at the present shortfalls in distribution system of seed, the decentralized seed production by means of seed village will be appreciated. Government of India is providing incentive in shape of subsidy on foundation seeds, subsidy on storage bins and free training will encourage “seed village” scheme ((Box5.4).

5.27 Participatory variety selection (PVS) is a farmer participatory approach for identifying improved crop cultivars. New varieties are evolved in participatory plant breeding (PPB). MS Swaminathan Research Foundation (MSSRF), Chenai has been successful in participatory variety selection and participatory plant breeding in paddy in Koraput district of Orissa. The community is involved in identifying promising local varieties and their multiplication in strip plots along with the HYVs to identify desirable characters of local varieties. Through pure line selection they have identified promising aromatic varieties like *Kalajeera* and *Barapanka*. Seeds are obtained from selected panicles and stored in seed banks

by the community. As a back up, a portion of the seeds could be kept at Community Gene Bank at MSSRF, Chennai to rescue land races that might be eroded. The field-gene-seed-grain bank is to be managed by a committee selected by the people. Other crop seeds like finger millet, minor millet, legumes, maize, niger etc. have been stored by the community in Kalahandi and Kandhamal districts also. Participatory variety selection and participatory plant breeding can be taken up in OTELP for agricultural biodiversity conservation and improvement of local landraces through participatory plant breeding with involvement of NGOs.

BOX 5.4

SEED VILLAGE PROGRAMME AS PER GOI GUIDELINE

Objective

To upgrade the quality of farmer-saved seed for crop production programme, it is proposed to provide financial assistance for distribution of foundation/certified seed at 50% cost of the seed of crops for production of certified/quality seeds only and to provide training on seed production and technology to the farmers.

Implementing Agency (IA)

The IA will be State Department of Agriculture, State Agricultural Universities*, Krishi Vigyan Kendras*, State Seeds Corporation, SFCI, and State Seed Certification Agency.

Approach

The areas suitable will be identified by the IA along with minimum 50 willing farmers for same crop in compact area or in cluster approach. The IA will select farmers in consultation with Department of Agriculture, which will be up to 150 (50-150). The State government will ensure that the project areas of different IA are clearly and separately demarcated. The varieties normally grown in the seed village will be decided in consultation with the farmers, preferably the same crop for all farmers. The project area should receive the assistance for a maximum period of two years so that the identified farmers become aware of seed production technology and after the project period of two years they will be independent seed producers.

Supply of seed

The concerned IA will supply foundation/certified seeds at 50% cost to the identified farmers. If the IA feels that farmers are showing more interest they can form SHGs and take the assistance for setting up of seed processing unit under 25% back- ended credit linked subsidy scheme.

Other incentives

Assistance of 33% subject to a maximum of Rs 3000 for SC/ST farmers and @25% subsidy subject to maxim of Rs 2000 for other farmers for procuring seed storage bins of 2 ton capacity is available. Three-day training is given to the farmers on seed production technology and the IA spends Rs 15000 for giving training to 50 farmers.

5.28 Nearly 85% of cultivatede area in the tribal areas is rain-dependent which invariably shown unstable yield of crops. Dry land technology evolved by the Central Research Institute for Dry land Agriculture (CRIDA) and sub-station at Phulbani can fit into the requirements of the area. The major strategies would be choice of suitable crops, identification of suitable varieties, alternate crop strategies, crop life-saving measures, mid-season corrections and alternate land use system. The detailed guidelines on these measures are given in Annexure I and II. Agri-silvicultural (field crops with forest trees on bunds) systems supplement firewood in addition to production of food grains. Agro-horticultural systems (field crops with fruit trees on the bunds) will supplement the diet (especially when there is availability of planting material in time) without compromising on field crops. Horticulture (plantations of fruit trees) will increase farm income and stabilize production under dry land situation. Silviculture (plantations of forest trees) in dry land and degraded lands will meet the household needs and generate substantial income.

5.29 The lands with continuous intensive cropping system and without any rotation are subjected to nutrient depletion, compaction due to frequent movement of heavy equipment, and build- up of cropping system-associated pests. Topsoil depletion,

ground water change, increasing cost of production are some of the descriptors for intensive cropping system. In contrast, the subsistence cropping systems do not follow appropriate management practices resulting in low production. The earlier attempt to introduce LISA (low input sustainable agriculture) has been gradually changing towards “sustainable” agriculture to make it more holistic. The elements key to the concept of sustainability is environmental stewardship, profitability and maintenance of rural communities and quality of life. The basic production practices likely to be associated with sustainable systems include integrated pest management with high reliance on biological and cultural control, well planned crop rotations, careful attention to soil conservation methods, use of cover crops for soil building and nutrient enrichment, diversification of cropping/ animal production system, often with animal and plant production systems tightly integrated, integrated nutrient management using compost, manures, green manures, biofertilisers and leguminous crops, agro-forestry and alternate market strategies.

5.30 Crop selection on rotational basis is important as it affects many of the production input factors such as seedbed type and preparation, seed variety and quality, seed treatment, seeding methodology and timing, fertilizer application, pest management and harvesting methods. Rotating crops usually means fewer problems with insects, parasitic nematodes, weeds and diseases caused by bacteria, viruses and fungi. It is always advisable to include a legume crop in the rotation as the crop has many advantages including soil health restoration.

5.31 It will be prudent to prepare a micro-level crop production plan for each of the villages which would cover resource inventorisation, resource conservation, arable cropping, non-arable farming and non-farming systems in the village. The technical manuals developed by MANAGE, Hyderabad will be of much help in this direction.

Livestock Production

5.32 The mixed farming system is the tradition where crop farming and livestock rearing go together. It ensures spreading of risk over both crop (primary) and livestock (secondary) production; the two are complimentary to each other; and the inbuilt flexibility allows for adjustment of the crop/livestock ratios in anticipation of risks, opportunities, and needs when they arise. Some of the important initiatives that are needed are:

- Promotion of appropriate crossbreeds while conserving indigenous breeds
  of livestock.
- Establishment of livestock marketing system.
- Promotion of rural backyard poultry in a cooperative marketing s
- Enhancing livestock extension services.
- Encouraging private veterinary clinic and standardizing ITKs.
- Provision of an insurance package to avoid distress.

There is a need to train a member of the community who then delivers the services at the doorstep of livestock keepers. One male and one female member from each village (CLW) selected by the village community, who will be trained with skills of veterinary first-aid and poultry disease control measures. The training comprises simple first aid, vaccination, deworming of sheep and goats,

and castration of bucks and rams. The degree of CLW performance is found dependent on age, literacy status, intention to remain in the village, skill in working with livestock, desire to learn new skills, and amount of time devoted to work. In general, CLWs make services available to poor people at their doorstep, and have reduced the mortality rate of small animals by improved vaccination and deworming (ILDP, Koraput and WORLP). Analysis of the CLW approach indicates that input supply seen as a problem area, followed by linkage with government AHD institutions. As both livestock inspectors and CLWs tend to work in villages, they may face a conflict of interests. So, there are areas like poultry vaccination, small animal castration, and wound treatments which both agree that CLWs can deliver, whereas LIs want the CLWs to assist them in castration and vaccination of large animals. Female CLWs equally practice castration of animals like male CLWs, contrary to the belief that female CLWs cannot do it.[9]

F. Food Security

5.33 Food security is more concerned about availability, stability of supplies, access and consumption by all than more production. Promotion of farming system approach to achieve triple goal of more food, more income & more livelihood, diversification of cropping & enterprises, bio-intensive & nutritious gardens in back yards, support for micro-enterprises supported by micro-credit, management of commons for enjoying usufruct rights etc. are various options for food and nutrition security at community level. Private investment on long lease of waste lands for production of raw materials for industry and contract farming need to be pursued vigorously. There is immense scope for back yard nutrition garden and back yard poultry with little bit of support to increase the physical availability of nutritious food, especially for poor and landless.

5.34 National Commission on Farmers has suggested for a three-pronged strategy for farmers, landless agricultural labourers and rural artisans. Improving the productivity of land, water, livestock and labour in the case of asset owning farmer families, converting unskilled agricultural labour into skilled entrepreneurs engaged in organising market - driven non-farm enterprises, and enhancing skills of families involved in the secondary and tertiary sectors of the rural economy will be the strategy so that they will be able to assist in improving agriculture efficiency and its competitiveness ,and in ending the prevailing mismatch between production and post-harvest technologies.

5.35 **Promotion of Alternative Livelihoods**

Low employment opportunities in sectors outside of agriculture and forestry activities mark the depressed economy of tribal communities. Though more detailed locale specific feasibility studies may be required in relation to alternate livelihoods, the sub-sectors like eco-tourism, village crafts, small manufacturing and repairs, rural transport and petty business of processed products show promise as a whole:

5.36 **Education and Health**

Education and health are priority areas of social development for tribal communities and gains in these will result in long term socio-economic change. There are other significant initiatives in these sectors such as DPEP in education

and RCH program in public health which needs convergence with OTELP. As a general principal such proposals from FNGOs that seek funds for education and health related activities will be justified if they represent a genuine gap in the available services and resources. However as an area program with a wide village level institutional base OTELP will also be in a good position to contribute to the effectiveness of the existing programs.

5.37 **Gender Equity**

Evidence from various studies confirm that the women had no voice in watershed management until SHGs gave them confidence to assert themselves. The SHGs also provide space to discuss their problems, to work towards solutions and to meet their credit needs. On the issue of equity in wages, evidence from all sources clearly indicates that women's wage are always less than what men earn. The technologies develop so far male-oriented. There is a need to have gender-sensitive extension training and workshop for dissemination of technology and gender equity. The specific measures required to address the gender issue would be:

- The collective rights of tribal women to land, water and forests should be recognized and mentioned separately in government plans and policy documents
- The tribal women living within the forest area should be guaranteed their ancestral ownership and inheritance rights as per customary law
- CPRs may be allotted to women SHGs for cultivation and dry land horticulture
- Tribal women should be given adequate training to assume leadership roles in formal public. There should be gender sensitization workshop in each project districts.
- Traditional women farmers' wisdom and experience related to biodiversity conservation and enhancement, seed selection and storage, water harvesting, risk minimizing agricultural practice and sustainable use of natural resources should be acknowledged.

[9] .Das, Kornel: Poverty Reduction in Tribal Communities:ILDP in Koraput

- Tribal women's right to collect minor forest produce should be guaranteed by government as it constitutes a major source of their livelihoods
- Tribal women farmers should be provided training in marketing their produce and supporting in setting cooperatives
- The women farmers in tribal area can be supported for construction of grain bank, horticultural programme, organic farming , seed production, preparation of planting materials, kitchen gardening, animal husbandry and agro-processing for substantial income generation and food security.
- Encouraging thrift and credit societies with micro-finance support for micro-enterprises.

5.38 Vulnerability Reduction

The vulnerability of tribals occur due to trends in gradual degradation of natural resource quality, excessive population, inappropriate developments in

technology, undesired change in political representation, general economic stagnation , and shocks due to climatic extremities, out break of diseases and seasonality in prices and employment opportunities . The broad strategies to deal with vulnerability would be natural resource based, non-natural resource based and appropriate migration. All these require a village level vulnerability analysis and development of a micro level planning.

5.39 **Credit**

Lack of access to institutional and formal credit suitable to the needs of poor families is a major economic constraint that the OTELP will need to overcome. The needs of the poor are small, unpredictable, and urgent and consumption oriented and are not catered to by banks. As a result of this they have a high dependence on private moneylenders who extract high interest rates and also enforce other insidious conditions of repayment (lien on crop produce, mortgage etc). Lack of credit also inhibits ability to invest in productive purposes hence poverty remains persistent among vulnerable groups such as tribals. OTELP may think of providing some seed money or revolving fund to the SHGs for timely internal lending among the members.

5.40 **Access to developmental programmes**

Over the years tribal households have received assistance in cash and in kind, through several developmental programmes. Assistance rendered through these schemes has undoubtedly played a strategic role in improving the living conditions of tribes folk. The areas of assistance received are broadly classified as agriculture, animal husbandry, education, self-employment, and house construction. The FNGOs should coordinate with line departments so that the ongoing schemes are converged with OTELP. At the same time the people should be made aware and motivated to participate in all development schemes.

5.41 Issues, strategies and interventions

Sub-component	Issues	Strategy	Interventions/Tactics
1. Land and water management	Natural resource degradation (a) Soil degradation due to soil erosion, physical degradation and loss of vegetative cover	Soil & water conservation on watershed basis (i) Conservation measures for hill slopes	• Village ecosystem management plan development • Contour trenching • Bench terracing • Stone terracing • Plantation & and natural regeneration of forest • Indigenous technology • CCT and water absorption trenching (WAT)

		(ii) Conservation of agricultural lands (private land)	• Contour cultivation • Strip cropping • Bunding & terracing • Contour bunding and graded bunds • Surplus weirs • Grassed water ways • Bed & furrow system • Sunken ponds • Diversion drains • Minimum tillage and mulching • Vegetative barrier
		(iii) Conservation of public land and commons	• Construction of village tanks, gully ponds etc. • Afforestation with mixed forest species • Fodder development • Gully control • Check dams • Drainage line treatment • Vegetative barrier • Dry land horticulture
	(b) Excess run-off and moisture stress at root zone during Kharif	Rain water management (i) Rain water harvesting	• Rehabilitation of indigenous water bodies • Construction of water harvesting structures • Farm ponds • Percolation tank • Staggered trenching • Provision of drinking water
		(ii) *In situ* moisture conservation	• Contour cultivation • Vegetative barrier • Dead furrows • Ridge & furrow • Off-season tillage • Ploughing across the slope • Mulching • Broad bed & furrow • Compartmental bunding • Contour trenches
		(iii) Agronomic measures	• Inter cropping • Crop rotation • Alternate land use • Contour tillage • Mulching • Minimum tillage • Application of organic matter • Row adjustment, spacing & time of seeding

2. Participatory forest management	(a) Indiscriminate deforestation leading to loss of forest cover impacting livelihoods security of tribals	(i) Regeneration of forest area in micro-watersheds through participatory forest management	• Organisation of VSS • Development of micro-plan by the community • Natural regeneration with gap filling and planting of blanks • Coppicing by cutting high stumps & stump protection • Nursery development & seed processing • Multiple cutting of timber trees • Staggered contour trenching • Protection against forest fire • Selected harvesting • Erection of live fencing on shallow continuous trenches • Controlled grazing of ruminants • Eco-tourism
		(ii) Collection & processing of NTFP and marketing	• Group formation, collective processing and value addition • Development of storage godown, market yard and drying units etc. • Alternate livelihoods strategy to avoid distress sale • Revolving fund for financial assistance and collective buying • Collective bargaining • Market survey and business plan development • Convergence of SGSY • Information flow about price structure • Bulk buying of herbal products • Handing of kendu leaf plucking to SHGs and cooperatives • Skill mapping & capacity building • Middlemanship
3. Agricultural & horticultural development	(a) landlessness	(i) Access to land for settled cultivation	• Distribution of land under Vasundhara scheme • Access to forest land with usufruct right • Access to CPR with usufruct right by the SHGs, preferably women's groups • Alternate livelihoods (off-farm and non-farm enterprise) • Allotment of land within 10^0-30^0 slope • Correction of soil acidity
	(b) Low level of cropping intensity and unsustainable agricultural production	(i) Irrigation development	• Irrigation development under gravity flow system by check dams, diversion weirs etc. • Construction of farm ponds • Constriction of dug wells • Rehabilitation of existing water bodies • Low cost water pumps • Low cost irrigation devices for pitcher irrigation • Producer's company
		(ii) Improved rain-fed	• Selection of crops and cultivars

		farming system	• Crop rotation • Cover cropping • Mixed cropping & inter cropping • Mulching • Adjustment of plant population (spacing, lining, crop geometry) • Integrated nutrient management • Integrated pest management • Weed management • In situ moisture conservation • Alternate land use • Contingent planning & mid-season correction • Multi-tire cropping • Conservation tillage • Strip cropping • Use of dry land implements
	(c) Low level of crop productivity	(i) Technology improvement and improved service delivery	• Technology generation & dissemination by participatory technology development • Varietal improvement by participatory variety selection and participatory plant breeding • Field demonstration of improved practices • Seed replacement through seed exchange programme • Field trials with new varieties and new packages • Conservation agriculture • Integrated pest management • Integrated nutrient management • Alternate extension • Improved mechanization • Off-season vegetable cultivation • Access to credit & marketing
		(ii) Improvement of Podu cultivation	• Increasing period of Podu cycle • Encouraging alternate livelihoods (forest based) like basket making, rope making and cane furniture • Adopting SALT in Podu areas • Mixed cultivation of trees, dry land fruits and dry land cultivation • Equitable distribution of wasteland • Preparation of eco-development plan • Farm forestry and planting of timber • Promoting forestry in upper reaches with silvi-pasture • Annual and perennial fruit trees in middle slope • Lower slope under agricultural crops.

	(d) Fruit cultivation	(i) Supply of quality planting material	• Establishment of nursery and production of planting materials • Capacity building of groups for preparation of planting materials
		(ii) Area expansion under fruit cultivation	• Plantation of fruit grafts/ saplings in CPR by SHGs • Dry land horticulture in hill slopes • Plantation of fruit plants on home stead lands • Mixed plantation with forest species, Amla and Anona etc.
		(iii) Production improvement of existing fruit trees	• Provision of irrigation • Rejuvenation of old orchards • Integrated nutrient and pest management • Organic cultivation
		(iv) Unorganized marketing	• Collective buying and processing of semi-processed products • Collective marketing • Packaging and transportation • Vertical diversification
	(e) Household food & nutrition security	(i) Homestead gardening	• Live fencing • Supply of vegetable minikits and fruit seedlings • Production of vermicompost • Floriculture • Nursery management • Fruit and vegetable cultivation • Health and drinking water • Back yard poultry • Back yard nutrition garden
	(f) Allied agriculture development	(i) Encouraging bee keeping	• Group mobilization • Training on bee keeping • Supply of equipment & bee colony • Processing and marketing
		(ii) Mushroom cultivation	• Training on mushroom cultivation • Supply of spawn and other requisites • Mushroom cultivation in groups • Organised marketing
	(g) Cultivation of aromatic and medicinal plants	(i) In situ cultivation	• Demarcation of forest area and protection against grazing and fire • Improved method of harvesting • Processing and organized marketing
		(ii) Ex situ cultivation	• Collection of seed and planting material • Training on cultivation of medicinal plants • Cultivation in home stead land and on CPR • Semi-processing and marketing

4. Livestock and aquaculture development	(a) Improved production and productivity of livestock	(i) Village poultry	• Introduction of new breeds (Banraja) • Deworming and vaccination • Nutrition, sanitation and hygiene • Cultivation and feeding white ants
		(ii) Sheepery, goatery and piggery	• Breed upgradation • Community farming • Nutrition, health and sanitation • Deworming and vaccination • Disease control • Correction of iron deficiency in piglets
	(b) Production improvement for aquaculture	(i) Cultivation of fish in created water bodies	• Fishing right in created water bodies • Capacity building • Group mobilization • Supply of fingerlings • Feeding • Management of diseases
		(ii) Fishery in individual ponds	• Composite fish cultivation • Supply of inputs • Training • Testing of new technologies through demonstration

Chapter 6. Guidelines on Strategy for Livelihoods Enhancement

6.1. Land and Water Management Strategy

Soil and water erosion are major problems of tribal area. Measures that impede and shorten water flow (e.g. vegetation through cover crops and trash lines or engineering structures like bunds) will reduce the erosive effect of rain water. Traditional soil and water conservation works like bench terracing, stone bunding, earthen ponds *(katta)* , earthen bunding and check dams are found in the Programme area. Interventions like masonry check dams, diversion weirs, bunding, plantation etc. have already been tried through ITDA/OTELP support. Basing on the R&D experiences the mechanical measures like contour bund, graded bund, bench terrace, grassed water ways, diversion drain, and gully control etc. have been suggested. Field observation on practices followed by the farmers has been that field boundary bunds, stone bunds, bench terraces, vegetative barrier, diversion drains and silt harvesting structures are in practice. Keeping in view all above, the possible soil and water conservation measures that can be adopted/ adapted in the watershed areas have been suggested as under:

Possible solutions	Activities
1. Terracing and in field earth works	• Earth bunds- on contour • Earth bunds- field boundaries • Earth bunds on gradient • Stone bunds on gradient • Bench terracing • Field leveling • Repair of existing terrace
2. Protection to terrace and disposal of surplus	• Diversion ditch • Blind interception drain • Artificial water ways • Field weir
3. Treatment of water courses	• Stone gully plug • Wooden crib gabion structure • Wire gabion structure • Temporary check dam • Permanent check dam • Flumes and chutes
4 Vegetative method	• Reseeding • Grass strips • Tree planting • Strip cropping

6.2 Rain water harvesting through appropriate water harvesting system is also important to maintain the water balance in the watershed area. The various options are indicated below.

System	Type of intervention
Indigenous rainwater harvesting	• Cross bunds • Conservation ditch • Embankments

	• Farm ponds • Katta/ Munda
In situ rainwater harvesting	• Off-season tillage • Contour farming • Sowing on contour and ridging later • Dead furrows • Inter-row water harvesting • Inter-plot water harvesting • Broad bed and furrow system
Structure for ground water recharge	• Check dams • Gully plugging • Percolation tank • Sand filled bund • Sub-surface barrier • Stop dam • Sunken pond • Brushwood check dam • Gabion structure

6.3 Land and water management is to be done on watershed basis in the programme area with above considerations. Hence the planning on watershed should have to focus on:

- Make use of possible rainfall conservation techniques with a focus on preserving soil moisture *in situ* on the farm lands;
- Introducing agronomic improvements with an aim to conserve soil moisture in the root zone for longer periods; and
- Constructing water-harvesting structures to provide protective irrigation from traditional tanks, diversion structures and wells.

An average micro-watershed in the programme area has a total area of about 650 ha with 130 ha of treatable reserve forest area, 20 ha of non-treatable area, 300 ha of non-arable area (treatable) and 200 ha of arable area including rainfed and irrigated lands. Thus 650 ha has been considered as the basis of the micro-watershed planning exercise.

6.4 Watershed Development Works

The watershed development works comprise surveys, construction of tanks and ponds, diversion weirs, dug wells, gully control structures and measures in forest and non-forest area and system improvement for control of water area for control of water over fields. The illustrative cost structure for each micro-watershed (650 ha) is about 44.32 lakh rupees at the rate of Rs. 6820 per ha (Table 6.1)

Table 6.1 Cost Structure for MWS

Work	Unit	Unit Cost (Rs.)	Number of units	Total cost (Rs.)	Labour component
Surveys					
- Watershed plan with streams and contours	Sqm	21000	1	21000	-
- Site surveys for structures	Sqm	2100	20	42000	-

Tanks and ponds - Repair and improvement	Number				
0.5 ha submersion	Number	17550	2	35100	80%
2.0 ha submersion	Number	117000	1	117000	80%
- New tanks 2-3 ha	Number	468000	2	936000	80%
- New sunken ponds	Number	40950	3	122850	80%
Diversion weirs - repair and improvement	Number	29250	2	58500	80%
- New diversion weirs and canals	Number	116250	4	465000	75%
Hand dug wells - Improvement of wells	Number	17550	10	175500	80%
- New wells & pump sets	Number	35100	15	526500	80%
Gully control structures and measures a) Non-forest area					
- Mini percolation tanks	Number	11775	30	353250	85%
- Mini sunken ponds in gullies	Number	2093	140	292950	75%
- Gully stabilization / bank protection	Number	174	300	52313	75%
- Stone / gabion checks	Number	2906	10	29063	75%
- Nala protection and stabilization	Number	116	100	11625	75%
- Foot hill trench	Number	67	1000	66500	75%
b) Forest area					
- Mini percolation tanks	Number	11775	20	235500	85%
- Mini sunken ponds in gullies	Number	2093	110	230230	75%
- Gully stabilization bank protection	Number	174	100	17400	75%
- Stone/ gabion checks	Number	2906	80	232480	75%
c) Systems for control of water over fields					
- Vegetative	Ha	474	20	56880	90%
- Contour bund improvement	Ha	1080	120	129600	100%
- Channels for low flood flows	M	36	2000	72000	100%
- Cover crop in rainfed land	Ha	119	300	35550	90%
-Sub surface dam in nala	Number	117000	1	117000	80%
Total				**4431790**	

6.5 Participatory Forest Management

Shifting cultivation is taking place in Revenue Forest Land which is classified as demarcated, undemarcated and unclassified forests. Grant of land *patta* to the landless people from three categories of forest are permitted by State government. Regulation of encroachments outside the Reserve Forest, which took place before 1980 is currently being addressed by the State Government. The tribals have their right for collection of edible roots & fruits, honey, flowers and creepers from the RF free of any payment. Regular and excessive exploitation of some NTFPs such as amla, harra, bahera and bhelwa etc. is limiting the scope of natural regeneration. The programme is expected to introduce a number of new initiatives like NTFP processing & marketing, participatory forest management and forest treatment. The programme supports initiatives on NTFP, reduction of dependence on forests, training of communities on PFM, forest regeneration, nursery development and seed processing, technical assistance and studies as well as action research. The details of support to be provided under the above components are as under:

Sl. No.	Component	Activities/interventions
1	NTFP	• Training of SHG members in NTFP collection and processing • Access to finance for processing and marketing • Strengthening of local capacity to market NTFPs • NTFP marking information support
2	Reduction in dependence on Forests	• Promotion of fuel efficient stoves and development of iron ploughs • Linkage with ORMAS for improved stoves.
3	Training for communities and support agencies for PFM	• Awareness raising • Study tours • Capacity building of PFM sub-committee members • Training of forest officers
4	Forest regeneration	• Formation of PFM Sub-Committee • Preparation of micro-plans – 20 ha • Treatment for natural and artificial regeneration (coppicing and cleaning for natural regeneration combined with soil and moisture conservation works)
5	Nursery Development and Seed Processing	• Support for establishment of small nurseries near PFM treatment areas for 10,000 seedlings (A model report on group nursery is at Annexure- 5) • Training on nursery management • Forestry seed processing and seed storage
6	Technical assistance	• Consultants for PFM • Training consultants
7	Studies & action research	• Vegetation survey through participatory approach • Forest produce marketing study • Action research • Documentation of experience • Survey of current experience

6.6 Mixed tree species with multi-purpose value and nitrogen fixing capacity are mostly preferred for the forest area. Wherever facilities exist, dry land fruit crops can also be planted. The selection of tree species may be made in consultation with the people following the criteria like adaptability to local agro- climatic condition, fast growth, short gestation period, coppicing ability, multiple use, higher demand and better value of produce, ,ability to improve the soil and easy market. Some of the tree species and their adaptability are indicated below.

Situation/ Purpose	**Preferred tree species**
Marshy area	*Acacia auriculiformis, Bambusa species, Derris indica, Eucalyptus grandis, Gliricidia sepium, Terminalia arjuna*
Shallow rocky soil	*Acacia Senegal, Anacardium occidentale, Annona*

	squamosa, Azdirachta indica, Casia siamea, Acacia leucopholea
Sandy soil	*Acacia auriculiformis, Anacardium occidentale, Dalbergia sisoo, Eucalyptus spp., Accacia Senegal*
Acid soils	*Albizia procera, Derris indica, Gliricidia sepium, Tamarindus indica*
Dry areas	*Acacia nilotica, Azadirachta indica, Derris indica, Leucaena leucocephala, Ziziphus, mauritiana*
Best fodder	*Leucaena leucocephala, Acacia albida, Acacia ferruginea, Tamarindus indica, Ziziphus mauritiana. Sesbania grandiflora*
Best Fuel Wood	*Acacia nilotica, Cassia fistula, Acacia Senegal, Madhucal latifolia, Pongamia pinnata*
Best Timber	*Dalbergia sisoo, Terminalia arjuna, Eucalyptus tereticarnis, Acacia nilotica, Shorea robusta, Pterocarpus indicus, Tectina grandis*
Fruit trees for dry land horticulture	Guava, Ber, Custard apple, Pomegranate, Mango, Jamun, Aonla

The details of model nursery has been given in **Annex 5.**

6.7 Agriculture & Horticulture Development

The current study indicated that there are mostly three villages in each MWS with average population of 282. The average family is 5.8 and 32% families are landless with access to shifting cultivation and share cropping. The average size of holding is about 0.64 ha while area under cultivation by each family under shifting cultivation is 0.53 ha. The total cultivated area of average village is about 30 ha under settled cultivation and agriculture accounts for 30% of family income. Thus in a MWS covering three villages about 90 ha under settled cultivation and another area of 75-90 ha under shifting cultivation are cropped. With the assumption of nearly 900 people living in the villages of MWS, the adult equivalent comes to 770 of which 70% are non-vegetarian and 30% are assumed to be vegetarian. The moderately working men and women require the following minimum food items to meet their energy requirement (**Table 4.3**). Basing on the above requirement the total food requirement for the inhabitants of every MWS would be as follows(Table 6.2).

Table 6.2 Gross Requirement of Food Items in MWS

Item	Total quantity in tons	Gross requirement after allowing for seed, storage loss etc.
Cereals	115.80	139.00
Pulses (whole grain)	19.11	24.84
Vegetable	80.66	113.00
Fruits	8.43	11.80
Milk	36.53	38.36
Fish/meat	5.90	6.20
Fat/oil	11.24	14.05(42.15 tons of oil seeds)
Sugar	9.83	10.33

Since the current level of production is much below the above requirement, the deficit quantity has to be further produced in each MWS in order to ensure household food security as shown in the Table6.3

Table 6.3 Total Requirement and Production of Food in MWS

Major food items	Gross requirement in tons	Current level of production	Deficit
Cereals	139.00	127.92	11.08
Pulses	24.84	1.92	22.92
Oil seeds	42.15	1.24	41.94
Vegetables	113.00	7.56	105.44

Source: Primary survey

Hence there is need to develop perspective plan so as to make the people within a watershed self-sufficient in major food items while having some marketable surplus to meet the other consumption expenditures. Adoption of suitable farming models along with appropriate technology can achieve this goal.

6.9 Therefore the programme strategy needs to focus on natural resource management and improved production technologies for sustainable crop production which includes improved varieties of existing crops, changed cropping sequence and rotation, improved crop husbandry, use of bio-fertilizer, management with low cost inputs and *podu* conversion. Various technological suitable for adoption in MWSs are indicated below:

Sl. No.	**Situation**	**Key technological interventions**
1	Low lands	• Use of high yielding varieties • Row transplanting and maintenance of plant population • Use of moderate levels of fertilizers • Use of green manuring • Integrated pest management
2	Uplands	• Irrigation development by farm ponds and percolation tanks • Crop substitution with non-paddy crops (maize, ragi, pigeon pea, oil seeds) • Introduction of HY varieties • Improved planting techniques like line sowing • Integrated nutrient management with crop rotation
3	Padar land	• Inter cropping and mixed cropping • Focus on pigeon pea, millets and pulses • Inclusion of legume on crop rotation for nitrogen fixation • Line sowing and timely weeding
4	Sloped hilly land (shifting cultivation)	• Introduction of multi crop approach • Alternate land use with agro-forestry, silvi-culture and dry land horticulture • Inter cropping with legume crops for nitrogen fixation. • Provision of assistance by compensating for loss of food production for podu dependent farmers

		• Provision of increased employment and food assistance for 60 days • Introduction of SALT as substitute to shifting cultivation (Model description at Annexure 9)
5	Fruit trees	• Plantation of fruit seedlings of mango, cashew, papaya, banana, pine apple, custard apple, citrus and Amla etc. • Protection against grazing.
6	Homestead gardening/ Livestock rearing	• Fencing and cultivation of vegetable crops • Planting of fruit grafts / seedlings • Backyard poultry

6.10 The programme sub-components and required interventions are indicated as under.

Sub-components	**Interventions**
Technology generation & dissemination	• Farmers' training • Field demonstrations • Field trials • Training of VAVs (Models for Field demonstration , field trials and Farm model are **at Annex 6 , 7 &8**)
Podu Conversion	• Adoption of SALT • Dry land farming • Dry land horticulture (Models of " Wadi" and SALT and Dry land farming system are at **Annex 9, 10 &11**)
Capacity building	• Awareness camps • Trainings • Exposure visits

6.11 Land based livelihoods strategies with farmers' preference are indicated below.

Land-use options	Reasons for preference	Risks perceived
Dry land farming (seasonal field crops)	• For subsistence • Traditional occupation • Millets and coarse diets for staple food • No other employment	• Drought • Wild animal attack • Soil degradation
Agri-silvicultural system	• Supplement fire wood • Income security at the failure of seasonal crops	• Availability of planting material • Tree shade may reduce crop yield • Apprehension about rights to harvest
Agri-horticultural system	• Supplementary diet • Short term and long term cropping	• Availability of planting material • Transport and marketing
Dry land horticulture	• Low water requirement • More income	• Availability of planting material • Market

	• Unsuitability of field crops	• Wild animal
Silviculture	• Unsuitability of land for field crops • Dependence on NTFP	• Availability of planting material • Transport

The details of alternate land use, agronomic measures, IPM and INM have been given in **Annex 1, 2, 3, & 4**

6.12 Livestock and Aquaculture Development

Important role played by livestock in the socio-economic and cultural life of tribal people (every social, cultural and religious activity requires a pig, hen or goat) is well recognised. Cattle are mostly reared for drought and manure. Low productivity of livestock is mainly due to lack of breed upgradation, poor housing, nutrition and animal health, indigenous system of animal health treatment, as revealed from the primary study. Considering these the strategy for livestock development is given hereunder:

- Build on the existing system and practices for gradual process of development rather than introducing a new system.
- Overcome the major existing constraints to livestock rearing like fodder availability, vaccination, deworming etc.
- Build the capacity of local people to identify problems and to overcome the problems.
- Respond to changing livestock scenario in respect of emerging opportunities.

6.13 Suggested Technological Interventions and Programme Assistance

Sl. No.	Strategy	Activities	Assistance required
1	Development of village poultry/ duckery	• Deworming and vaccination against Ranikhet disease, fowl pox, delousing and development of basic husbandry skills	• Training on improved livestock management to SHGs /VVVs / LIs • Improvement in the cold chain for vaccines.
2	Development of sheepery and goatery	• Improved management practices • Disease control	• Training to SHGs / VVVs / LIs • Improvement in the cold chain for vaccination.
3	Development of Piggery	• Reducing incidence of disease • Correcting iron deficiency among piglets	• Training to SHGs / VVVs / LIs

The models on poultry and goatery are given in **Annex 12& 13.**

6.14 Aquaculture Development

The programme is required to adopt approaches like raising awareness on the scope and potential of aquaculture, propagation of semi-intensive and intensive aquaculture in tanks / pond, encouraging SHGs to take up aquaculture as

income generating activity and providing assistance on training and inputs including facilitating marketing. Two models of aquaculture have been given in **Annex 14 &15.**

Programme components

The programme components for livestock and aquaculture development are:

- Capacity building of farmers, livestock volunteers and supporting agency staff.
- Improvement in animal health services of FARD Department and community
- Breed improvement
- Technology testing
- Technical assistance

6.15 Capacity building

The beneficiaries, livestock volunteers and livestock inspectors including FFDA staff are required to be trained to improve their skill, knowledge and change the attitudes. The training of beneficiaries conducted at village / G.P level will enable the women farmers to participate. One village veterinary volunteer (VVV) of programme village can be trained at cluster level for a duration of 10 days comprising several sessions including practical exposure .The course content of such training should cover improved livestock practices, elementary knowledge of vaccines, veterinary first aid and use of common drugs, deworming of animals, castration of small ruminants, and aquaculture on community basis in watersheds. Refresher training for 3 days every year for the VVVs is to be undertaken. Such refresher trainings can be conducted at LI centers. Training of LIs of FFDA staff can be organised at block level to understand the concept and components of the programme, and participatory approaches to development in addition to enhancing their knowledge base. The duration of training should be 7 days which would be devoted for 3 days on theory and 4 days on practical. A refresher's training can be provided to the LIs and FFDA staff every year for 3 days at Block level to review programme performance in their area and prepare annual action plan.

6.16 Improvement in Animal Health Services

One LI in each programme block has been designated by the Department of FARD to work full time in the programme village. His basic work would be to provide technical back-stopping to VVVs and the villagers / SHGs. The LI may be provided operational cost of motorbike to visits the villages to supervise the demonstrations. The programme may assist establishment of a well functioning cold chain from district to the village level. One deep freezer of 185 ltr capacity, equipment for sterilization of syringe and needless for vaccination, furniture to LI at block level and 2 thermo flasks along with a vaccination kit at village level may be provided. Each VVV can be supplied with one poultry vaccination kit, veterinary first aid kit and a medium size burdizzo castrator for a cluster of village. Each VVV may be supplied with a veterinary kit containing a set of basic drugs while vaccines will be supplied by the LI at block centre. The VVV would charge for the drugs and vaccines along with service charges in order to ensure the sustainability of the system. The VVV would be responsible to replenish the drugs either through FARD Department or from private pharmacists. The VVV

would be allowed to draw the veterinary drug fund of Rs. 2500/-. The VDC may provide a small honorarium to the VVV out of programme fund.

6.17 Breed Improvement

In order to improve the genetic stock of goats, the programme may provide a breeding buck of improved breed (Barbari or Sirohi) to a member of SHG or a user group. The buck will be maintained by the beneficiary group and would charge a fee for the service provided.

6.18 Pilot project on Testing of new technologies

White ants form a good source of protein and energy for local scavenging birds. The programme would test the technology of white ants cultivation and feeding to local scavenging birds on a pilot basis. Demonstration on cultivation and feeding of white ants is required to be organised at village level with SHGs.

6.19 Rural Financial Services

The strategy for developing financial services under the programme focuses on SHGs. The concept of using SHGs for financial service delivery is attractive to both the groups and banks. The concept offers easy access to financial service which is village based, reducing transaction cost for the beneficiaries, enabling self management of the groups; a frame work for participatory decision making , flexibility in operation ,and accountability & transparency in transaction.

The sub-components and interventions are indicated in the Table 6.4.

Table 6.4 Sub-Components of Rural Finance Service

Sub-component	Activities/interventions
Promotion and capacity building of SHGs and their promoters	• Formation of SHGs consisting of self-selected members of 6-20 in the group which may be women/man or mixed groups. • To start with saving and credit, the SHGs would be linked with FFIs, SIDBI and CARE for micro-finance activity and networking. • The various activity which would be undertaken are (i) capacity building of FNGOs in human resource development, financial management, micro-project management and production and marketing (ii) capacity building of SHGs, and (iii) capacity building of banks.
Enhancement of capital base of the SHGs	• Contribution to the equity of the SHGs for augmenting their capital base. • The equity would be provided in two instalments with a ceiling of Rs. 4000 for SHGs having less than 10 members and Rs. 8000 for larger SHGs. • The equity would belong to the programme and would revert back to the ITDA in the event of closure of any SHG.
Access to loan funds	• Established SHGs (after about 12 months) can be provided with bank loan at the ration of 1:1 to 1:4 related to the saving of the group.

	• In case of suspicious by the banks, linkage with specialized micro-finance NGOs with support for NABARD and SIDBI would be an alternative. To cover these situations, a small Credit Fund (CF) would be created at each ITDA to provide onetime loan to the facilitating NGO at the rate of Rs. 2,00,000/- per block. • Any amount beyond this will have to be accessed by the FNGO from SIDBI or CARE.
Promotion of non farm income generating activities	• In order to set up trade and/or value addition to their current aquaculture, livestock and NTFP the SHGs will be supported to undertake those activities. • Identification of the activities depending upon the nature and human resource available within the SHGs and development of the required skills for managing the micro-enterprise would be made by the FNGO. • The programme would support the development of non-farm activities through training in skill development, entrepreneurship management, provision of work sheds and facilitating linkages with relevant support agencies such as SIDBI and DIC.
Networking of SHGs	• The programme would facilitate on a pilot scale, the formation of clusters of 15-25 SHGs and association of 4-8 SHGs clusters among the matured groups. • Programme assistance would comprise provision of expert advice for the development of appropriate institution structures orientation of the NGOs to the functioning of clusters / associations, provision of exposure visits to the existing SHG association and networking of cluster / association within and outside of the programme to facilitate exchange of ideas

6.20 Community Infrastructure

The programme provides a community infrastructure fund (CIF) to support meeting infrastructure needs identified by the community. The infrastructures eligible for financing includes drinking water supply, village road upgradation, storage facilities, work sheds and economic infrastructure and community building focusing on the following priority areas. A set of criteria has been prepared for taking a decision of establishing community infrastructure under the programme.

Eligible infrastructure	**Focus**
Drinking water supply	Additional tube well in small and under

	serviced villages, provision of iron treatment plants, repair of hand pumps and training of pump maintenance with supply of spare parts
Village road upgradation	Culverts, bridges, retaining walls and critical stretches of earthen road beyond 3% gradient for upgrading to all weather roads to provide access during monsoon.
Storage facility	Provision of village level facilities for food banks, PDS supplies storages and NTFP and Agriculture products etc.
Work sheds and economic infrastructure	Work sheds for community / user groups supporting income generating enterprises
Community building	Construction of meeting hall and over night accommodation targeted to remote communities.

Chapter 7. Capacity Building Plan for Livelihoods Enhancement

7.1 Capacity Building (CB) needs of livelihoods enhancement has to look beyond the traditional top- down approach of enhancing skills and knowledge through training and provision of technical advice. It must focus on all aspects of NRM and sustainable livelihoods in the MWS, from planning to on-ground action.. Therefore, the CB strategy should address transfer of technology and enhancing technical capability with focus on cohesion with the communities, and attempt to build both **human** and **social capital**.

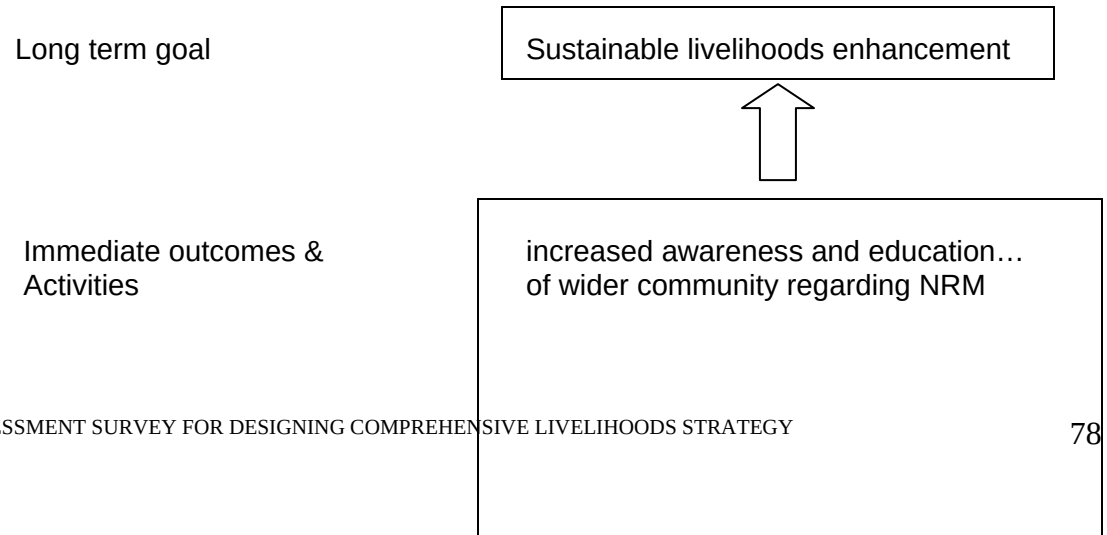
7.2 Rationale

In order to achieve the long term outcomes through sustainable livelihood system, investments in capacity building of the stakeholders are as critical as investments in actual work component under NRM. The long term success will depend on the extent to which the concerned stakeholders (primary and secondary) are informed about the decisions, skills, knowledge and motivation that result in sustainable crop production and ongoing economic activity.

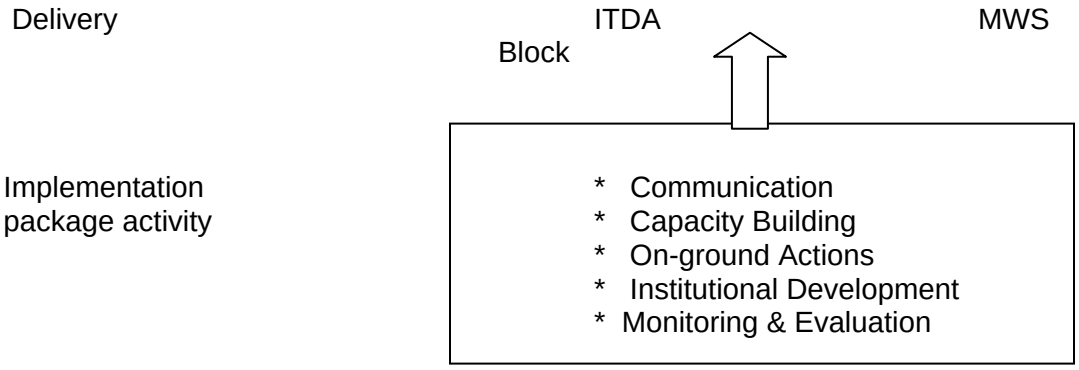
7.3 Capacity Building as a Key Investment for Broader Sustainable Livelihoods System

The problems associated with NRM and livelihoods of tribals are extremely complex and observed on a broad spatial and temporal scale. Trade- offs between efficient and alternate land use and users and alternate livelihoods at MWS are difficult due to such problems. Individuals within the community (farmers, user groups, SHGs, CIGs) and secondary stakeholders (FNGOs, WDT, VDC) of the programme require the skills and knowledge to respond to new challenges, opportunities and to adopt an integrated approach in the quest of long-term solutions to make the livelihoods system productive and sustainable. Investments required for sustainable livelihoods enhancement along with conservation of natural resources and formation of assets justifies enhancing the capacity of stakeholders to be actively involved at all stages of programme implementation so that ultimately the primary stakeholders will be self - reliant following capacity building processes. The capacity building frame work is illustrated in Fig. 7.1

Fig. 7.1 Conceptual model for support and interventions for sustainable livelihoods enhancement.



issues and sustainable livelihood systems and their role in contributing to livelihood system modifications / problems. Action such as resource management to make the livelihood system economically viable, socially acceptable and environmentally sustainable.



7.4 Guiding Principles

The guiding principles for capacity building of stakeholders should :

* ensure that the key stakeholders (primary and secondary) and priority issues are targeted to meet the priority livelihood system outcomes of the MWS;
* encourage partnership between stakeholders;
* value and build on existing capacity involving local expertise and indigenous knowledge;
* rely on learning from each other through sharing resources, experience and expertise;
* work on principles of mutual trust, as well as reciprocity and norms of action;
* encompass 'learning by doing' and other appropriate learning styles;
* be accessible to the entire community including landless and vulnerable.
* should be based on access to appropriate, scientific and implementable information; and
* contribute to building **human and social capital**

7.5 The goal and expected Strategic Activity Areas of CB Frame work

Goal	Key areas	Potential areas of activity
Informed and improved decision making and implementation of the decisions with optimum use of Natural Resources for sustainable livelihoods	1. Awareness : Farmers and landless within the MWS being aware of livelihoods system and NRM issues, and understanding the link between these issues and the long-term viability.	Awareness raising activities through community based organizations (CBOs) and local events. Formal advertising through wall painting and distribution of hand outs will not be very helpful as most of the tribals and illiterate. Rather pictorial material, may help creating awareness.

enhancement		
	2. Information and knowledge : Farmers & landless are able and willing to access the necessary information, technology etc. to make sound decisions on livelihoods enhancement with various planning options to make it sustainable	* Identification of bio-physical, social and economic issues responsible for yield and technological gap in farming system; * Developing mechanisms for Identifying, validity and making use of traditional knowledge. * Developing new approaches to extension and adoption of such ITKs. * Packaging information to make it accessible to users; and * Collection of baseline data for setting workable targets, monitoring and evaluation.
	3. Skills and training : Farmers are equipped with or having access to the necessary technical and management skills to carry on new innovations, new experiences or adopt sound management practices on sustainable NRM & livelihood enhancement.	* Development of tools for identification of skills and knowledge gaps by skill mapping; * Development of new and modification of existing training materials and * Strategic delivery of trainings based on identified skills and knowledge gaps and strategic partnership with NGOs, Resource Centres and Krushi Vigyan Kendra
	4. Exposure visits : Farmers and landless within MWS are convinced about new innovations, new experiences, or new technologies adopted elsewhere for livelihoods enhancement in sustainable manner.	* Identification of critical gaps in technology adoption to make the livelihood system productive & sustainable; * Identification of areas within the district / state / or outside the district / state where initiatives have been successful to reduce / abridge the gap; * Sharing of experiences between the users of technology
	5. Facilitations & support : Support system in place to ensure the engagement and motivation of the	* Provision of technical support to WDTs / VDCs in developing integrated NRM and livelihoods plan at MWS

	community, build social capital and human capital and enable skilled NRM and livelihoods options / strategy to exercise ownership over decision making process and effectively implement actions arising from these process.	level and develop VDLP accordingly. * Leadership development programme within the community regarding livelihoods production system options & NRM. * Community motivation initiatives such as recognition of accomplishment and information sharing ; * Establishing linkage with development departments like Agriculture, Horticulture, Soil Conservation, Forestry, FARD & PR to enhance the support for poverty eradication, production enhancement & asset creation.

7.6 Participants in Capacity Building Programme

The principal participants in the CB initiatives are :

- Primary stakeholders like user groups, common interest groups, SHGs & farmers within MWS.
- Secondary stakeholders like VDC, FNGO, WDT, Volunteers, ITDA personnel, extension personnel of line departments.
- Experts of PSU at state level.

7.7 Critical Areas for Trainings

With a view to bringing desirable change in attitude, knowledge & skill of the key stakeholders, the critical areas of training are indicated below.

S.N	Name of the Stakeholders	Areas of training
i.	Primary stakeholders (Farmers, User Groups, CIGs, SHGs)	• Participatory watershed development • Crop production technology and input management. • Rainfed farming technologies. • Seed production, preservation and production of planting materials. • Land & water management technologies • Post - harvest management and Agro-processing. • Allied agricultural activities like mushroom & bee keeping. • Livestock production technology on dairy, poultry, goatery / sheepery & piggery • Food & Nutrition security • Collective buying, storage & marketing.

		• Alternate land use system • Sloping Agriculture Land Technology (SALT). • Coping strategy against weather aberrations • Organic farming • Management and Common Property Resources • Cultivation of Medical & Aromatic plant • Improvement on shifting cultivation • Fodder cultivation • Book keeping & record maintenance.
ii.	Primary stakeholders (Landless & vulnerable)	• Livestock production • Community Aquaculture • Collection & processing of NTFP • Value addition to NTFP • Allied agril. Enterprises like apiary & mushroom cultivation • Income generating activities (Village crafts, agro-processing, vending, collective buying and marketing etc.) • Management of common property resources
iii.	Para professional, VVVs, VVs, etc.	• Crop production technology • Input management. • Seed production and storage • Village level micro-planting • Farm mechanisms • Cropping system and farming systems • Natural Resources Management • Methodology for conducting demonstration and field trials • Leadership development and group management • Livestock production system • Animal Health , Nutrition and Sanitation • Post harvest management • Business plan development • Book keeping and record maintenance • Group mobilization and community empowerment.
iv.	WDTs	• Watershed Development • Micro-planning • Stakeholder Analysis • Livelihood Analysis • Community mobilization • Land classification and land use • Engineering Design and Estimations for land and water management. • Participatory monitoring & evaluation • Water budgeting and water use planning • Training Management and Design of

		Training • Gender Sensitization • Participatory variety selection and participatory plant breeding • Integrated Nutrient & Pest Management • Organic farming & sustainable Agriculture • Dry land crop production technology • Livestock production • Aquaculture • Micro-credit supported micro-enterprises
v.	FNGOs / Extension Officer of Line Department	• Training Management • Micro – planning development • Participatory Natural Resource Management • Participatory watershed management • Land rights & entitlements • Convergence of ongoing schemes • Participatory Monitoring & Evaluation • Participatory Forest Management
vi.	Experts of PSU / ITDA	• Participatory Natural Resources Management • Participatory Forest Management • Participatory variety selection and participatory plant breeding • Participatory Technology Development • Convergence of ongoing schemes

7.8 Training Courses

Subject	Title	Course outline
NRM	Watershed Awareness	• Watershed Development Concept & Necessity • Participation in watershed development • Involvement of women and landless in watershed development • Problems and solutions in watershed development • Involvement of villagers, VDC, local agency, Govt. functionaries in watershed development • Livelihoods issues in watershed development
	Soil Survey and Classification	• Soil genesis and its development • Soil profile study • Physical characteristics of soil and its classification • Chemical characteristics of soil • Classification of soil on the basis of physical & chemical characteristics • Soil survey and land capability classification • Water holding capacity of soil • Soil testing and method of soil sampling
	Land Treatment	• Soil erosion and its impact • Types of land treatment • Gully plugging and trenching - Bunding techniques

		- Terracing - Vegetative barrier - Vegetative outlets and water course • Farm ponds and diversion drains • Biological methods of soil and water conservation • Problems in development work and people's participation
	Drainage Line Treatment	• Scanning for water conservation • Run-off and water balance study • Requirement of water for agriculture, drinking water and for other purposes • Various types of treatments - Brush wood check dam - Live check dam - Loose boulder structure - Earthen structure - Gabion structures - Masonry check dams • Structural designs of various structures
	Natural Resource Management	• Key issues of NRM • Conservation measures for hill slopes - Contour trenching - Bench terracing - Stone terracing - Plantation - Stump management • Conservation measures of agricultural land - Biological method - Contour cultivation - Strip cropping - Cropping system and rotation - Engineering measures - Contour and graded bunds - Surplus weirs - Grassed water ways - Bed and furrow system - Diversion drains • Rain Water Management - Water harvesting structures - Farm ponds - *In situ* rain water conservation - Check dams - Percolation tank
	Participatory Watershed Development	• Concept of watershed • Features of watershed • Delineation of watershed • Objectives of watershed development • Participation • Approach to participatory watershed development • Activities in watershed development • Watershed resource inventory • Watershed treatment • Watershed plus activities.

	Rainwater Harvesting	• Why rainwater harvesting? • Rain water harvesting technique - Check dams - Percolation tanks - Cement plugs - Subsurface dykes - Deep wells - Farm ponds • Water harvesting structures • Maintenance of water harvesting structures
	An alternate method of moisture and soil conservation on uplands	• Causes of moisture stress on upland • Basic techniques of in situ moisture conservation • Compartmental bunding • Collection pits • Mulching
	Establishment and Management of Nursery	• Importance of nursery for horticultural crops and forestry • Introducing garden implements, planting media and structures • Plant propagation by seed • Plant propagation by vegetative methods • Preparation technique • Maintenance of plants / grafts in nursery • Marketing of planting materials
	Training on PFM	• Micro-planning • Forest management - Ecological succession in forests - Impact of supply of timber and non- timber forest products - Forest regeneration • Local ecological services - Indigenous knowledge about forest species - Productivity of forest fringe farms - Forest growth and yield measurements • Accounting and book keeping
	Training on SALT	• Adverse effects of shifting cultivation • Ten steps SALT -Preparing the 'A' frame and its use -Locating contour liens -Preparation of contour lines -Planting seeds of nitrogen fixing trees -Cultivation of alternative strips -Planting permanent crops -Trimming of nitrogen fixing trees -Practicing crop rotation -Building green terrace • Good qualities of SALT
	Agro-forestry for sustainable farming (SALT -3)	• Importance of Agro-forestry • Production of seedlings for agro-forestry • Care & maintenance of seedlings • Land preparation for plantation • Division of land for plantation

		• Planting of seedlings • Inter cropping and multi-tier cropping • Maintenance of forest plants / trees • Periodic harvesting from Agro-Forestry
Agriculture & Horticulture development	Crop planning	• Concept of sustainable agriculture • Importance of soil survey in agriculture • Climatic analysis • Factors affecting selection of crops • Crop water requirement • Crop rotation • Recommended cropping pattern • Involvement of community in crop planning
	Land use planning	• Need and importance of land use planning • Land use capability classification • Existing land use pattern (a) Culturable land - Rainfed Agriculture - Perennial crops - Seasonal crops (b) Culturable waste lands (c) Waste lands (d) Community lands • Agriculture - Dry land agriculture - Irrigated agriculture - Crop selection - Crop water requirement • Dry land Horticulture -Management of dry land horticulture trees -Special methods of planting, watering system -Nutrient management -special measures like pruning, mulching, watering and weeding
	Rainfed Farming system	• Weather and climatic factors for planning dry land agriculture • Soil & water conservation including rain water management and water conservation and crop improvement. • Alternate land use system • Crop management practices • Dry land cropping systems • Integrated nutrient and pest management • Contingent planning and mid-season correction
	Non-Arable Cropping Systems	• Agro-forestry • Social forestry • Nursery practices and planting methodology • Pasture development • Management of wastelands • Dry land horticulture
	Production Technology of	• Dry land farming - Importance of dry land crops

	Dry land crops	- Amount and distribution of rainfall and variation in monsoon. - Production constraints in dry lands - Thrust areas for improving crop production • Cultivation practices for dry land crops - Millets - Pulses - Oilseeds (Seeding, weeding, interculture, nutrient & pest management) • Intercropping and mixed cropping
	Organic farming	(a) Composting and green manuring - Compost making - Nutrient value of composts - Green manuring practices (b) Vermi-culture and vermi-compost - Role of vermi-technology - Different types of earth worms and composting technique - Effective vermi-composting - Establishment of vermi-compost units - Use of vermi-compost and vermi-wash (c) Bio-Inoculants - Bio fertilizers - Methods of application (d) Integrated Nutrient Management - Role of organic manure - Various options
	Integrated Pest Management (IPM	• Principles and concepts • Cultural methods • Physical and mechanical method • Biological method of pest / disease control • Botanical pesticides • Safety insecticide use
	Seed production	• Quality of good seed and types of seeds • Seed certification and testing • Seed technology on production • Seed processing and marketing
	Maintenance and use of Agricultural Implements	• Role of farm implements in improving the agricultural operations • Different implements for tillage, sowing, inter culture and harvesting and their maintenance. • Post harvesting implements (threshers, winnowers, driers etc.) and their use. • Use of woman-friendly implements to reduce drudgery.
	Horticultural Development	(a) Orchards and vegetables - Orchard layout and planning for mango, guava, sapota, pomegranate, lime (Propagation, planting, manurial,

		fertilization, irrigation , crop protection, harvest) - Vegetable cultivation and improvement. Nursery, planting, fertilization, irrigation and harvesting of tomato, bhendi, bean, brinjal etc. - Floriculture and its importance - Post harvest technology. Processing & preservation of fruits and vegetables - Medical & aromatic plants. Cultivation techniques & post harvest management (b) Mushroom cultivation - Improvement of mushrooms - Nutritive value - Cultivation methods - Marketing
	Bee keeping	• Roles and functions of honey bee • Honey bee management • Source and use of honey • Equipment for honey bee keeping • Methodology for honey bee rearing • Harvesting and processing
	Fruits and vegetable preservation	• Factors for spoilage of fruits and vegetables • Preparation of pickles • Preparation of squash • Preparation of jam and jelly • Preparation of sauce and ketchup • Preservation of products
Livestock production & aquaculture	Training on Animal Husbandry	• Importance of breed improvement and role of artificial insemination • Maintenance of milch animals for higher milk yield. • Management of dairy animals (cows, she-buffaloes). • Different breeds of sheep, goat, their rearing and maintenance • Diseases of sheep & goat and their management • Deworming & vaccination of animals.
	Backyard poultry	• Improved breeds for back yard poultry (Banaraj etc.) • Feeding schedule of poultry birds • Housing & sanitation of poultry units Disease of poultry birds and their management
	Improved goatery	• Improved breed • Housing and sanitation • Disease management • Nutrition
Livelihoods strategy	Development of livelihoods under watershed projects	• Livelihoods development under watersheds. An overview of strategies and approaches • Agriculture and livestock based livelihoods • Non-land based livelihood opportunities and enterprises • Methodology for preparation of action plan for

		livelihoods development • Community organization and institutional aspects for livelihoods development • Linkage for promotion of livelihoods • Capacity building of community organization • Planning for follow-up actions.
	Developing Livelihoods Strategy	• What is livelihood • Characteristics of rural livelihood • Conservation – oriented livelihood • Equity, benefit sharing and sustainability • Livelihood processes and strategies • Livelihood outcomes • Alternate livelihood option
	Non-farming systems in watersheds	• Integrated farming systems - Integrated livestock management - Sericulture - Non-conventional energy sources • Food production at watershed level - Product processing -Agro-based enterprises

7.9 Guidelines for Training

The training course module should be simple , specific, well defined, measurable and achievement within the available time and resource and must be based on the needs of the participants. Once the course objectives are clearly defined, it will give a direction to the training organizer and keep him on track to achieve it.

The training need assessment should be the basis for planning and implementation of training. The needs of the functionaries / stakeholders is required to be assessed based on their job / role and the performance level in the actual field conditions. The individual need can be assessed on the first day of training after in-depth discussion with the participants. The content of the course should be decided keeping in view the training objectives. The relevance of the selected content may also be discussed with the participants before the actual implementation and suitability modified, if needed .Keeping in view the available time and resources, the course content should be formulated and prioritized on essential, desirable and possible basis. Each days programme should be divided into modules of similar nature and relevant to each other to maintain the continuity of the subject matter and keep on track the concentration of the efforts. The ratio of theory and practical sessions including skill teaching should be at the ratio of 30 : 70. In each session emphasis should be given on the relevant skills, which should be practiced by the trainees themselves under the supervision and guidance of the trainers.

7.10 Methodology

The training should be participatory and use different methods basing on the principle of adult learning. Session should be handled by key point and use of relevant teaching material for actual involvement and better interaction. The participants should be demonstrated different skills and be given sufficient exercises to acquire skills. Study tours and field trips within or outside the campus may also be organised in accordance with the duration of course which are of actual practical utility. The participatory approach, group dynamics, brain storming techniques etc. can be useful for making the participants active.

7.11 Evaluation

To assess effectiveness of the programme by identifying the strong and weak points of the programmes for which schedule questionnaires may be developed. The session-wise assessment of trainees and the programme will help in moving on the track. In addition, pre and post training evaluation should also be done for documenting the reactions of the participants.

7.12 Areas of Training

In the context of goal and objectives of OTELP various training would fall on the following categories

i. NRM & farming system
ii. Livelihood enhancement
iii. Management of community based organization
iv. Participatory planning and management process
v. Health and nutrition
vi. Civil entitlements and rights

The trainings could be of immediate priority (within six months) and medium - term priority (within 2 years). Various training courses required for livelihoods enhancement are suggested along with possible course contents.

7.13 Training Budget

Various institutions have their own cost structure for institutional trainings. However, for district level trainings and field level trainings of different duration indicative cost structures have been proposed in Table 7.1

Table 7.1 Tentative cost of training

Training site	Duration	No. of Participants	Item of Expenditure	Exp. Per head per day	No. of units	Budget in Rs.
District level	2	30	Food (BF + Lunch + Dinner)	125	60	7500
			Training materials	50	30	1500
			Accommodation	75	60	4500
			Travel expenses	80	30	2400
			Hiring of training hall	500	2	1000
			Resource person fees (including transportation)	500	6	3000
			Contingency & Misc.	300	2	600
			Total			20,500
District level	1	30	Food	125	30	3750
			Training materials	50	30	1500
			Accommodation	75	30	2250
			Travel expenses	80	30	2400
			Hiring of training hall	500	1	500
			Resource persons fees (including transportation)	500	3	1500
			Contingency & Misc.	300	1	300
			Total			12,200
Block level / G.P. level	2	30	Food	80	60	4800
			Training materials	25	30	750
			Accommodation of participants	50	60	3000
			Travel expenses	40	30	1200
			Hiring of training hall	300	2	600
			Resource persons fees	500	4	2000
			Contingency & Misc.	300	2	600
			Total			12,950
Block /	1	30	Food	80	30	2400

G.P. level			Training materials	25	30	750
			Accommodation of participants	50	30	1500
			Travel expenses	40	30	1200
			Hiring of training hall	300	1	300
			Resource persons fees	500	2	1000
			Contingency & Misc.	300	1	300
			Total			7450
Village level	1	30	Food	50	30	1500
			Training materials	20	30	600
			Resource person fees	500	2	1000
			Contingency & Misc.	200	1	200
			Total			3300
Village level	½	30	Snacks	10	30	300
			Training materials	10	30	300
			Resource person fees	300	1	300
			Contingency	200	1	200
			Total			**1100**

Chapter 8. Operational and Technical Manual

Keeping in view the cost norms and the programme cycle the broad technical manual for livelihoods enhancement has been developed.

8.1 Livelihoods Enhancement

The sub-components are land and water management, agriculture and horticulture development livestock and aquaculture production and rural financials service under NRM and livelihoods support component. Community infrastructure fund, participatory forest management and development initiation fund are sub-components of Additional Component under OTELP. On an average Rs. 43.90 lakh is being invested for NRM and livelihood support while Rs. 16.60 lakh would be invested on Additional Component in one MWS. All the activities taken up under these sub-components are intended to strengthen the NRM and promote sustainable livelihoods of tribals including poor, vulnerable and woman.

8.2 Capacity Building

After organisation of CBOs in the probation phase capacity building of (i) administrators and manages, (ii) implementers and (iii) trainers are to be completed before preparation of village Development Livelihoods Plan (VDLP). The capacity building needs during the implementing phase have been indicated separately which would be implemented after developing a CB calendar by the FNGOs.

8.3 Planning Exercise

The base line survey and participatory micro-planning will make use of thematic maps, secondary information and PRA/RRA tools. Before starting the planning exercise, the community is to be oriented properly about (i) main features of the learning process as well tentative schedule to be followed during action plan preparation ,and (ii) roles and responsibilities to be assumed by outsiders as well as insiders etc. Each household in a village will be required to devote about 60-80 hours time within a span of about 50 days to facilitate intensive discussion. Towards the end of the micro-plan exercise, the community will pass a resolution for Palli Sabha to accept the plan document.

The participatory planning process will involve 14 steps.

8.3.1 Collection & Analysis of Secondary data

The data collected from secondary sources should be analysed before starting the primary data collection through PRA exercise. This would facilitate triangulation. The secondary data may include land records as per ROR, revenue maps of the village and other relevant statistics about the community and their livelihoods. The revenue map obtained from the Tahasildar with land records will be utilized to capture information on ownership, land kisam and land use particulars. The demographic data of the village and existing status of agriculture, horticulture, livestock, fisheries and other livelihoods will be collected from secondary sources.

8.3.2 Reconnaissance survey

After collection of secondary data in 10-15 days, reconnaissance survey of micro-watershed may be carried out in 2-3 days to have comprehensive understanding of the field situations with regard to identifying needs and priorities under land and water management as per ridge to valley concept

8.3.3 Rapport building with the community

Rapport building with the community may be achieved through a series of visits and night halts to discuss with the community in small groups to explain them the objective of OTELP and identify the urgent need of the community relating to health, nutrition, food security etc.

8.3.4 Orientation of community about land record

A land literacy campaign may be organised to make them aware of land settlement and land rights. The community may be thoroughly oriented about existing land records as per ROR and their kissam for understanding about the land ownership and land problems including indebtedness.

8.3.5 Participatory exercise and household survey

The thematic information including demography, health, education, poverty and vulnerability, food security, land rights, natural resource base, agricultural and livestock production system etc. are collected to form the base line situation of the village and household. Identification of issues / problems with possible solution could be made at the stage.

8.3.6 Participatory exercise and area-wise survey

The participatory exercise identifies area-wise specific problems and farmers preferred solutions. The design and plans are worked out based on the data collected in this exercise. The community will be oriented about the scope of development interventions like drainage line treatment, development of water resources by user groups, participatory forest management, soil water conservation measures etc.

8.3.7 Preparation of design and estimates for common initiatives

Once the common works are decided by the community like irrigation structures, common land development etc. the designs and estimates are prepared along with the community members and shared in the meetings.

8.3.8 Village level approval for the base plan

After completion of the participatory planning exercise, the entire plan would be reviewed by the community and the plan document would be placed for approval.

8.3.9 Compiling the data base

The household and area wise data base generated in the exercises are compiled into formats and computerized, including maps.

8.3.10 Converting the action points into plans and estimates

The action points which need external budgets are considered and designs , plans and estimates are prepared by the technical team members.

8.3.11 Compilation of watershed level plan, estimate and budgets.

The technical team also compiles the database across all villages in the watershed to generate a watershed level picture.

8.3.12 Formation of VDC

While the plans are prepared simultaneously the responsibilities are fixed with individuals . The village level sub-committee (VLSC) and Village Development Committee (VDC) are formed for different purpose.

8.2.13 Ranking and prioritizing plan elements and budgets

The prioritization of plan elements and budgets along with norms for implementation like contribution of the community, source of funding and modes of implementation are discussed and finalised in the exercise.

8.2.14 Preparation of final plan document

The facilitating team would finalize the watershed action plan based on the above exercise on order to complete the micro-plan.

8.4 Strategy for Capital Formation

Four capitals viz. social capital, human capital, physical capital, natural capital and financial capital are important in the livelihoods context. The following interventions are required for capital formation in the Programme area (Table 8.1).

Table 8.1 Programme Intervention for Capital Formation

Asset/Capital	Objective	Intervention	Outcome/impact
1. Social Capital	More supportive social environment	• Rapport building & realization of existing capital • Group formation & strengthening • Facilitation for collective action/group effort • Gender sensitization	• Groups formed & institutionalized • Work plan for village developed • Participation of deprived men & women in decision making • Women empowered
2. Human Capital	Awareness, skill and capacity building & transfer of technology for sustainable livelihoods	• Capacity building on different components • Identification of VAV, VVV and their capacity building • Need based training and scaling up of activities and its diversification	• Introduction & adoption of community link worker system • Dissemination of processes and approaches • Increase in technical know-how • More communication
3. Financial Capital	Access to financial resources	• Facilitation of small saving in group funds • Group fund development & its management • Linkage with financial institutions & government programmes	• Rise in thrift habit • Group fund generated • Improved security to the deprived • Credit availed
4. Natural	Access to and better	• Farm and non-farm	• Increase in area

capital	management of Natural Resources	activities undertaken based on NRs • Management of CPRs • Introduction of technology for its adoption to improve agricultural service	under cropping and forest • Diversification of farm and non-farm based activities and their scaling up
5. Physical Capital	Access to facilities and infrastructure	• Introduction of improved tools as per requirement • Creation of infrastructure as per need of the community • Linking the groups with government programmes for improved infrastructure	• Increased irrigation facilities & drinking water facilities • Improved housing condition of the deprived community in the villages

8.5 Operational Guidelines and Technological Options for NRM

8.5.1 Land resource development

The land Kisams as classified by the tribal communities are *Danger, Aat, Berna* and *Bahal* . Most of the Patta lands belong to *Bahal, Berna* and *Aat* categories t, while *Danger* and forest lands are mostly encroached or under possession of forest department. The characteristics of each of these land types and technological options for their development are described in Table 8.2

Table 8.2 Technological Options for Different Land Types

Sl. No.	Land type	Distinct features	Technological options for development
1	*Dangar* land (Hill slopes)	* Situated above Aat land with slopes higher than 30% * Podu cultivation is invariably taken on these lands * Soil depth is within 0.3 m and covered with stones, pebbles with high erosion	* Safe disposal of run-off water * Stone embankments to arrest erosion and wild fire * Bench terracing on steep slopes * Land slide control by vegetative means * Contour trenching and continuous contour trenching (CCT) * Adoption of Sloping Agriculture Land Technology (SALT)
2.	*Aat* land (Upland)	* Situated above Berna land having 5-25% slope, unleveled.	* Raising the height of existing bund * Compartmental bunding

		* Soil depth is up to 0.30 m and rainfed cereals, pulses and oilseeds along with rainy vegetables are usually cultivated. * Soil erosion and nutrient loss possessions problems.	* Land leveling for facilitating irrigation * Grassed water ways * Contour bunds and graded bunds * Gully control * Diversion drains * Vegetative barrier * Broad bed and furrow system
3	*Berna* land (Medium land)	* Situated above Bahal (low land) with mild slope * Under levelled and irrigation situation two crops are assured * Paddy with short & medium duration are usually cultivated * Erosion takes place due to over flow of runoff water from near by areas	* Raising the height of existing bunds * Development of drainage course * Land levelling * Provision of spill ways at the lower side of the field for safe disposal of excess water.
4	*Baha*l land (Low land)	* Developed from stream bed where water flows regularly. *Jholla* land comes under this category. * Due to retention nature of soil moisture and continuous flow, two crops of paddy are usually taken	* Drainage development * Repair of breached bunds * Stone packing of bunds * Removal of sand cast * Provision of spillways * Cutoff wall at lower side to check sub-surface flow of water

The land treatment options on forest and common pool land shall have to include continuous contour trench, bench terracing, gully plugging, bunding, vegetative barrier, diversion weirs and mixed plantation etc. Stream bank erosion should be controlled by planting trees and drainage line treatment.

Soil conservation: Some Do's and Don'ts

* Vegetation is the best moderator in soil conservation
* Do not worry for soil conservation if the slope is less than 2% in light soil and 1% in heavy soils.
* The contour bunds along with waste weirs are for low rainfall (less than 600 mm) regions and in light soils, the graded bunds are for the other rainfall zones and in less permeable soils.
* Periodic maintenance of the bunds has to be done. Vegetating the bunds with fodder legumes/ grasses is one important way of protecting the bunds and also compensating the loss of about 6% land occupied by the bunds.
* If contour / graded bunding is not acceptable to the farmer, strengthen the boundary bund across the slope with the above said vegetative means and provide a waste weir at the lower point .
* Grassing the waterway and gully plugging should be an integral part in the watershed development.

8.5.2 Rain water harvesting and water resource development

Rain water harvesting and water resource development is required to provide assured drinking water for human being and livestock to meet the domestic need and for the purpose of irrigation. Most of the WHSs have been silted due to want of catchments treatment. It has been imperative to focus on indigenous water harvesting structures like farm ponds, soak pits, *in situ* rain water harvesting systems, ground water recharge by check dams, gully plugging, percolation tank, sunken pond, stop dam, brush wood check dams, gabion structures, subsurface barriers using indigenous materials with adequate measures for the sustainability.

Some Do's and Don'ts in water Harvesting

* Encourage traditional system of water harvesting.
* Do not go for big structures in case of check dam and the like
* Small cheaper and manageable structures are desirable as those benefit poor people and are to be constructed in the upper reaches where these people cultivate .
* Sustainable exploitation of ground water may be explored and have social budgeting.
* Do not go for high water demanding crops like rice, sugarcane and wheat.
* The catchments of the water bodies MUST be protected with proper vegetation.

8.5.3 *In situ* Rainwater Harvesting

All efforts need to be made to enhance the rainwater entry into the soil so that the soil profile is adequately charged with moisture. Entry of rain water into the soil is through the surface. So the surface soil condition should be conducive for rain water entry into the soil. It is best achieved by providing vegetative/ mechanical barriers at set intervals so that water is retained on the surface for its entry onto the soil. The other option is to provide more opportunity for the rainwater for its entry into the soil. Any form of contour farming does this job. Even deep ploughing or opening of the surface by blading allows more rain water entry into the soil. Off-season tillage, ploughing across the gradient and mulching etc. would enhance the entry of rainwater into soil.

8.5.4 Forest Development

Recognising the fact that forest development is very important for livelihood enhancement of tribals and vulnerable people, Govt. of Orissa has clarified that existing JFM approach would be adopted under OTELP. The revenue forests like

Jangal, Patra Jangal, Bada Jangal, Gram Jangal etc are also to be protected. The activities decided to be taken up in association with Forest and Environment department for participatory forest management have been indicated in the process guidelines of OTELP. In addition to strengthening of VSS a JFM a micro-plan for the treatment of identified forest area will be prepared by the VSS members and the Range Officer, which would be approved as per JFM Resolution of the State Government.

The approved micro-plan will be executed by the VSS members and the forest department will provide necessary technical guidance. Out of 200 ha of available forest area, about 80 ha will be effectively treated @ Rs. 7000/ha as per existing cost norm of F & E Department for rehabilitation of degraded forests and balance 120 ha will be protected for natural regeneration. For treatment of 80 ha, the micro-plan should be so prepared as to take up new plantation, soil and moisture conservation measures and protection through social fencing including provision of wages to watchmen. The usufruct right in favour of different stakeholder should be guaranteed as per JFM guidelines.

8.6. Sustainable Development of Livelihoods

In the context of watershed development the livelihoods of tribals the livelihoods can be grouped under three broad categories.

i. Land based livelihoods: Arable cropping and non-arable farming systems including collection and marketing of NTFP/MFPs.
ii. Livestock and Aquaculture: Goatery Sheepery, Piggery, Dairy, Poultry, Fishery.
iii. Micro-enterprises including allied agriculture: Non-farming systems, apiary, mushroom, sericulture, income generating activities, agro-processing etc.

8.6.1.1 Land based livelihoods

Arable cropping

Arable cropping system is required to focus on improved rainfed farming system and development of irrigation. The improved agronomic measures with non-monetary system has been indicated in Annexure 2.

The practices like proper tillage, early sowing, correct choice of crops and varieties, optimum plant population and weed and pest management through cultural practices are stressed in non-monetary system of rainfed farming. Under high cost inputs, fertilizer use, organic recycling use of agricultural implements, integrated nutrients management, integrated pest management, use of herbicides etc are appropriate packages. The improved technologies have to be demonstrated in form of field demonstration and field trials which have already been explained under agriculture and horticulture development strategy. Some do's and don'ts on rain fed farming are explained in Box.

Do's and Don'ts in Rain fed Farming

* Prepare seed bed for timely sowing to escape weather bound pests.
* Use seed cum fertilizer drill or seed drill for precise placement of seed in moist zone. In absence of seed drill use plough sole for the purpose.
* If there is not much time for sowing widen the seed rows, but maintain the same population. For instance the sorghum rows would be widened from 45-75 cm.
* Never broadcast seed or fertilizer.
* Placement of fertilizer pays
* Keep the crop weed free at least up to 4-7 weeks depending on the duration of the crop (One week / month of duration).
* Introduce a legume crop in the cropping system
* Do not go for blanket dose of various fertilizer / nutrients. Be need

8.6.1.2 Some of the tribal farmers have taken up rice cropping in uplands which are prone to severe moisture stress and drought. There is a need to diversify the cropping system by taking maize, ragi, millets, black gram, green gram, cow pea and pigeon pea in such lands.

Intercropping is an assured cropping system under dry land situations. Yield advantage up to 50% has been recorded in Orissa by intercropping system. Such intercropping could be pigeon pea based, maize based or rice based in the following crop geometry.

Pigeon pea + green gram/black gram	2:3
Pigeon pea + ragi	2:4
Pigeon pea+ groundnut	2:6
Maize+ cow pea	2:2
Maize + pigeon pea	2:2
Rice+ green gram/ black gram	4:1

The seeds should be sown with the onset of monsoon or just before the monsoon in lines using a seed drill or behind the plough sole. Organic manure in form of FYM or well decomposed compost should be applied before the sowing in appropriate quantity. Wherever possible a moderate dose of balanced fertilizer application should be ensured to boost the crop yield. Fertilizer schedule for some important field crops is indicated in Table 8.3.

Table 8.3 Fertiliser Requirement of Dry Land Crops

Crop	Fertilizer quantity (in nutrient) in kg/ha		
	N_2	P_2O_5	K_2O
Rice	40	20	20
Ragi	40	25	20
Maize	80	40	40
Green/Black gram	20	40	40
Pigeon pea	20	40	40
Groundnut	20	40	40
Sesame	30	20	20

Toria	30	20	20
Niger	10	20	-
Turmeric	60	30	90
Ginger	125	100	100
Yam	80	60	80

8.6.1.3 Non - arable farming

Non-arable farming systems comprise agro-forestry systems, social forestry, pasture development, dry land horticulture and farming on wasteland etc. Alternate land use is the basic principle in such farming system. The research experience of the Central Research Institute for Dry land Agriculture (CRIDA) are quite useful for stabilizing production in dry lands. Dry land horticulture with water harvesting in situ, Alley farming, ley farming, silviculture , tree farming and sustainable development of wasteland through afforestation are various options under Non-arable farming systems. Along with selection of appropriate tree /horticulture species by the community, nursery raising ,adopting better planting techniques and soil and moisture conservation practices like contour bunding, staggered trenches, 'V' ditch, construction of farm ponds, gully plugging, continuous ridges and furrows along the contours in sloppy lands and pitcher irrigation are various technological options.

Management of the common and social waste lands

* Arrange land lease of such lands to the user groups (preferably women and landless)
* Dispense with the powerful local leadership.
- Develop action plan through discussion among the users.
* Sub divide the area into smaller units so that smaller groups of persons can effectively treat such lands with suitable multipurpose trees or fruit trees.
* Provide incentives to the individuals /small groups who do good work.
* See all the user groups get access to the gains.
* in case of silvipasture system social fencing need be adopted in a staggered way.
* Introduce new grasses / fodder legume and trees for top feed to enrich these silvi pasture system.
* All these efforts decrease the beating action of rain that leads to soil erosion.
* It also helps in the recharge of ground water as the rain water moves into soil than running away.

8.6.1.4 Agro-forestry systems like Agri-silviculture system (tree+ crop), silvipastural system (tree+pasture), Agri-silvi-pastoral system (tree+ crop+ pasture/animal) and trees with other enterprises are found to be very suitable in non-arable areas. Different species recommended for such systems and their economics are detailed in Table 8.4.

Table 8.4 Different Non-Arable Farming Systems

Name of system	Name of crops/tree species	Economics

Agri-silviculture	*Acacia mangium, Acacia auriculiformis*, babul, subabul, Eucalyptus, Teak, Gambhar etc are planted on farm boundary/field bund @ 100-133 per ha at 2-3 m spacing	Rs 5000-6500 per ha at 5-7 years from fuel wood
	In alley cropping crops are grown between trees or hedges. Number of trees should be maintained at 250-300 per ha and row spacing would be 8,10,12 m and field crops are grown in alleys	Rs 30,000 from 300 timber trees per ha after 5-6 years and Rs 3,00,000 /ha after 12 years
Silvi-pastoral system	Subabul, babul, siris, kanchan, agasti etc maintained @ 400-500 trees/ ha. Grasses are anjan, stylo, guinea and hybrid napier grown between tree rows	Annual grass yield is 25-40 tons/ha in Kharif season under rainfed and 100 tons/ha under irrigated condition
Energy and pulpwood plantation	*Acacia auriculiformis*, Eucalyptus, Casuarina, Subabul and *Cassia siamea* are planted @ 2000-2600 plants/ ha at 2mx2m spacing	Rs. 15000-20000/ ha or Rs 1.00 lakh after felling per ha.

8.6.1.5 Shifting cultivation

Attempts should be made to increase the Podu cycle for natural regeneration of forest cover. Cultivation of annual crops maybe limited to lower slopes or nearly flat lands while hill slopes maybe covered by tree, timber and horticultural species. There is need to motivate the practitioners to build terraces and contour bunds and plant soil binding species to minimize soil erosion. This will be possible if alternate livelihoods and land for settled cultivation are provided to the practitioner. The tribal farmers may also be trained to adopt Sloping Agricultural Land Technology (SALT, SALT 2, SALT 3) on some pilot basis. The variation in these three are given under.

- SALT 1 (Slopping Agricultural Land Technology) adopts 10 steps for integrated cropping system involving tree crops, dry land horticulture, agro-forestry and field cropping.

- SALT - 2 (Simple Agro-Livestock Technology). In this scheme, half of the farm is occupied by the forage garden and the livestock barn. The other half is for 2/3 field crops, which are mostly perennials, and 1/3 contour hedgerows interspersed throughout the farm, very akin to SALT-1.

- SALT - 3 (Sustainable Agro-forest Land Technology). Also popularly called as the "food-wood" integrated system, the upper half of the slope land is for timber crops of short, medium, and long-term harvest periods. The lower half is planted with food crops and woody legumes, following the SALT-1 pattern.

8.6.1.6 NTFP

Scientific forestry may be reoriented to mean wild fruits, nuts, MFPs, grasses, leaves, twigs and other environmental reserves become the main intended products form forest lands and timber a by product. The communities may be motivated to adopt scientific harvesting methods instead of indeterminate falling of trees and wild firing. Simple processing activities, such as, broom making, leaf plate making, tamarind processing, mat and rope making and their simple value addition activities would be encouraged in the household/ cottage sector. Small

scale forest based enterprises would be supported by ensuring a sustainable supply of input materials providing market support to help tribals to get better price for the forest products and secure sustainable livelihoods. The assistance provided under community infrastructure fund and rural finance and capacity building can support these activities. Collective buying and marketing has to form integral part of the intervention also.

8.6.2 Livestock Development and Aquaculture

The approaches like establishment of a village based livestock disease control system, increased availability of fodder under PFM and breed upgradation including purchase of new livestock through revolving fund should be adopted for sector development. The capacity building of the VVV through intensive training and deployment at MWS level to render veterinary services on charge basis would control animal diseases. The existing cold chain should also be improved by providing deep freezers to the LAC as well as thermos flasks for transport to villages.

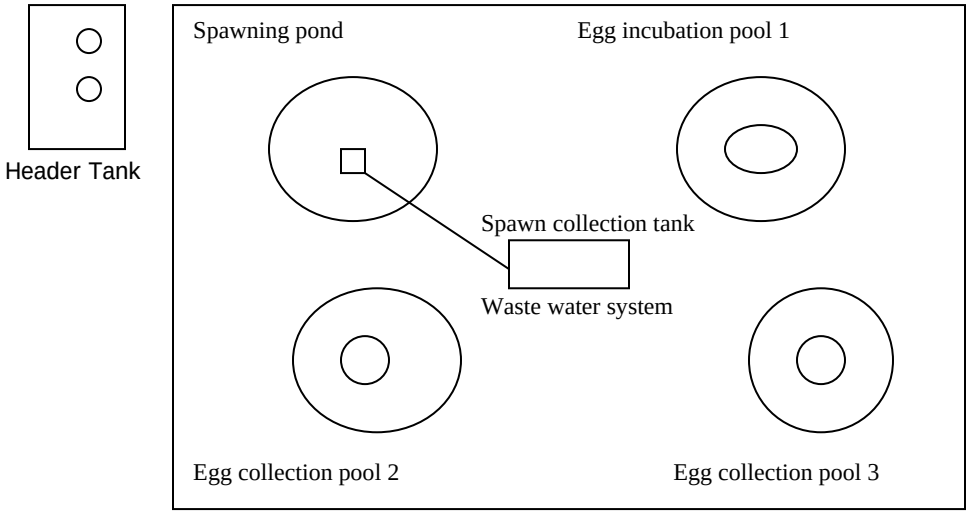
Aquaculture maybe introduced in the created water body after allowing fishing right to women SHGs or landless people. Recognising the difficulties in getting quality fingerlings in time, it is proposed to start modular nursery at the campus of FNGO. One such modular nursery developed by STREAM may be adopted.

Pilot hatchery and modular approach (Fig.8.1)

The objective is to pilot local hatchery production by FNGO in association with a network of nursing ponds operated by SHGs, to increase fingerling supply to farmers and other SHGs in western Orissa.

A modular design is proposed, which can be scaled up according to demand:

Fig. 8.1 Plan view of hatchery platform



- A suitable sized module can be piloted with support for the design and development and capacity building'
- The module is sized to accommodate sequential breeding and hatching events, each comprising one breeding set of carp (10 kg of brood fish - 6 kg female plus 4 kg males).

- 10 kg can be spawned in a 2.15 m diameter spawning arena. Plastic reinforced fiberglass is proposed as a cost-effective and portable material now available in India.
- A breeding set would produce about 7 lakhs of spawn (700,000) which could be incubated in a 1.4 m diameter hatching tank
- Three species of carp (Catla, Rohu and Mrigal) are commonly reared together to utilize different parts of a water body and available natural feed.
- To rear these in rapid succession (so they could be sold together), three hatching tanks are required.
- A reinforced concrete platform, of dimensions 7 m x 3.5 m, with a simple roof(to provide shade) will accommodate all four tanks, plus a spawn collection chamber
- Water supply to the module will be by 1 ½" diameter$_3$ ring-main fed from a header tank with supply pipes with control valves to each tank.

In fish culture, the first limiting factor in water quality is the level of dissolved oxygen (DO) and this is used to determine the required flow rate. DO is affected by temperature and salinity, but in freshwater at 29^0 C (the temperature of the borehole water every liter of water, provided it is 100% saturated with oxygen, contains 7.67 mg of dissolved oxygen. Fish and other organism need a minimum dissolved oxygen level of 5 mg/l in order to be able to extract oxygen from the water.

- The oxygen available is therefore 7.67 – 5 = 2.67 mg/l
  Carp Broodstock require about 133 mg O_2/kg carp/ hour (though this varies with health stress, age, activity and duration since eating). 133 mg O_2/kg/h delivered at 2.67 mg/l would require
- A flow rate to 10 kg of Broodstock of 498 l/h or 8.3 l/min
- 700,000 of spawn require about 3-4 l/min
- The hatchery requires 20 l/min or 0.33 l/s at full capacity (for one spawning and three hatching tanks)

A borehole should be constructed to supply regularly water for the hatchery.

- The bore hole can deliver 167 l/min constant flow without recharge diminishing
- The filling rate is 8 times faster than the hatchery module utilization rate.
- The other uses of the borehole at SVA are for domestic and irrigation purposes. Irrigation will takes place for 2-3 hours daily.
- A 10 m$_3$ header tank capacity can accommodate the maximum hatchery flow requirement for more than 8 hours. A 4 m$_3$ of header tank would accommodate maximum hatchery requirements for more than 3 hours.
- A tank bund next to the proposed site is 1.5 m elevation above the proposed platform location and might be considered for a header tank location.

Estimated hatchery costs item detail/quantity unit cost total cost Rs

Item	Detail/quantity	Unit cost	Total cost Rs
Breeding pool	1 x 2.15 m diameter	20,000	20000
Hatching tank	3 x 1.4 m diameter	18,000	54000
Collection chamber	1 x for 10-12 lakhs	5,000	5000
PVC pipe	local supply	5,000	5000

Fiberglass tank	1 x for transport	15,000	15000
Hapa	4 x with covers		4000
Canvas bag	2x for holding brood fish		1000
Contingency	10%		10400
Delivery	Transport	6000	6000
Commissioning	By supplier	Inclusive	
5 HP pump set		10000	10000
Show sand filter		15000	15000
			!,45,400

8.6.3 Micro-Enterprises

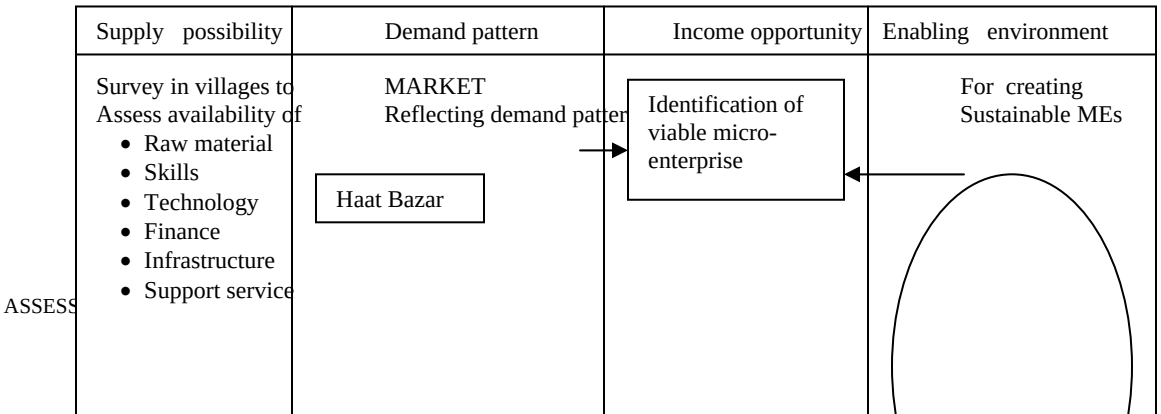
Micro-enterprises supported by micro-credit will be very crucial for income germination of vulnerable groups, landless and women. Capacity building of SHGs for promotion of apiary, mushroom cultivation and sericulture would be required on the basis of micro-plan prepared. Some of the agro-based enterprises feasible in the programme are as under:

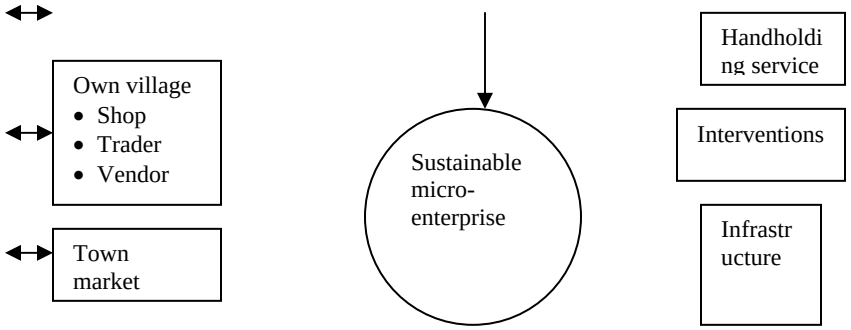
* Processing of fruits and vegetable
* Processing of coarse cereals
* Sun drying of fruits and vegetables
* Preparation of biscuits and namkeens
* Processing of animal products
* Processing of honey
* Processing of medical plant parts

For the illiterate and semi-literate groups livelihoods based on traditional arts and crafts or agro and forest based activities need to be encouraged. Handicraft products have a tremendous potential to create a niche for themselves not only in India but also in the global market. Strong market links will have to be developed and technical inputs for product improvement and design would need to be given. The FNGO is required to facilitate development of business plan for the SHGs for such enterprises. The funds available under rural finance and rural infrastructure development would be helpful for promotion of micro-enterprises. The networking of SHGs is also required to raise the bargaining power and market promotion. There is also need for convergence of Rural Employment Guarantee Schemes and support to agro and forest based activities for livelihood promotion.

8.7 Marketing

3 M Model of micro-enterprise development looks at micro-finance, micro-market and micro-planning. The model proposed by MART is presented below:





The survey has to be done at village level and *haat* level .While conducting the survey the steps like team composition, deciding the area of survey, field planning, prior intimation to SHGs and understanding the questionnaire will be taken after which the techno-economic survey will be conducted to capture information on raw material availability, skill, technology, infrastructure and support service available in the area. After the village survey, the *haat* survey is also to be made to include buyer's profile and seller's profile. On the basis of survey, data analysis will be made to select activities,. categorise the activities and to prepare the business plan. After the development of business plan the micro-enterprise will be implemented and enabling environment like handholding support, investment and infrastructure can be supplied to the SHGs.

A common interest group (CIG) is to be formed in the village to undertake collective marketing with an objective of selling the produce directly at the collection centre. This can generate extra profit due to elimination of different tires of middlemen. Collective marketing also saves time and labour. Value addition and agro-processing can also be feasible in this system of marketing. Similarly the SHGs can buy agricultural inputs collectively and distribute among themselves which will eliminate spurious products & adulteration while supplying the inputs at reasonable price.

The following specific steps may be taken to initiate collective marketing of produce by the CBOs

- Organization of community into mature SHGs at village level and their federation at micro-watershed level
- Identification of experienced resource organization which can provide market intelligence as well as handholding support
- Identification of 2-3 major commodities for which collective marketing is to be carried out during the first year. These commodities may however be increased as the CBO gains working experience
- Formation of common interest groups (CIGs) with respect to particular commodities which may consists of members who are willing to market their surplus produce through SHGs
- Identification of locally available entrepreneurs who have some background experience on marketing of above commodities. If needed, help may be taken from persons, who are located even in adjoining villages
- Construction of storage structure (through assistance from the project) or storing the produce in respective houses till it is constructed
- Arranging a working capital (possibility through project support) for carrying out collective marketing

8.8 Gender Equity

(i) Pro-active approaches and appropriate action strategies are needed particularly at legal, policy, strategy, program and resource allocation levels to provide tribal women farmers a level playing field in relation to their contributions in the areas of conservation, cultivation and micro-enterprise. The following interventions require immediate attention:

- The collective rights of tribal women on land, water and forests should be recognized and mentioned separately in government plans and policy documents.
- Tribal women particularly those living within the forest area, as well as women in forest dependent communities should be guaranteed their ancestral ownership and inheritance rights as per customary law or laws of the state.
- Where access to privately owned land is not available, rights and concessions for livelihoods and subsistence use should be rationally provided for communities on public land such as Reserve Forests and protected areas like Sanctuaries. In such areas the livelihoods and subsistence needs of fuel, fodder, water and plant resources of communities must be ensured in policies and regulations that delimit or restrict women's access to it.
- Women living in forest villages should be given land rights so that they can have access to maternal and child care services and other developmental facilities in their villages.
- Sustainable use of village commons should be ensured by providing sufficient land, as support areas for subsistence needs, particularly for women of forest dependent and forest and tribal communities.
- The scale of extractive use of forests and common property resources (water bodies, forests, grazing lands etc.) should be limited by reforming laws to maintain primacy of subsistence use and local markets, rather than commodification for global markets.
- Tribal women should be supported and trained to assume leadership roles in formal public institutions through time bound programs.
- Tribal women farmer's traditional wisdom and experience related to bio diversity conservation and enhancement, seed selection and storage, water harvesting, risk minimizing agricultural practices, and sustainable use of natural resources should be acknowledged, preserved and used for natural resource management, research, planning and decision making at all levels. This will also prevent them from becoming dependent upon expensive seeds, fertilizers and pesticides.
- Tribal women's right to collection of minor forest produce should be guaranteed by the government as it constitutes a major source of their income and they are almost exclusively involved in collection, storage, processing and marketing of this produce.
- Tribal women farmers should be provided training in marketing their produce and support in setting up cooperatives
- Consultations should be held with tribal women and their ideas and concerns should be included in designing and managing canal systems.
- Government schemes should be initiated to lease land to women's groups for collective economic activity on long-term leases for fish ponds for waste land development. Government as well as non governmental agencies should work for transfer of group titles of farm related activities to landless women.
- Women's land and resource rights need to be accompanied by availability of credit, information, training as well as access to services and amenities.

(ii) The programme approach would be based on the following steps:

- Facilitation of community groups including women to identify kinds of land and natural resources and its distribution pattern in village. Collection of statistics on the percentage of land and resource ownership by women to determine distributive justice of resources.
- The information from the resource mapping can be shared with others in the. village through meetings and in the village knowledge information centres
- Arrange joint ownership with men for income generation (like fishing rights, pond lease) and mobilise women's groups on common property resources
- Developing land-based economic programmes
- Once land is identified, its legal title granted and its land use agreed, additional support would need to be thought of in terms of linkages other civic amenities which include ownership of ground water as common property, access to health & education, and access to market etc.
- Gender budgeting in government programmes
- Promote group-based economic livelihood generating activities & micro-enterprises
- Securing access to and ownership of resources needs to be accompanied by sustenance of process of women empowerment efforts to infrastructure support, credit access, information support, recognizing women farmer's and marketing cooperatives, and providing training for credit management.
- The women farmers in tribal area can be supported for community grain bank, horticultural programme, organic farming, seed production, preparation of planting material, kitchen garden, animal rearing for substantial income generation and food security.
- The women SHGs may be federated to take up collective buying and marketing of agricultural and forest produces.
  The possible income generating activities in tribal areas could be paddy processing, rope making, mat weaving, pottery, vermi-composting, nursery raising, bee-keeping, food processing, leaf plate and cup making, mushroom production and petty business.

8.9 Livelihoods Strategies for Vulnerability Reduction

Assets are both destroyed and created, as a result of the trends, shocks and seasonality of the *vulnerability context (*Refer to Fig. 5.1*).* For example, the sudden disappearance of formal seed distribution systems in a given area could cause people to return to local crop varieties and seed systems, which would enhance diversity or a natural or human-induced disaster, could lead to the loss of local seeds.

The broad strategy to deal with vulnerability would be natural resource-based, non-natural resource-based micro enterprises.

- **Natural resource based:** The majority of rural dwellers will plan on ways to make a living, based directly on the natural resources around them e.g. subsistence farmers, fishers, hunter/gatherers, plantation managers.

- **Non-natural resource based:** Some rural dwellers will opt to make a living based on created resources ranging from begging, service jobs, drivers, government jobs to shop-keeping.

  All these require a village level vulnerability analysis and development of a micro-plan along with skill mapping. If there are no appropriate opportunities for people to make a living, then a third option may be to migrate away from the area to a place where they can make a living. Examples vary from nomadic tribes to the expatriate academic. This migration can be seasonal or permanent.

8.10 Inadequate access to land is the key factor for food insecurity in the Programme area. Attempts would be made to allot land to landless and allow long term lease of common land for their sustenance. There is also need to ensure participatory forest management to make the forest a reliable alternative livelihoods support system. The key interventions for the development of the vulnerable section are indicated below.

- Distribution of land and issue of tree right
- Improvement of shifting cultivation by alternate land use, better technology and land use system
- Increased production, processing and efficient marketing of NTFP
- Capacity building and financial support for infrastructure development and micro-enterprise based on business plan and market plan
- Creating middleman-ship for trading of commodities
- Micro-credit for petty business and development of rural artisans.

Annex 1

Alternate Land Use

All lands are not suitable for crop production. Pasture and agro-forestry systems could be tried with success on marginal and sub-marginal lands. Various

alternate land use systems are agri-silviculture (tree + crops), fruit and food system (fruit + grain legumes), poly culture (agri- silvi- horti- pastoral system), silvi- pastoral (tree-pasture) and alley cropping (cereals in hedge rows) are some popular alternate land use systems.

Agro-forestry

Agro-forestry is a collective term for land use system in which woody perennials are grown with herbaceous crops and / or animals on the same land by spatial arrangements or temporal sequence so that they are economically and ecologically compatible. The practice of agro-forestry in dry lands improves the ecological status of the area through the trees along with agricultural, pastoral and other crops. In irrigated area also it provides scope for dairy. The multipurpose trees (MPTs) provide timber, fire wood, fodder, fruit, shade, soil amelioration and environment protection. The MPTs suitable to adverse situations as indicated below may be preferred in consultation with the farmers. However, the following criteria should be followed for selection of tree species.

- Adaptability to local agro-climate.
- Fast growth.
- Short gestation period.
- Coppicing ability.
- Multiple uses.
- Higher demand and better value.
- Ability to improve soil and fix atmospheric nitrogen.
- Easy management and protection.

Trees suitable for alkaline soils

Albezia lebbek (Siris)
Leucaena leucocephala (Subbul)
Pangania pinnata (Karanj)
Terminalia arjun (Arjun)
Tamarindus indica (Tamarind)
Emblica officinalis (Amla)
Acacia nilotica (Bamur)
Madhuca latifolia (Mahua)
Dalbergia latifolia (Indian rose wood)

Best fodder trees

Leucaena leucocephala (Subabul)
Tamarindus indica (Tamarind)
Acacia nilotica (Bamur)
Ziziphus mauritiana (Ber)

Best fuel wood trees

Acacia nilotica (Bamur)
Madhuca latifolia (Mahua)
Albizia lebbek (Siris)
Terminalia arjun (Arjun)
Terminalia tomentosa (Asan)
Cassia sp (Chakunda)
Pongamia pinnata (Karanja)

Best timber trees

Dalbergia latifalia (Indian rose wood)
Dalbergia sisoo (Sisoo)

Eucalyptus camalldulensis (Eucalyptus)
Terminalia arjun (Arjun)
Gmelina arborea (Gambhari)
Tectona grandis (Teak)
Peterocarpus marupium (Piasal)
Shorea robusta (Sal)

Trees adapted to shallow, rocky soils
Anacardium occidentale (Cashew)
Annona squamosa (Custard apple)
Madhuca latifolia (Mahua)
Pongamia pinnata (Karanja)
Azadirachta indica (Neem)

Fruit trees suitable for dry lands
Annona squamosa (Custard apple)
Artocarpus heterophyllus (Jack fruit)
Borassus flabellifer (Palmyra)
Emblica officinalis (Amla)
Feronia limonia (Wood apple)
Punica granatum (Pomegranate)
Eugenia jambolana (Jamun)
Mangifera indica (Mango)
Ziziphus mauritiana (Ber)

Medicinal plant cultivation

Activities for *ex situ* cultivation of medicinal plants have already been started in some areas by developing medicine plant nursery. Looking at the current demand in the market *ex situ* and *in situ* production of herbal products may be taken up.

Aromatic plants - Palmarosa, Lemon grass, Citronella, Patchouli.

Medicinal herbs/ plants - Aswagandha, Amla, Baidank, Tihudi, Guluchi, Kalmeg, Satabari, Sarpagandha, Senna, Pipala, *Aloe vera*

Annex 2

Improved Agronomic Measures

1.Low Monetary System

Proper tillage

Off-season tillage is useful to open the soil for more intakes of summer rains. There should be widely spaced furrows across the slope (in *alfisols*) to avoid soil erosion. Off-season tillage invariably increases crop yields due to higher intake of rains, weed control and reduced pest attack. Choice of tillage system will depend on soil texture and management strategy as well as equipment available, residue and soil characteristics, soil temperature, allelopathy, soil moisture and drainage, soil density, organic matter, soil aggregation, climate, crop rotation, and in general tillage adaptability to the specific location. Deep tillage once in 2-3 years to break the hard pan can increase the rate of infiltration and yield. Restricted tillage systems are centered on the idea that tillage can limit soil compaction and residue removal. No till (tilling in a narrow and shallow area for seeding) is adapted for coarse-textured soils as they compact less.

Timely sowing

Early sowing has several advantages like better moisture conservation, good seedling vigour and longer growing season in addition to reducing pest attack and providing opportunities for a second crop. The rainfall pattern and PET generally determine the appropriate time of sowing the rain-fed crops. The analysis of such parameters reveals that beginning of transition period when precipitation equals one-half of PET is usually first fortnight of June, which is most ideal time of sowing.

Choice of crops and varieties

Although HYVs are superior in performance to local varieties, such varieties do not perform well in poor soils where production levels are very low. In such soils local varieties grow well and compete equally with weeds. In order to express the yield potential some of the suitable HY varieties could be adopted in the area as indicated below.

Crop	Land type	Varieties
Rice	Highland	Heera, Kalinga III, Vandana, Khandagiri, Udaygiri, Parijat. Pathara, Lalitgiri, Udaygiri
	High-medium	Annada, Satabdi, MTU1010, Radhi, Konark, Lalat, Kharvel
	Medium	MTU1001, Surendra, Tapaswini, Swarna, Pooja, Mahsuri
	Lowland	Mahanadi , Ramchandi, Utkalprabha, Savitri, Prachi, Durga
Wheat		Sonalika, UP 262
Green gram		Dhauli, PDM 11, PDM 54, TARM 1, Jyoti, OUM 11-5, Sujata
Black gram		T9, Sarala, Pant U 26, Pant U 30, LBG 17
Pigeon pea		UPAS 120, Pragati, Jagruti, Maruthi, Asha
Field pea		Rachana, Aparna, Uttara, DDR 27
Gram		Radhey, Annegiri, JG 62
Ground nut		AK 12-24, Smruti, TAG 24, TG3, TMV 2, JL 24
Mustard		PT 303, M 27, Anuradha, Parvati, Vinoy, Pusa Bold, Pusa Jaikishan
Sesame		Vinayak, Kanak, Kalika, Nirmala, Prachi, Usha
Sun flower		FSFH 17, KBSH 1, PAC 36, PAC 1091, Morden
Potato		KCM, Kufri Lalima, Kufri Jyoti
Onion		Pusa Red, Pusa Ratnar, N 53, Arka Pragati, Agrifound Light Red
Chilli		Pusa Jwala, Pant C 1, Utkal Rasmi, Sindoor
Tomato		Utkal Pallabi, Utkal Dipti, Hybrid
Brinjal		Utkal Tarini, PPC, PPL, Pusa Kranti, Arka Navneet

Optimum plant population

The number of plants required per unit area to achieve the highest yields will depend on the nature of the crop, variety and environment. As plant density

increases, most components of yield of the individual plants are reduced. Only grain weight is rarely influenced by changes in the plant density. High density is desirable for indeterminate crops/ varieties whereas low density is desirable for determinate crops/ varieties. When nutrients are adequate higher density would be required for full exploitation of resources. In case of cereals optimum numbers of ears per unit area can be achieved by low plant density compensated by increased number of fertile tillers per plant or by high plant density, which will keep the number of tillers per plant low. Timely inter-culture and weeding should also be ensured to maintain required plant population. It must be borne in mind that placement of good seed at appropriate depth giving recommended spacing is desirable for ensuring optimum plant population.

Weed management

Weeds, if left uncontrolled, can take away as much as 30 % moisture and nutrients leading to substantial crop loss. Cultural measures like off-season tillage, preventive measures to restrict entry of weed seeds to the crop field, and timely weeding within critical growth stages are suggested measures for low-cost weed management. Sowing the seeds in lines and running weeders/ inter-cultivators in the inter-row space will minimize the cost of weeding. Crops using C_4 pathway of photosynthesis or crops with dropping leaves and early vigour have smothering effect on weeds.

Nutrient management

Organic recycling using farm wastes, animal manures or locally available organic materials, green manuring with Dhaincha, Sunhemp, cowpea or incorporating green leaves collected from the forests, preparing compost in quick method, NADEP method and use of bio-fertilisers are some of the options of nutrient management in low monetary system.

Inter cropping

Areas with growing season of 20-30 weeks which receive at least 800 mm rainfall are suitable for inter cropping system that will cover the risk under rain-fed situations. Inter cropping with pigeon pea + groundnut (2:5), pigeon pea + jowar (1:1), pigeon pea + rice (2:5), maize + cowpea (2:2), pigeon pea + green gram (2:6) may be taken up under upland situations during *Kharif* season where irrigation facility is not available.

2. High Monetary Systems

Fertilizer use

The response of crops to moderate dose of fertilizers (particularly N and P) has been confirmed under rain-fed situations whereas response to high dose of fertilizer has been confirmed under irrigated situation. Application of fertilizer should be given based on soil test results and properties of soil. A general fertilizer schedules for various irrigated crops is given below.

Nutrient Requirements in Kg/Ha

Crop	N_2 /ha	P_2O_5 /ha	K_2O /ha
Early paddy	40-60	20-30	20-30
Medium /Late paddy	60-80	30-40	30-40
Green gram	20	40	20

Black gram	20	40	20
Field pea	25	50	25
Cow pea	25	50	-
Chick pea	20	40	20
Groundnut	20	40	40
Mustard (NI)	40	20	20
Mustard (I)	50	25	25
Sesame	30	20	20
Sunflower (hyb)	60	32	24
Wheat	80	50	40
Tomato	120	75	100
Cauliflower	120	60	60
Cabbage	150	50	75
Brinjal	120	50	50
Onion	120	60	100
Garlic	120	60	120
Chilli	110	75	75
Maize	80	40	40
Ragi	60	30	30

Integrated Nutrient Managenet (INM)

INM is explained in Annexure 4. It is always profitable to use fertilizers on the basis of soil tests and amend the soil by using chemicals before application of fertilizers in case the soil is acidic or alkaline/saline. The dosage, form, timing and method of application are very important for higher fertilisere use efficiency. Practices like split application, integrated use with organics, placement, incubation of urea with moist soil or nitrogen inhibitors (Nimin, oil cake etc.), water regulation etc. under wet land situation can enhance the fertilizer use efficiency by 10-20% more. Various factors influencing crop responses to fertilizer are choice of crops, timely sowing, optimum plant population, tillage, water management, weed management, and fertilizer management (source, time, method and integrated use). Currently targeted yield concept approach is adopted which takes into account the nutrient requirements of a crop to produce unit yield, likely contribution from soil and from the fertilizer to know fertilizer to be added for a given yield level.

Weed management

Non-chemical weed control is desirable under rain-fed cropping systems. However, chemicals could be utilized under irrigated situation where labour scarcity is noticed during critical crop growing seasons delaying weeding operations. Same of effective herbicides are indicated below.

Crop	Name of herbicides	Dosage in kg/ ha	Method of application
Upland rice	Butachlor	1-2	Pre emergence
	Benthiocarb	1-2	Pre emergence
Red gram	Alachlor	2-3	Pre emergence
	Benthiocarb	1	Pre emergence
Groundnut	Alachlor	1	Pre emergence
	Fluchloralin	1	PPI
	Oxadiazon	1	Pre emergence
Green / black gram	Fluchloralin	1	PPI
	Benthiocarb	1	Pre emergence

Pest management

Seed treatment with fungicides or insecticides has been proved as a cheap means of preventing initial disease and insect attack. Bio-agents can also be used to provide natural pest control. Bio-pesticides like BT, NPV, *Trichoderma*

and *neem* pesticides are also found useful in managing crop pests. Integrated pest management practices have been indicated in separately. The integrated pest management (IPM) strategy is explained in Annexure 3.

Farm mechanisation

Timeliness and precision farming are very important for rain-fed cropping systems. Delayed land preparation will cause delayed sowing, which will reduce crop yields. Animal drawn or power driven implements/ equipment could be used for effective operations in time.

Annex 3

Integrated Pest Management (IPM)

The crops of project districts are exposed to several biotic and abiotic stresses. Warm and sub-humid climate during *Kharif* season favours multiplication of key

insect pests and disease pathogens causing serious damage to crops. The subsistence farmers either do not take necessary control measures or adopt some indigenous measures of pest control. Deliberate attempt to kill insects and eradicate fungal or bacterial diseases by using toxic chemicals by resource rich farmers has not provided lasting solution, rather it has caused several ecological problems and environmental consequences making the cropping system unsustainable. During the course of discussion with the farmers the following key pest were reported.

Paddy : Stem borer (*Scirpophaga incertulas*), gall midge (*Orseolia oryzae*), green leaf hopper (*Nephotettix virescens*), case worm (*Nymphula depunctalis*), leaf folder (*Cnaphalocrocis medinalis*), mealy bug (*Ripersia oryzae*), bacterial leaf blight (*Xanthomonas oryzae pv*. *Oryzae*), false smut (*Ustilaginoidea virens*), sheath blight (*Rhizoctonia solani*), brown spot (*Helminthosporium oryzae*) and blast (*Pyricularia oryzae*)

Pulses : Aphid (*Aphis craccivora*), leaf eating caterpillar (*Azozia rufricans*), pod borer (*Helicoverpa armigera*), powdery mildew (*Erysiphe polygoni*), yellow mosaic virus and leaf spot (*Cercospora sp*)

Groundnut :Termite (*Odontotermes obesus*), hairy caterpillar (*Amasacta albistriga*), tikka (*Cercospora personata*) collar not (*Aspergillus niger*)

Brinjal: Shoot and fruit borer (*Leucinodes orbonalis*), epilachna beetle (*Epilachna vignitioctapunctata*), mite (*Tetranchus urticae*), wilt (*Ralstonia solanacearum*), phomopsis blight (*Phomopsis vexans*)

Tomato: Fruit borer (*Helicoverpa armigera*), serpentine leaf miner (*Lirimyza trifoli)*, damping off (*Pythium aphanidermatum*), fruit rot (*Phytopthora palmivora*)

Chilli : Thrips (*Scirtothrips dorsalis*), twig blight (*Colletotrichum sp*), wilt

In order to adopt a successful pest management strategy, it is not the tools and techniques used, but the human element in the system – the decision maker is more important. The cropping system selected should always be oriented at preventing pest outbreaks rather than coping with them after they occur. The producer should have an adequate understanding of the biological factors interacting in the agro-ecosystem favouring attack of pests and low cost measures in preventing occurrence of key pests. IPM and sustainable agriculture share the goal of developing agriculture systems that are ecologically and economically sound. IPM may be considered as a key component of a sustainable agriculture system. A premise common to IPM and sustainable agriculture is that a healthy agro-ecosystem depends on healthy soils and managed diversity. Therefore, there is a need to establish equilibrium between beneficial insects and pests and by using cropping practices that reduce pest population. The low cost measures in achieving such goal, the following management factors are to be considered.

Crop Rotation

Crop rotations reduce pest problems by denying easy access to the crop and by increasing the abundance and effectiveness of insect predators and parasites. The diversified habitat provides these parasites and predators with alternate sources of food, shelter and breeding sites. Therefore, crop rotation with diverse

crops should form the basic strategy to reduce the pest outbreak and maintain ecological balance in the agro-ecosystem.

Timely Sowing

Timely sowing of crops (either early or late) more often reduces the incidence of pests and diseases as their incidence is weather bound. Any delay might create an imbalance between pest-predator relations or humidity-disease relations. In most cases early sowing/ planting of crops avoids major pest attack in the crop field.

Sanitation

Removing or destroying crop residues and alternate host sites can be used to control some insect pests as the insects over winter in crop residues or lay their eggs in crop residues. Cutting the rice plants close to ground reduces the carry over pest attack of rice stem borers. Cleaning of field bunds is also very important as most of crop pests harbour on grasses on field bunds. Off-season tillage (or summer ploughing) is very effective in reducing pest attack as most of insect eggs, larvae, pupae and disease pathogens are exposed to sun and predating birds etc. The close proximity of volunteer plants could provide alternate habitats for insects to complete their life cycle until an appropriate crop occurs in the nearby fields. Hence, sanitation in the cropping system is very important for management of pests.

Weed Management

Weeds should always be controlled to reduce their impact on crop yield and quality. However, the increase in plant diversity by allowing a certain amount of weed growth has been shown to have positive effect on the diversity of insect pests. The diversity may increase the number of predators attacking a pest, for which often it is desirable to allow a low population of weeds to encourage the activities of certain predators to control key pests. Various tactics that can be integrated into weed management system include prevention, crop rotation, cultivation, stale bed technique, delayed planting, staggered planting schedule, surface residue management, altered plant spacing or row width and use of herbivores for feeding on weeds. If considered necessary, effective herbicides may be carefully used depending upon weed size, weed species, and soil moisture. For resource poor farmers' prevention is beneficial in the following manner for weed management.

- Have a long, diverse rotation
- Sow clean seed
- Prevent weed seed formation
- Avoid imported manure
- Compost all manures thoroughly
- Control weeds in the field borders / irrigation channels
- Maintain good soil quality
- Use crop varieties which can efficiently suppress weed growth
- Adopt stale bed technique

Seeding Date

Early seeding reduces crop damage caused by grass hoppers, aphids, gall midge etc. as the vulnerable stage of the crop is over by the time the insect pests become active. Often, delayed planting is beneficial to control pests like

cutworms and thrips etc. as waiting until the insect has finished its life cycle before seeding will avoid pest problems.

Seeding Rate

Increasing plant densities using higher seeding rates can have a positive effect on control of insect pests like aphid, leaf hoppers and flea beetles. These insects are attracted to the contrast between a green host and a dark soil background which are obscured by this contrast. On the other hand, higher plant densities favour pest abundance in case of armyworms etc. Therefore, looking at the nature of insect pests the density and planting pattern have to be altered.

Summer Fallow and Stubble Management

Summer fallow is intended to break the life cycle of many insects. Destruction of green growth in summer fallow fields should begin early in the year before insects like grass hoppers begin to hatch. This will destroy their food and starve newly hatched grass hoppers. Summer fallow lands should be cultivated after egg hatching of cutworms that prefer to lay eggs in loose soil so that the larvae will not get any feed to survive. Burning stubbles has several advantages in controlling pest problems.

Trap Crops/ Strips

Use of trap crops for allowing concentration of insect pests makes the control easier. Trap crops like cowpea have been attempted with success in cash crops like cotton for control of aphids. Wheat stem fly may be lured into a temporary trap crop of a susceptible variety placed around the crop.

Soil Fertility Management

Adequate, balanced soil nutrition is essential for crop quality, yield and moisture use efficiency. Imbalance in nutrient application (e.g. more of nitrogen) can result in plants becoming more succulent and thus more attractive to insect pests. Therefore, soil testing should be conducted on a regular basis to monitor nutrient levels and allow corrections. Combination of organic manures and balanced use of fertilizers is desirable to maintain the soil fertility which will also reduce pest problem.

Resistant / Tolerant Cultivars

Use of resistant / tolerant cultivars in the cropping system is a cost – effective pest control measure. A wide array of cultivars resistant / tolerant to crop pests is now available which could be used in the locality against key pests where the pests are regularly appearing. Insect resistance can also occur simply as a function of plant architecture or geometry. Certain varieties of cereal crops which have pubescent leaves are less attracted by leaf beetles. Traditional cultivars with such type of characters are also available in the region which may be identified and used in the cropping systems.

Biological Control

In a balanced ecosystem, biological control by natural predators is constantly occurring. The more diverse a cropping system becomes, the greater is the spectrum of insect species within it. Conservation, augmentation of predators and parasites in the field by appropriate cultural practices and release of parasites and predators after multiplying them in the laboratory conditions have

been proved very successful in biological pest control. Examples of some bio-control agents currently used for pest control are indicated below.

Name of crop / pest Use of bio-agents

Crop pest	Use of bio-agents
sunflower head borer (*Helicoverpa*), Groundnut aphid (*Aphis craccovora*)	*Chrysoperla carnea*@ 50,000/ ha twice during the season with a gap of 15 days
• Sugarcane borers (*Chilo infuscatellus*), top short borer (*Scripophaga excerptalis*) and stalk borer	*Trichogramma chilonis* sugarcane strain @ 50,000/ha at 10 days interval starting from 45 days of planting.
• Maize stem borer	*Trichogramma chilonis* @ 75,000/ha 6 releases at 10 days interval from 45th day
• Paddy stem borer	*Trichogramma japonicum* @ 50,000/ ha (6 releases).
• Tomato fruit borer	*Trichagramma brasiliensis* 6 releases @ 50,000/ha from 45th day.
Pyrilla of sugarcane	*Epiricania melanoleuca*

Traps

Light traps, yellow traps and sticky traps etc. are in use for low cost pest control measures. Pheromone traps using synthetic insect hormones (lures) are used to disrupt insect movement and attract them to monitor population levels in the trap.

Indigenous Technologies

Timely operations and non-use of chemicals can favour natural predators to eliminate / minimize the pests in the field. Manual collection of egg masses, caterpillars, affected plant parts and killing them would provide control measures against different insect pests and diseases. Vegetative trapping like growing cucumber along with castor and use of Calotropis and Jatropha twigs, growing of marigold in tomato field, use of bamboo perchers in the rice field, fixing twigs of Karada plant in rice fields and other low-cost technologies are adopted successfully by farmer. Cow dung ash is often used for dusting on vegetable crops to deter the defoliators and borer pests. Sprinkling of mixture of cow dung manure in water on the plant foliage also works as a deterrent against pests. Spraying of raw cow dung solution to rice crop prevents infection of bacterial leaf bright. Some farmers' innovations in ingenious pest control are indicated below.

Innovation	Pest controlled
• Ash dust	Aphid
• Cow urine	Aphid
• Decoction of Ragi / *Ipomea fistulosa*	Termites
• Some morsels of cooked rice mixture with turmeric placed at 10 m interval for 3 days in castor fields.	To attract birds which finally prey on castor semi-looper.
• Thorough covering of whole pulse grains with castor / mustard oil	To avoid stored grain pests
• Cover an earthen pot with ash after it is fully filled with grains of cereals.	To prevent entry of stored grain pests.

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Plant Products

Locally available plants like Neem (Kernel or Leaf), leaves of Jatropha and Ipomeas have been traditionally used as botanical pesticides. Annona, capsicum, garlic, pyrethrum, tobacco, turmeric etc. have insecticide properties, which could be formulated and used in pest control operations.

Use of Pesticides

Application of pesticides for control of insect pests and disease pathogens becomes imperative when all other measures fail and the pest population exceeds the economic threshold level (ETL). The eco-friendly pesticides with low mammalian toxicity may be used in such cases.

Annex 4

Integrated Nutrient Management

Development of an Integrated Plant Nutrient System (IPNS) involving an approximate mix of organics, biological nitrogen fixation, phosphorus solublising

microbes, industrial wastes and need based chemical fertilizers would be crucial for the sustainability of production and maintenance of soil health. As a rule of thumb two-thirds of nutrients in inorganic form and one-third in organic form may be ideal for all types of soil.

Organic Recycling

Application of FYM is confined to land situated near villages and better lands covered by high value crops. It is therefore imperative to increase the organic matter content of the land by recycling of organic wastes such as crop residues, manures from domesticated animals, biomass of weeds, organic wastes etc. It is possible to dig compost pits near the fields and prepare compost by using crop residues and cow dung / urine as starter.

Bio-Fertilizers

Biological nitrogen fixers like BGA and *Azolla* for rice, *Rhizobium* for legumes and *Azotobacter* and *Azospirillum* for non-legume crops and phosphorus solublising bacteria available as cultures solublizing unavailable phosphorus to increase its availability to crops have several advantages including mobilizing plant nutrients at a cheaper rate, enhancing growth and development of crops for crop production. Use of bio-fertilizers is proved to be cost effective and eco-friendly.

Green Manuring

Green manuring (*in situ* and *ex situ*) is an age old practice for improving soil fertility and supplying part of nutrient requirement of crops*. Sesbania rostrata*, *Sesbania aculeata*, *Crotolaria juncea*, mung bean and cowpea are most suitable crops grown for green manuring (*in situ*) and *Gliricidea sepium* and other green leaves collected from areas are suitable for *ex situ* green manuring. In forest-rich areas there is greater scope for green leaf manuring for rice and other crops from the looping of various multipurpose trees popularized through afforestation and agro-forestry system. *Kharif* legumes like black gram and green gram can be incorporated into soil after harvesting of pods.

Vermitechnology

Vermicompost is a good source of humus and contains substances like hormones, auxins, vitamin B_{12} and other growth promoting compounds and antibiotics like actionomycetes ,which are very useful for high value crops like fruits and vegetables. Low cost vermi-technologies are now available which could be practiced at every household level for at least kitchen gardens, vegetable cultivation and back yard plantation of fruit trees.

Cultivation of Legume Crops

Food legumes and fodder legumes can find a place in cropping systems for improving nitrogen economy. Even when a legume is rotated with a cereal, there is a definite improvement in the yield of the cereal crops. Residual effect of preceding legumes on cereal yield in terms of fertilizer nitrogen equivalent ranges from 20-40 kg/ha with pigeon pea, green gram and pea etc. as legumes. Considering these benefits of legumes in improving soil productivity, the area under pulse crops need to be further enhanced in project districts. Availability of

short duration varieties of pulse crops maturing within 70-90 days makes the task much easier for the incorporation in a sequence cropping or inter-cropping.

Fertilizers

Fertilizers, particularly nitrogen is considered as the kingpin of crop production. But the ideal ratio of NPK at 4:2:1 is heavily tilted in favour of nitrogen and the districts are no exception to such imbalance use of fertilizer. Further, the fertilizer use efficiency in rain-fed areas is less than 35 per cent in case of nitrogen. For rain-fed crops, the cardinal principle is to use moderate levels of fertilizer, particularly N. Under rain-fed condition, adjustment of fertilizer application to the moisture regime under which the plants are expected to grow is the prime objective. Even under conditions of limited moisture, nutrient deficiencies will reduce water use efficiency and, therefore, a moderate amount of suitable fertilizers adjusted to soil moisture level many increase WUE. If, however, the fertilizers increase water use excessively in the early stages of growth so that severe water stress occurs at the critical stages, the opposite effect will result. Hence, there should be a very delicate and critical balance between vegetative and reproductive growth under conditions of limited moisture. The plants fertilized with P shows greater ability to take up available moisture while application of K regulates transpiration rate and provides drought resistance. Therefore, a balanced nutrient supply is beneficial even under conditions of limited rainfall, as it actually enables the crop to make more efficient use of the limited soil moisture available.

Annex 5

Model for Group Nursery

Capacity – 10,000 Seedlings

Cost of production

a) Material cost

Polythene bags	15 kg	@ Rs. 100.00	Rs. 1500.00
Organic manure	2400 kg	@ Rs. 0.20	Rs. 480.00
Inorganic fertilizer	60 kg	@ Rs. 8.00	Rs. 480.00
Pesticides	2 ltr	@ Rs. 250.00	Rs. 500.00
Seeds	30 kg	@ Rs. 40.00	Rs. 1200.00
Growth hormones	0.5 ltr	@ Rs. 200.00	Rs. 100.00
Improved seeds	5 kg	@ Rs. 100.00	Rs. 500.00
Planting material			Rs. 200.00
Watering cane	1	@ Rs. 200.00	Rs. 200.00
Improved potting material			Rs. 1000.00
Misc. cost			Rs. 200.00
Total material cost			**Rs. 6360.00**

b) Labour

Nursery bed preparation	2 person days @ 70.00	Rs. 140.00
Fencing	2 person days @ 70.00	Rs. 140.00
Soil preparation & filling of bags	30 p. days @ 70.00	Rs. 2100.00
Seed sowing	3 person days@ 70.00	Rs. 210.00
Tending, fertilizing & watering	70 p. days @ 70.00	Rs. 4900.00
	Total labour cost	**Rs. 7490.00**
	Grand total	**Rs. 13850.00**
Cost of production of 10000 seedlings =		**Rs.13,850.00**
Sale of seedlings	9000 @ Rs. 2.00	Rs. 18,000.00
Sale of Gambhar & teak seedlings	700 @ 4.00	Rs. 2800.00
Sale of Rhizomes for bamboo planting	300 @ 4.00	Rs. 1200.00
	Total Return	**Rs. 22,000.00**
Net benefit (22,000.0 – 13,850.00) =		**Rs. 8,150.00**

Annexure 6

Field Demonstrations

The improved technologies adoptable to farmers situations are to be demonstrated in their fields in the 'seeing is believing" concept. The essence of these demonstrations is to compare the farmers practice with the improved practice(s) to observe the superiority

of improved practices over the farmers practice in terms of higher productivity and profitability. The demonstration can be conducted in strips or strip – plots involving 1-4 factors compared against the farmers practice (control) as shown in the following diagram.

Model -1

Farmers' Practice	Improved

Model – 2

O,O	O, A
B,O	A,B

1. Strip

2. Cross : O = Farmers' Practice
A = One improved practice
B = Another improved practice

The size of the field demonstration should be relatively small (0.05 – 0.1 ha or 500-0.1 ha or 500-1000 sqm) and replicated in many farmers' fields across the village and MWSs. At least two demonstrations will be conducted in each village within the cost structure of Rs. 115 towards critical inputs while operational costs will be borne by the farmers.

The demonstration will be conducted by the farmers and VAVs under the guidance of WDT. A field day will be orgnaised at the time of harvest to convince the neighbouring farmers to have spread effect.

Crop Demonstration Models

i) Demonstration on diversified cropping

Objective : To demonstrate the success of non-paddy crops in uplands in place of paddy.

Area : Control – 0.05 ha Demonstration – 0.05 ha
(The non-paddy crops like maize, sesame, mung, blackgram, pigeon pea etc. will be selected as per adoptability and choice of farmers).

Cost of critical input

* The seed cost of farmer's practice is borne by farmer.

*	Cost of new seeds i.e. 1 kg pulse or 1 kg maize	Rs. 30.00
Cost of fertilizers		
1 kg N and 2 kg P for 0.1 ha		Rs. 55.00
Cost of pesticide for one spraying 100 ml.		Rs. 30.00
	Total	**Rs. 115.00**

ii) Inter Cropping Demonstration

Objective : To demonstrate the risk coverage and insured yield through inter cropping demonstration.

Area : 0.05 ha on farmers practice & 0.05 ha on intercropping (maize + cowpea , Arhar + Paddy or Arhar + Ragi)

Cost of critical input

*	Cost of seed of new crops under intercropping i.e., 2 kg paddy + 0.4 kg Arhar, or 0.3 kg maize and 0.5 kg cowpea	Rs. 30.00
*	Cost of fertilizer for 0.1 ha	Rs. 55.00
*	Cost of pesticide for one spraying 100 ml.	Rs. 30.00
	Total	**Rs. 115.00**

iii. Demonstration on INM & IPM

Objective ; To demonstrate the efficiency of INM & IPM practices to reduce the cost of inputs and protect the environment while increasing crop yield.

Area : 0.1 ha

Layout : 250 sqm – Farmers practice
250 sqm- INM. 250 sqm- IPM, 250 sqm- INM + IPM

Cost of Critical inputs

*	Cost of seed is borne by farmers	
*	Cost of resistant paddy 3 kg	Rs. 30.00
*	Cost of FYM borne by farmers	
*	Cost of bio-pesticide (neem pesticide – 100 gm Trichoderma – 100 gm for 500 sqm)	Rs. 40.00
*	Cost of 50% of fertilizer for 500 sqm	

	i.e., 1.5 kg N, 0.75 kg P, 0.75 kg K	Rs. 40.00
*	Cost of seed treatment chemical	Rs. 5.00
	Total	**Rs. 115.00**

Annex 7

Field Trials for Adaptive Research

In order to find a solution to location specific problems adaptive on-farm research is necessary. Adaptive research would be simple in design aimed at exploring under

farmers conditions various options relating to current problems. The on-farm trial will be conducted in an area of 0.1 ha (1000 sqm) and 2-3 trials will be conducted in the MWS for 3-4 years.

Objectives : To finally test the new varieties / technologies under field conditions before on-ward demonstration for providing a solution to local problems.

Area : The area of the field trial will be 0.1 ha accommodating four new varieties of field crops or horticultural crops and one existing variety as control.

Cost of critical inputs

*	Seed cost of rice varieties or pulse varieties or groundnut varieties or tuber crop varieties received from CRRI / ICRISAT / CTCRI (Limited)	Rs. 100.00
*	Cost of moderate dose of fertilizers for 1000 sqm 6 kg N, 3 kg P, & 3 kg K	Rs. 160.00
*	Cost of pesticides for two spraying 200 ml.	Rs. 60.00
*	Cost of seed treating chemical	Rs. 10.00
*	Cost of labour for lay-out & misc. expenditure	Rs. 70.00
	Total	**Rs. 400.00**

Annex 8

Farm Model

Total cropped area (ha) 1.0 (present) after project 1.25 ha

	Without project	With project				

	Kharif		Kharif	Rabi	Total				
Lowland									
Rice (Irrigated)	0.10		0.10	0.10	0.20				
Padar land									
Rice rain fed	0.10		0.10		0.10				
Maize	0.05		0.05		0.05				
Pigeon pea	0.05		0.05		0.05				
Upland									
Maize (Irr)	0		0	0.05	0.05				
Veg (Irr)	0		0	0.10	0.10				
Ragi	0.10		0.10		0.10				
Pulses	0.10		0.10		0.10				
Podu									
Crop	0.50		0.25		0.25				
Tree crop			0.25		0.25				
Total	**1.0**		**1.00**	**0.25**	**1.25**				
Labour	**Man daya/ ha**					Man days actual			
	WOP		Wp			WOP		Wp	
	Hired	Family	Hired	Family		Hired	Family	Hired	Family
Lowland									
Rice (Irrigated)	50	70	50	100		5	7	10	20
Padar land									
Rice rain fed	40	80	40	80		4	8	4	8
Maize		100		100			5		5
Pigeon pea		80		80			4		4
Upland									
Maize (Irr)		0		120			0	0	6
Veg (Irr)		0		200			0	0	20
Ragi	30	60	30	60		3	6	3	6
Pulses		60		60			6	0	6
Podu									
Crop		200		250			100	0	62
Tree crop				80					20
Total	120	650	120	1130		12	136	17	157
Inc. hired labour								5	
Inc. family labour				480					21
Net income	Production per farm (kg)					Value per farm (Rs)			
	Av. Product.Kg/ha		Actual kg						
	Wop	Wp	Wop	wp		Unit price	Wop	wp	
Lowland									
Rice (Irrigated)	2000	2500	200	500		6	1200	3000	
Padar land									
Rice rain fed	1500	2000	150	200		6	900	1200	
Maize	1000	1500	50	75		5	250	375	
Pigeon pea	200	400	10	40		20	200	400	
Upland									
Maize (Irr)	-	2000		100		5		500	
Veg (Irr)		5000		500		4		2000	
Ragi	750	1200	37	60		4	150	240	
Pulses	200	400	10	20		20	200	400	
Podu									
Crop	1200	1500	600	375		5	3000	1875	
Tree crop	-	-		300		5		1500	

Total						6000	10090	
Production cost								
Lowland								
Rice (Irrigated)	2950	3700				295	740	
Padar land								
Rice rain fed	2700	3000				270	300	
Maize	2000	2400				100	120	
Pigeon pea	750	1050				37	52	
Upland								
Maize (Irr)		2400					120	
Veg (Irr)		3000					300	
Ragi	1400	1650				140	165	
Pulses	750	1050				75	105	
Podu								
Crop						250	300	
Tree crop							150	
Total						1167	2352	
NET INCOME						4833	7738	
Inc, net .ben.from crop							2905	
Ret.from fam.lab/crop						36	49	
HH Food security		wop	wp					
Total grain production	kg	757	1370					
Less seeds		90	164					
Available for consumption.		667	1206					
Grain requirement		900	900					
% of self sufficiency		74%	134%					

Annex 9

"WADI" MODEL

The “wadi” model of tribal development is holistic in approach addressing production, processing and marketing of produce and also other needs. The core of the programme is “wadi” (small orchard) covering an area of one to two acres. The “wadi’ may be of mango, cashew, amla or guava or any fruit crop suitable for the area or a combination of these tree crops with forestry species in the periphery of the land holding. One acre of land would accommodate 60 fruit plants suitable to the local area and 600 forestry plants on the boundary. Other development interventions in the area of environment, gender and health viz. soil conservation in the wadi, water resource development, agricultural development, women development, health etc. are woven around wadi. The key interventions are :

Strategy	Activities
Water resource development	• Run-off water harvesting • Construction of temporary check bunds across river streams
Soil conservation measures	• Bunding, tree platform • Terrace-cum-bund
Health programme	• Education on sanitation & Hygiene • Training on treatment of common diseases
Women development	• Promotion of SHG • Income generating activities • Drudgery reduction • Support to landless by micro-enterprise
Processing and marketing	• Decentralised processing of produce • Formation of cooperatives

After identifying willing tribal farmers having less than 5 acres of land, micro-plan may be developed and linked with FIs or other development funds including micro-credit.

Annex 10

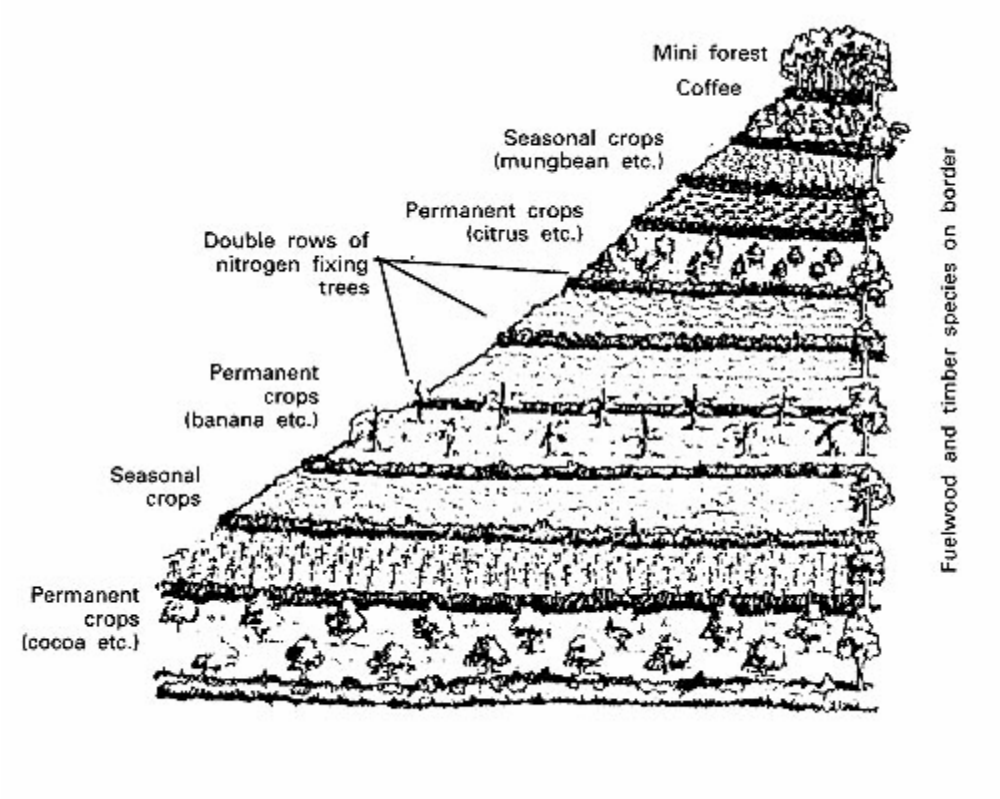
SALT for Podu Conversion

Sloping Agricultural Land Technology (SALT) is not the only, but one method of soil stabilization and conservation for promoting forest farming for the rural poor .It combines

agro-forestry, tree growing, soil conservation, fuel production and income generation. In SALT 1 soil conservation is combined mainly with agriculture. In SALT 2 (Simple Agro-Livestock Technology) it is combined with livestock breeding. SALT 3 (Sustainable Agro-forest Land Technology) stresses on agro-forestry. SALT 4 (Small Agro-fruit Livelihood Technology) focuses on ¾th of the slope land multi-storied with high value fruit trees and the remaining ¼ th for annuals. “SUPER SALT” is the newest variant which integrates the elements of the so-called modern farming such as HYVs, commercial fertilizer, pesticides and appropriate farm equipment into SALT 2 (Simple Agro-Livestock Technology). The different steps of SALT 1, Salt 2 and SALT 3 are indicated below.

S.N	SALT 1	SALT 2	SALT 3
1	Construction of ‘A’ frame	Location and develop contour lines	Raising seedling
2	Locate contour line	Establish hedge rows	Care and management of seedlings
3	Prepare the contour lines	Plant food and cash crops	Field cropping at the bottom of hills
4	Plant seeds of N – fixing trees	Develop the forage garden	Land preparation for Agro-Forestry
5	Cultivate alternate strips	Build the goat barn	Division of site and pit preparation
6	Plant permanent crops	Bring the breeding stock at right time	Planting of seedlings
7	Plant short term crops	Give the goats sufficient feed	Inter cropping / multi – tire cropping
8	Trim N-fixing trees	Breed the goat on time	Maintenance trees
9	Practice crop rotation	Sell milk and other farm products immediately	Periods harvesting of Agro-Forestry
10	Build green terrace	Maintain the farm	

The over view of SALT 1 is shown in Fig.


Mini forest
Coffee
Seasonal crops
(mungbean etc.)
Permanent crops
(citrus etc.)
Double rows of
nitrogen fixing
trees
Permanent
crops
(banana etc.)
Seasonal
crops
Permanent
crops
(cocoa etc.)
Fuelwood and timber species on border

Annex 11

Dry land Farming System

In a dry land farming system crop husbandry and animal husbandry are integrated . In a model dry land farming system in Coimbatore condition (Rajendran, 1994) the crop components were sorghum+ cow pea (grain) in 0.20 ha, sorghum+ cow pea (fodder) in 0.20 ha, Subabul + *Cenchrus ciliaris* in 0.20 ha, *Acacia senegal*- tree fodder in 0.20 ha and *Prosophis cineraria* (tree fodder) in 0.20 ha. Six goats (5 female and 1 male) are reared as livestock component. The field crops are sown in broad bed and furrow system by applying FYM and bio-fertiliser. Tree crops are planted for fodder, timber and fuel .In deep soil fruit trees like pomegranate, sapota and guava are also planted. Annual crops are raised in the inter space of perennial crops for about 4-5 years. A farm pond of 280-320 cubic meter could be dug to store 240 cubic meter of water. The water so collected was used for pot watering to tree crops at least during the critical crop stages. Goat rearing is integrated with improved cropping. Organic recycling is ensured by feeding goats with fodder @ 3kg dry fodder and 3 Kg green fodder and 100 grams of concentrate per adult animal daily in stall fed method. The animals are reared in deep litter method and the manure so collected is applied in the field. The system gives a net income of Rs 5666 per ha/ year .

Annex 12

Poultry Production Model

	Particulars	Unit	Unit Price (Rs.)	Number of units (year-wise)					Total cost (year wise)				
				1	2	3	4	5	1	2	3	4	5
	Investment												
i.	Capital cost												
	Brick	No.	1.50	100	-	-	-	-	150	-	-	-	-
	Cement	Kg	4.50	50	-	--	-	-	250	-	-	-	-
	Hens	No.	40.00	5	-	-	-	-	200	-	-	-	-
	Cockerel	No.	50.00	1					50	-	-	-	-
	Feeding equipment	LS	-	200	-	-	-	-	200	-	-	-	-
ii.	Labour												
	Construction of Pen	MD	70.00	3	-	-	-	-	210	-	-	-	-
Iii	Operating cost												
	Broken rice/ millets	Kg	5.00	199	226	252	252	252	995	1260	1260	1260	1260
	G. N cake	LS		200	200	200	200	200	200	200	200	200	200
	Vaccines	Dose	0.50	97	124	150	150	150	49	62	75	75	75
iv.	Maintenance cost (10%)									106	106	106	106
	Total Investment								2304	1628	1641	1641	1641
	Output												
	Birds sold	No	40	85	106	130	130	130	3400	4240	5200	5200	5200
	Gross income (Rs)								1096	2612	3559	35.59	3559
	Inflow												
	Capital loan								1060				

	Working capital								1244	1244	1244	1244	1244
	Total inflow								2304	1244	1244	1244	1244
	Out flow												
	Repayment of loan												
	Capital Loan								530	530			
	Working capital								1244	1244	1244	1244	1244
	Interest								161	124	87	87	87
	Total outflow								1936	1898	1331	1331	1331
	Net income								1465	1958	3472	3472	3472
	Family labour @ ½ hr/day	MD		22	22	22	22	22	-	-	-	-	-
	Net return / family labour/ day			-	-	-	-	-	66	89	157	157	157

Annex 13

Goat Rearing Model

	Particulars	Unit	Unit Price (Rs.)	Number of units (year-wise)					Total cost (year wise)				
				1	2	3	4	5	1	2	3	4	5
	Investment												
i.	Capital cost												
	Construction of shed	Sqm	100	8	-	-	-	-	800	-	-	-	-
	Female goat	No.	800	2	-	--	-	-	1600	-	-	-	-
	Feeding equipment	LS	-	100	-	-	-	-	100	-	-	-	-
ii.	Operating cost												
	Vaccination	Dose	2	2	2	2	2	2	16	27	24	32	32
	Deworming	Dose	4	2	2	2	2	2	32	48	48	64	64
	Insurance	Unit	16	2	2	2	2	2	32	32	32	32	32
iii.	Service and maintenance cost	Unit	20	2	2	2	2	2	40	40	40	40	106
	Total Investment								2620	394	394	418	418
	Output												
	Sale of young lambs	No.	800	-	2	4	4	4	-	1600	3200	3200	3200
	Gross income								-2620	1206	2806	2782	2782
	Inflow												
	Capital loan								2500	-	-	-	-
	Working capital								120	394	394	418	418
	Total inflow								2620	394	394	418	418
	Out flow												
	Capital Loan								-	833	833	834	-

	Working capital								120	120	120	120	120
	Interest on loan								183	125	67	8	8
	Total outflow								303	1078	1020	962	128
	Net income								-303	522	2180	2238	3072
	Family labour @ ½ hr/day	MD		22	22	22	22	22	-	-	-	-	-
	Net return / family labour/ day			-	-	-	-	-	-14	24	99	102	140

Annex 14

Aquaculture: Watershed Community Pond Model (Size 0.2 Ha)

	Particulars	Unit	Unit Price (Rs.)	Number of units (year-wise)					Total cost (year wise)				
				1	2	3	4	5	1	2	3	4	5
	Investment												
i.	Capital cost												
	De-silting	Cum	7	200	-	-	-	-	140	-	-	-	-
	Bund repair	LS	8	200	-	-	-	-	1600	-	-	-	-
	Fishing nets	No	850	1	-	-	-	-	850	-	-	-	-
ii.	Operating cost												
	Lime	Kg	5	100	100	100	100	100	500	500	500	500	500
	G.N. cakes	Kg	9	30	30	30	30	30	270	270	270	270	270
	Rice bran	Kg	1.5	300	300	300	300	300	450	450	450	450	450
	Super phosphate	Kg	4.0	25	25	25	25	25	100	100	100	100	100
	Urea	Kg	5.00	25	25	25	25	25	125	125	125	125	125
	Cow dung	Kg	1	500	500	500	500	500	500	500	500	500	500
	Fish seed	100	100	2	2	2	2	2	200	200	200	200	200
	Lease	LS	100	100	100	100	100	100	100	100	1000	100	100
	Maintenance cost	-	-	-	-	-	-	-	-	513	513	513	513
	Total investment	-	-	-	-	-	-	-	6095	2758	2758	2758	2758
	Output												
	Fish sold	Kg	40	300	400	400	400	400	12000	16000	16000	16000	16000
	Gross income	-	-	-	-	-	-	-	5905	13245	13245	13245	13245
	Inflow												
	Medium term loan								3850	-	-	-	-
	Working capital								2245	2245	2245	2245	2245

	loan												
	Total inflow								6095	2245	2245	2245	2245
	Outflow												
	Repayment of mid-term loan								-	1283	1283	1284	-
	Repayment of working capital								2245	2245	2245	2245	2245
	Interest on med. Term loan								-	693	462	231	-
	Interest on working capital								157	157	157	157	157
	Total outflow								2302	4378	4147	3917	2402
	Net income								9698	11112	11343	11573	13088
	Labour												
	Family labour @ 2 hours in a day	MD	80	80	80	80	80	80					
	Net return / family / MD	-	-	-	-	-	-	-	121	139	142	145	163

Annex 15

Aquaculture: Individually Owned Pond Model (Size 0.2 Ha)

	Particulars	Unit	Unit Price (Rs.)	Number of units (year-wise)					Total cost (year wise)				
				1	2	3	4	5	1	2	3	4	5
	Investment												
i.	Capital cost												
	Excavation	Cum	8	3000	-	-	-	-	24000	-	-	-	-
	Inlets & outlet	LS	-	250	-	-	-	-	250	-	-	-	-
	Fishing nets	No	850	1	-	-	-	-	850	-	-	-	-
ii.	Operating cost												
	Lime	Kg	5	0	100	100	100	100	-	500	500	500	500
	G. N. cake	Kg	9	0	30	30	30	30	-	270	270	270	270
	Rice bran	Kg	150	0	300	300	300	300	-	450	450	450	450
	Super phosphate	Kg	4.00	0	25	25	25	25	-	100	100	100	100
	Urea	Kg	5.00	0	25	25	25	25	-	125	125	125	125
	Cow dung	Kg	1.00	0	500	500	500	500	-	500	500	500	500
	Fish seed	100	100	0	2	2	2	2	-	200	200	200	200
iii.	Maintenance cost 10% on work + 25 % on net									2638	2638	2638	2638
	Total investment								25100	4783	4783	4783	4783
	Output												
	Sale of fish	Kg	40	-	500	600	700	700	-	20000	24000	28000	28000
	Gross income								-25100	15217	19217	23217	23217
	Inflow												
	Medium term loan								25100	-	-	-	-

	Working capital loan								-	2145	2145	2145	2145
	Total inflow								25100	2145	2145	2145	2145
	Outflow												
	Repayment & med. Term loan								-	6275	6275	6275	6275
	Repayment of working capital								-	2145	2145	2145	2145
	Interest on med. term loan								-	4518	3389	2259	1130
	Interest on working capital								-	150	150	150	150
	Interest on working capital												
	Total out flow								-	13088	11959	10829	8700
	Net income								-	4274	9403	14533	16662
	Labour												
	Family labour @ 2 yr/day	MD	-	-	80	80	80	80	-	53	117	182	208

Annex 16

PHOTO GALLERY

1. Terracing in Village Eco-system

2. Stone Bunding for Field Cropping

3. Paddy Cultivation in *Jholla* Land

4. Community Nursery

5. Check Dam for Irrigation

6. Goatery as Rural Livelihood

7. Check Dam

8. Gully Plugging

9. Water Harvesting Structure

10. Agri-Hort System

11. Forage Bank

12. Improved Cropping

13. Wadi Model

14. Agro-Forestry

Annex 17

Itinerary of Study Team

District	Block	NGO	Team	Date
Gajapati	Rayagada	SWWS	A	3-6 May 2007
	Guma	CCD	B	3-6 May 2007
	Nuagard	JKP	C	3-6 May 2007
		PEACE	D	3-6 May 2007
Kandhamal	Tumudibandha	PRADATA	A&B	8-10 May 2007
	Kotagad	Jagruti	C&D	8-10 May 2007
Kalahandi	Th. Rampur	Gram Vikas	A	12-15 May 2007
		Antodaya	B	12-15 May 2007
	Lanjigarh	GBT	C&D	12-15 May 2007
Koraput	Laxmipur	CYSD	C	16-19 May 2007
	Narayan patna	VIKAS	D	16-19 May 2007
	Bandhugaon	RAAS	A&B	17-19 May 2007

Annex 18

Composition of Study Team

Coordinators:	Dr H.N.Mohanty
	Sri A.K.Dey
Principal Investigator :	Dr M.K.Mohanty
Group A:	Alok Kumar Das
	Uttam Kumar Bhukta
	Chakradhar Sahu
	Raghunath Sethi
Group B.	Mahendra Kumar Swain
	Biswa ranjan Ray
Group C:	Maheswar Jena
	Pratap Kumar Jena
	Ranjan Kumar Sahu
	Monoj Kumar Jena
	Surendra Narayan Ray
Group D:	Jitendra Sahu
	Rama Shankar Das
	Manas Ranjan Mishra
	Ranjan Kumar Jena
	Anadi Charan Mohanty
Experts :	Dr. A.K.Behera, Team Leader
	Jayesh Bhatia, NRMC
	B. Maharana, Knowledge Trust
	P.C.Achary, Knowledge Trust
	N.K.Mohanty, Knowledge Trust
	Swati Tanmaya Mishra, Knowledge Trust
	Minakshi Mishra, Gender Expert
	Dr. P.K.Mohapatra, Veterinary Expert
	P.K.Sahu, Marketing Expert
	Biswajit Nayak, Marketing Expert

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