NATURAL RESOURCES SYSTEMS PROGRAMME

PROJECT REPORT[1]

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Report Title

Enabling rural poor for better livelihoods through improved natural resource management in SAT, India. Scientific report. Part 1.

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NRSP Production System

Semi Arid

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SECTION-I

Project Overview

1. Introduction

This section gives a brief account of how the project originated, the project approach, and the project sites. It also gives an overview of the project partners, project team and the approach to implementation of the project.

1.1 Background

Natural resources (NRs) are the main stay of the life supporting system in rural areas. Both humans and livestock sustain on this resource base. However, growing population pressure and over exploitation is leading to rapid degradation of this resource base. Common property resources (CPRs) like grazing lands and water bodies are key avenues for income and livelihood for poor people in the villages but demographic pressures are also taking a heavy toll on the CPRs: this affects the livelihoods of the poor. In addition to the declining quality of natural resources in CPRs and PPRs (private property resources), the evolving socio-economic and demographic patterns in the rural areas are negatively influencing the ability of poor to access NRs. Against this backdrop, the project "Enabling Rural Poor for Better Livelihoods through Improved Natural Resource Management in Semi-Arid India" was sponsored by the Natural Resources Systems Programme (NRSP) of the Department for International Development (DFID) (of the Government of the United Kingdom), and was led by the Central Research Institute for Dryland Agriculture (CRIDA), in partnership with other institutes in the National Agricultural Research System (NARS), the International Crops Research Institute for the Semi-arid tropics (ICRISAT) and a Non-governmental Organization (NGO). The project has 5 clearly defined outputs which cover research processes, specific technical interventions in the clusters related to NRs, and communication and documentation of the improved understanding/lessons learnt from project implementation. The actual outcomes of each of the outputs are described in sections 2-5. The project commenced preparatory field work in January 2003, was officially inaugurated in May 2003 and closed in March 2005. Field activities were supported in Andhra Pradesh and Karnataka in southern India.

In its design, the project drew upon the experiences gained in three earlier NRSP projects (NRSP R 7877, 2002; NRSP R 7973, 2002; NRSP R 7974, 2002) "Common pool resources in semi-arid India – dynamics, management and livelihood contributions"; "Policy implications of CPR knowledge in India, Zimbabwe and Tanzania"; "Human and social capital aspects of soil nutrient management, semi-arid India". The first two projects considered the status, and livelihood role of CPR and the emanating policy implications of this. Some of the key findings are degradation and encroachment of CPRs, open access and unmanaged use of grazing lands, the need for research into the conditions for successful CPR management, for localization of responsibility for CPR management and for local capacity building. The third project (R 7974) investigated the human and social capital aspects of soil nutrient management practices. Farmers were found to manage the soil fertility prudently through a range of practices and are aware of

the ill effects of overuse of chemical fertilizers. Livestock redistribution has resulted in an emerging market for organic matter (OM), which is an opportunity for the increasing proportion of landless poor who now own livestock. It was also observed that soil fertility constraints are only one component of a larger set of constraints that limit productivity and that addressing this aspect of NR management is better achieved through a livelihoods perspective, and developing the capacity of self help groups to initiate effective NR management initiatives.

These issues are considered in this project. It takes a livelihood perspective, addresses the necessary capacity building of organizations to enable them to put mechanisms in place that try to manage the CPRs in a way that contributes to the livelihoods of the poor; through appropriate integrated technological crop and livestock interventions to improve productivity on CPR and private property resources (PPR), it gives importance to soil fertility management; and through its different communication activities, provides policy makers with information on the issues arising from the project.

1.2. Project Overview

The project spins around its goal of identifying and promoting strategies for improving livelihoods of the rural poor in semi-arid areas of India through integrated management and increased productivity of both CPRs and PPRs and better access of the poor to CPRs. The CPRs would include water, grazing land and forest as the basic resources. The development of these resources would depend on the status and management of NRs of the region i.e. soil, water and vegetation. The livestock of landless poor, who depend on grazing land, would receive prime importance in the project. The project was to identify and promote strategies for sustainable management of NRs in a participatory, poverty and gender sensitive mode, through firstly understanding the local livelihoods, then applying research and local knowledge to develop the improved livelihood strategies, and through establishing an enabling environment and social mechanisms for managing and sustaining the change. The project was to focus on specified target groups (small & marginal farmers, landless and women) and target areas (8 villages, 7 from A.P. and 1 from Karnataka). However, the project also sought to take a more inclusive approach to facilitate smooth implementation of the project as well as to create conditions for sustainability beyond the project period. Through involvement of the rural community and village organisations and institutions during project implementation, livelihood improvements in post-project period should be better or sustained.

Facilitation was to be done by the lead and participating institutions for evolving purposeful and socially active organisations and/or institutions through consensus, and for strengthening the understanding of the importance and relevance to their livelihoods of improving the management of NRs. The project will have a spin off effect on the policy makers so that the outcomes/lessons are upscaled and replicated through organized service providers (banks, development departments etc.)

The project would contribute to a positive change in the livelihoods of the rural poor if its interventions resulted in

- Increasing the productivity of water through appropriate rainwater harvesting utilization and nutrient management technologies in target areas,
- Increasing access to CPRs by the poor by strengthening social institutions at the village level.
- Strengthening the livestock based farming for addressing the landless people and marginal farmers.
- Understanding the strengths and weakness of rural service providers for further strengthening their services through capacity building,
- Increased adoption of simple and proven technologies, techniques / interventions / tools and implements relating to soil water conservation, INM and livestock production & management in the target areas,
- Improved livelihood quality of the rural women by reducing drudgery and hardship in farming operations,

All project interventions were to be fully participatory with target group members and rural institutions/organizations as partners in planning, implementation and review.

1.3 Project Location

The project was implemented in a cluster of 3 and 4 villages respectively in each of two districts of Andhra Pradesh (Anantapur and Mahabubnagar) and in one village in one district of Karnataka (Tumkur). Figure1.1 locates the target districts in India. The names of the villages in the selected clusters are listed in Table 1.1.

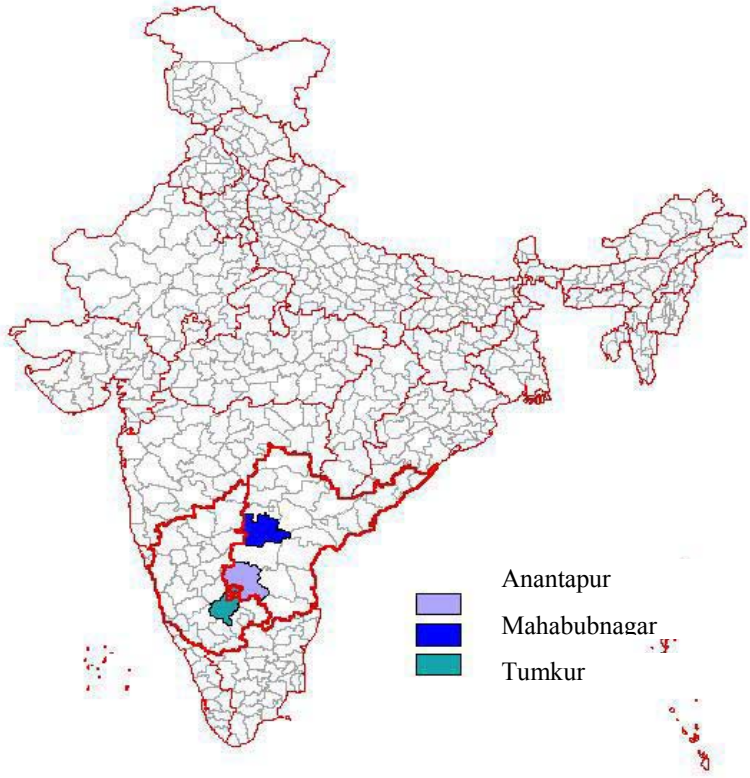

Figure.1.1: Map of India showing project clusters

The locations were chosen to represent the natural resource base available to rural communities in semi-arid regions in southern India. The previous exposure of the villages to NR related development aid was considered (villages that had had extensive and recent assistance e.g. through the Watershed Development Programme were excluded) as were logistic issues of access (contiguity of villages within a district for efficient use of travel time). The local field experience of the partner institutes and particularly the NGO BIRD-K (Bharatiya Agro-Industry Integrated Rural Development-Karnataka) was also considered.

The three districts have contrasting characteristics in terms of climate and rainfall viz. semi arid in Mahabubnagar and Tumkur and arid in Anantapur; soils range from very shallow-to-shallow and are mostly alfisols in all the three clusters.

Anantapur, the largest district of Andhra Pradesh, is a hot arid zone. It falls under the rain shadow region with a mean annual rainfall of 520 mm. The topography of the district is undulating with ridges and valleys. The soils are red sandy loams with patches of black cotton soils in certain areas. Mahabubnagar is another chronically drought prone district of Andhra Pradesh with light textured soils and severe erosion. Crop failures are common and people's dependence on livestock is high. Though the rainfall is scanty in both the districts, there are opportunities still to harvest rainwater by preventing or accumulating runoff and to use it productively (CRIDA, 2000). Excess withdrawal of groundwater is a major problem as groundwater is considered as private property and its use is not at all regulated at present. The relative economics of irrigated agriculture vis-à-vis rainfed agriculture, government policies with respect to power supply (free power supply to irrigation) and credit (easily available) are the principal reasons of excessive groundwater use. (In combination, they resulted in large numbers of bore wells being dug). The government recently enacted the Andhra Pradesh Water, Land and Trees Act (in 2002) to regulate the groundwater use, but it is yet to be implemented. Severe degradation of marginal and forest lands has occurred in the last four decades because of population pressure. Acute scarcity of drinking water, fodder and fuel is faced frequently.

Tumkur in Karnataka is part of the central dry zone of Karnataka and has bimodal rainfall distribution. Soils are mostly sandy loam with high slopes and high erosion rates. Because of the high altitude, the temperatures are relatively low. The cropping pattern is distinct compared to the other two clusters. Apart from rainfed crops such as finger millet and groundnut, orchards of coconut are a major economic activity in the district.

Table 1.1: Villages of the three clusters in 3 target districts

District	**Mandal or block**	**Villages part of the cluster**
Anantapur (A.P.)	Atmakur	Pampanur Pampanur Tanda Y Kothapalli
Mahabubnagar (A.P.)	Mahabubnagar	Dharmapur Chowdarapalli Zamistapur Bukkalonpalli
Tumkur (Karnataka)	Tiptur	Shankaranhalli

In all the clusters, a majority of families depend on agriculture. The land holdings are small. A significant proportion of families in most of the villages are below poverty line (BPL). The proportion of BPL families is more than 50 per cent in six out of eight project villages (Table 2.2, Section 2). Most of the common property resources are privatized. Villagers face acute water and fodder shortages particularly during summer. However, all 3 clusters have been receiving some degree of developmental and financial inputs during the last 2 decades, which resulted in the formation of community, based Self Help Groups (SHGs). The activities of these groups were however limited to thrift only. (Further information on the biophysical, demographic, institutional and agricultural profiles of these clusters is presented in section 2; as relevant in Sections 3-5; and in Annexure C PRA Reports).

1.4 Project Partners

The project was implemented and managed by a partnership of leading research institutes in the region and a non-governmental organization with considerable field experience (Figure 1.2). CRIDA, which led the project, is a national research institute under the Indian Council of Agricultural Research (ICAR) with a primary mandate of improving the productivity and sustainability of the rainfed farming systems all over the country. It has a national network of 25 cooperating centres and a team of 70 well-trained multidisciplinary scientists. CRIDA has developed a large number of cost effective technologies for management of natural resources in rainfed areas and these have helped in stabilizing the productivity of crops and livestock in these regions.

ICRISAT is an international institute, part of the Consultative Group on International Agricultural Research (CGIAR) system, head quartered in Hyderabad, Andhra Pradesh. The institute has a mandate for improving the productivity of major crops grown in the Semi-arid Tropical (SAT) regions of the world. ICRISAT also has a strong natural resources management research group, which has been actively involved in several national and regional projects in the country. In particular, the institute is an active partner in the Andhra Pradesh Rural Livelihood Project (APRLP), which has a focus on improving livelihoods, and has field experience in AP, including the project sites.

The University of Agricultural Sciences, Bangalore and Acharya N.G. Ranga Agricultural University, Hyderabad are, respectively, the Karnataka and Andhra Pradesh state Agricultural Universities. They have research centres close to the project clusters and have adequate knowledge on the natural resources of the region and the socio economic dynamics of the target population.

BIRD-K an associate organization of BAIF (Bharatiya Agro Industries Foundation), is a leading national NGO with more than 50 years experience in the area of rural development, particularly in participatory natural resources management and livestock improvement. It was working actively in Tumkur District and recently started working in Mahabubnagar district and had a network of field based staff.

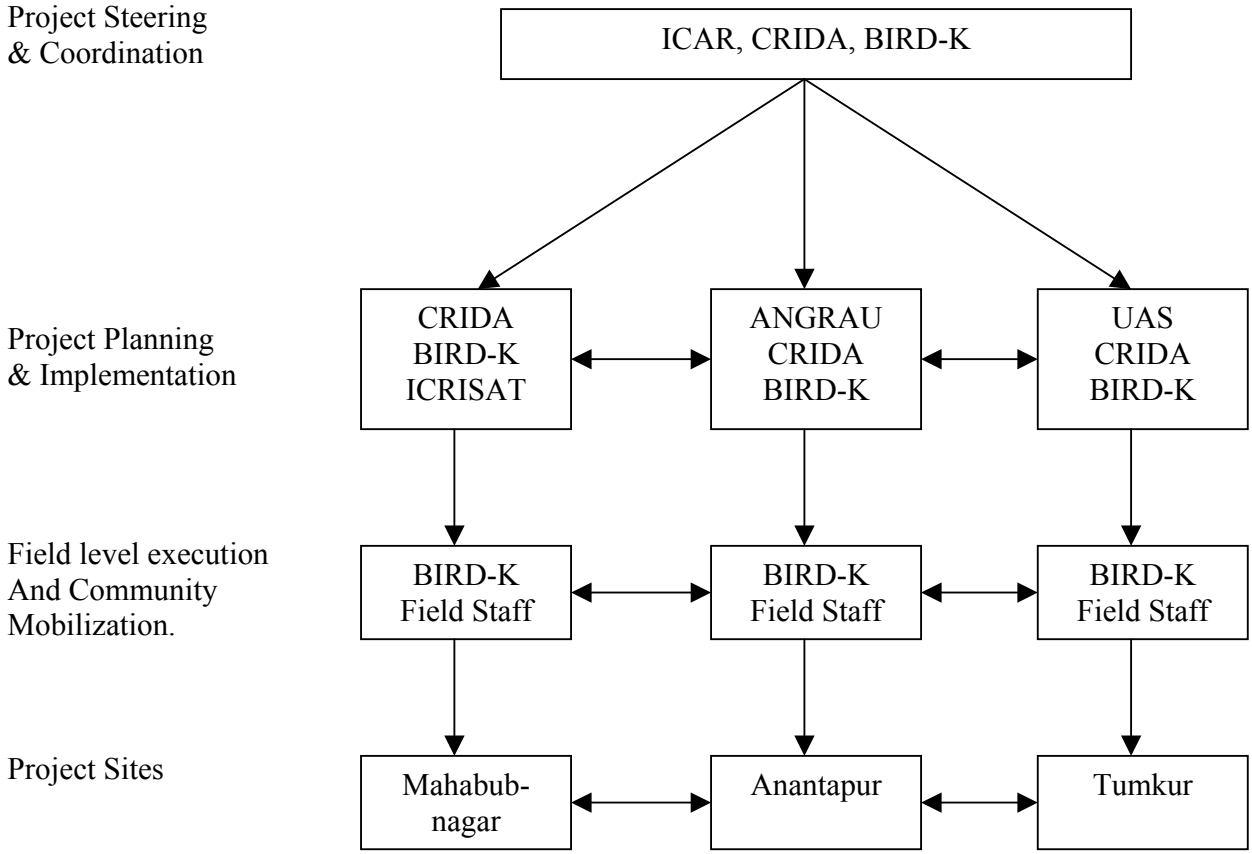

Figure 1.2: Schematic diagram of project structure

1.5. Partner expertise and knowledge base

Multidisciplinary teams of scientists and other experts were constituted from each of these institutions keeping in view the objectives of the project and the responsibilities of individual institutions. The team consisted of agronomists, soil scientists, soil and water conservation engineers, economists and communication specialists. The field-based implementing agency, BIRD-K have proven expertise in social mobilization and also in issues related to livestock development. The specialist background of the project team helped in identifying a range of options for consideration by the village households before they chose an appropriate technological or organizational intervention. Also, the expertise and knowledge of the project staff came in handy while working with the villagers to deal with any problems that arose during the course of implementing the interventions. The names and specializations of the team members are given in **Appendix 1**.

Considering the size and diversity of the project team, putting in place an effective communication mechanism was thought imperative to take project work forward. While regular communication was done through emails and telephone, interactions through different workshops gave opportunities to review the progress and plan for the future. Such a regular interaction was found highly useful. In hindsight, however, it is felt better to have a more compact team, which can put in a larger proportion of time on the project than to have a larger team with each member working for relatively shorter time in the project.

The project also kept the various development agencies that are active in the region informed, in particular the state departments of agriculture and animal husbandry. Representatives of these agencies participated in the launch workshop and regional workshops of the project. In some cases, they were actively involved in project activities. For example, the officers from the department of animal husbandry participated in the animal health camp conducted in the Mahabubnagar cluster. Their services were also utilized in training the local animal health practitioners. The intention was that these agencies could pick up the project experiences and adopt them in their activities.

1.6 Project process

The project followed a participatory approach to developing interventions with stakeholder farmers in the selected clusters. The approach was to take advantage of indigenous knowledge and the capacity of farmers to experiment and solve their own problems. It uses many of the principles of Participatory Rural Appraisal (PRA), but extends the active participation of farmers well beyond the initial stage of appraisal to intervention planning, intervention development and evaluation on farms and in the village. In this way, farmer-stakeholder input to project implementation decisions is continuous. The approach begins with in-depth participatory diagnosis by a broad cross section of the community, including men and women from the different wealth and age groups. This process helps the villagers to define, group and prioritize their main development needs, opportunities and problems.

After identifying the major issues, various interventions, mostly in the form of participatory or observation trials together with capacity building of village organisations and villagers, were planned and discussed in meetings with the volunteer villagers who formed an advisory committee (S*alaha Samithi*) in the village. Several interventions were brought to the

doorsteps of farmers in the form of a 'basket' of technologies'. The farmers were expected to select those interventions they thought could lead to better farm management systems. Then, a comprehensive schedule for implementing the interventions was discussed and finalised in the meetings. The farmer advisory committee facilitated implementation and monitoring and evaluation of interventions and adaptations were considered and changes made if agreed with the community. The core principle of this process is active, decision-making involvement of farmers at all stages of intervention development with specialist input and facilitation by project staff.

1.6.1.Project timetable

The project though planned to officially commence in October 2002, could only begin the actual work in January 2003. The project was concluded in March 2005. The important events of the project are given in Table 1.2.

Table 1.2. Important events in the project

Period	Subject	Participants
April 2002	NRSP inception support visit to CRIDA to facilitate developing project proposal and log frame	Representatives from NRSP, U.K., AICRPDA Centres, Solapur, Bijapur, Anantapur and Bangalore CWS (NGO), SDDDPA, Mahabubnagar , CRIDA
December 2002	Review proposal development	Dr. Margaret Quin & Dr. John Gaunt from NRSP and CRIDA staff and Mr. M.S. Ashok, Consultant, Bangalore
January 2003	Start of preliminary field investigations and community contact	CRIDA, UAS, ANGRAU, BIRD-K ,cluster communities
February – March 2003	PRA	BIRD-K, CRIDA, ANGRAU, UAS (B), Village communities
May 2003	Formal launch of the project	Representatives from NRSP, CRIDA, ICAR, ANGRAU, UAS, BIRD-K ,ICRISAT
April-May 2003	Intervention identification & planning	Project staff, villagers and village organizations
June 2003 onwards	Intervention implementation, follow-up and review	Project staff, villagers and village organizations

November 2003	Process Documentation workshop	All project staff, CRIDA and Collaborating centres
February 2004	Mid-term review	NRSP representatives, CRIDA, ANGRAU, UAS, ICRISAT, BIRD-K ,ICAR
April, 2004	Annual Workshop to review the progress	All project staff, CRIDA and Collaborating centres
June, 2004	Discussion on mid-term review	Dr. Christopher Floyd from NRSP and project staff, CRIDA
September 2004	Regional (project review) Workshop (Anantapur)	All project staff and representatives from state departments of agriculture, animal husbandry, fisheries, NGOs, and administrators
December 2004	Regional project review workshop (Mahabubnagar)	
January, 2005	Regional (project review) workshop (Tumkur))	
March, 2005	Technical report planning workshop	NRSP and Project staff
July 2005	Submission of final report	CRIDA

1.6.2. Nature of project

The project was designed to be participatory and flexible. Though the key issues the project attempted to address were identified in the beginning, the ways and means of achieving them were arrived at by actively involving the rural communities. For the issues identified as having a bearing on livelihoods, a range of options was considered by the village households and the project staff in interactive group discussions and the villagers were given opportunity to choose what ever they found was feasible. These chosen options were then implemented and evaluated in an action research mode. The project did not delimit the budget into specific types of technological interventions and thus provided for flexibility in executing the interventions chosen by the villagers. Thus the project decisions were more interactive and flexible within the focused theme of NRM and livelihood enhancement: this contrasts both with a rigid top-down approach where the clientele can only accept or reject a given option and with a completely open-ended approach wherein the emphasis is completely on 'enabling' without any material or financial support.

Appendix 1.1 Project Team

Project coordination and steering:

JS Samra, DDG, ICAR

Gurbachan Singh, ADG, ICAR

H P Singh, Director, CRIDA (till 31 May 2004)

Y S Ramakrishna (since 01 June 2004)

K V Subrahmanyam, Principal Investigator

Project Technical Team

CRIDA

K V Subrahmanyam	(Agricultural Economist)
M Osman	(Agronomist)
B Venkateswarlu	(Microbiologist)
P K Mishra	(Soil and Water Conservation Engineer)
A K Mishra	(Livestock Specialist)
C A Rama Rao	(Agricultural Economist)
S Dixit	(Agricultural Extension Scientist)
V M Mayande	(Farm Machinery Specialist)
V Maruthi	(Agronomist)
K Srinivas	(Soil Scientist)
I Srinivas	(Farm Machinery Engineer)
D B V Ramana	(Livestock Specialist)
K Nagasri	(Agricultural Extension Scientist)

ANGRAU

T Y Reddy	(Agronomist)
D Balaguravaiah	(Soil Scientist)
M V S Babu	(Soil Scientist)

UAS, Bangalore

M A Sankar	(Agronomist)
A Manjunath	(Plant Breeder)

ICRISAT

S P Wani	(Soil Fertility and Watershed Management)
T J Rego	(Soil Scientist)

BIRD -K

G N S Reddy	Vice-president BIRD-K
C.Doreswamy	Programme co-ordinator,
B.Shivarudrappa	Joint programme co-ordinator

All the project scientists spent only a part of time on the project. However, the field-level implementation of the project was supported by fully committed 3-4 field staff of BIRD-K in each of the three clusters. In addition, three research associates and one data entry operator were recruited in the project to provide technical and administrative assistance.

Reference

Central Research Institute for Dryland Agriculture 2000, ACIAR Project Report., Hyderabad, India. Central Research Institute for Dryland Agriculture

Section 2

Capacity development and cross-cutting methodologies

Link to project log frame

Output-I: Capacity of rural institutions to provide the poor better access to specified natural resources strengthened

OVI (Objectively verifiable indicators)

1 By 2003, rural institutions (e.g. CBOs, PRIs, other User/Self-Help Groups, development organizations) aware of the need of the measures to provide improved access to specified natural resources.

2 By 2005 rural institutions in at least two target areas report adoption of some measures/mechanisms that enhance access of poor to specified NRS.

Activities

1. Identification of existing institutions and their role in selected villages.
2. Participatory Rural Appraisal for ascertaining the availability of and access to specified NRs.
3. Interactive workshops for sensitization of CBOs and rural institutions.
4. Mobilisation and formation of user groups (UG) for improved access to CPRs and PPRs.
5. Capacity building of UGs and PRIs (Panchayat Raj Institute) through training and field visits to successful project sites.

2.1 Introduction

This section deals with Output 1 of the project and by so doing, deals with the methodologies adopted to achieve Outputs 2-4. Output 1 is related to strengthening the capacity of the rural institutions to provide the rural poor with better access to specified natural resources. Building up of social and human capital in the community is the main concern addressed. The activities undertaken to achieve this output were so designed that they would create awareness about the project among the rural community and the rural institutions and organizations, help the project staff understand the existing agro-climatic, NR and socio-economic setting of the villages so that they could work effectively with the villagers and finally work with the villagers to develop and put in place mechanisms and processes that would help achieve outputs 1-4 as well as enable the community to deal with their problems. This relationship between the outputs is presented in Figure 2.

Attempts were made under this output to:

- firstly create a general awareness within the cluster villages about the project;
- analyze with the villagers the NRM-related issues that have a bearing on their livelihoods,
- analyze the existing situations for opportunities for possible interventions that could improve rural livelihoods, and
- foster an enabling environment that would elicit and ensure people's participation, strengthen their capacity to manage their own NR development, and ensure that the interventions were appropriately targeted, facilitating faster adoption.

2.2 Participatory Rural Appraisal (PRA)

The participatory nature of this project has been introduced in Section 1. One part of this participatory approach is the importance of understanding the bio-physical, socio-cultural and economic contexts in which any interventions will occur. The PRA provided an occasion for this learning interaction between the communities and staff from partner institutes and its findings informed and guided all outputs.

2.2.1 PRA Process

PRA was conducted in all the three clusters of villages in order to assess the existing farming situations, conditions and use of NRs under common and private property regimes, existing rural institutions (the PRI), CBOs such as Self Help Groups (SHG), Youth Clubs etc) and their role, and also to create awareness about the project. The process adopted to conduct PRA typically included fixing prior dates in consultation with the PRI and the village community, conducting a *gram sabha* (village assembly) to put forth the project objectives and project scope and then conduct the PRA spread over 3-4 days. Before actual conduct of the PRA the project staff discussed about a rough time-table for PRA including who should participate in the PRA, established contacts with the key persons in the villages and the intended outcome of the PRA.

The PRA was facilitated principally by the field staff of the project (BIRD-K staff) and the technical experts also participated to moderate the proceedings with a view to achieving the intended purpose of the PRA (Table 2.1). A majority of the villagers including the PRI participated in various PRA exercises. The existing agro-climatic and socio-economic situation in all the three clusters was characterized using various PRA tools such as social mapping, resource mapping, village transect, seasonality and trend analyses, Venn diagram, wealth ranking and focus group discussions involving the PRIs, women, and landless. The major problems related to crop and livestock production and NRM in the villages were identified during the PRA. The outcome of the PRA was then considered and discussed among the project staff as well as with the villagers to arrive at appropriate solutions.

Table 2.1 Steps in the PRA process

When	PRA activity	Output	Participants
Week 1	Planning for PRA	Time schedules, participants, outline of intended outcome	Project staff, key persons from the villages
Week 2	Conduct of PRA - mapping, wealth ranking, problem-cause diagrams, Venn-diagrams, etc.	Characterization of agro-climatic and socio-economic setting in the villages	Project staff, villagers
Week 4 onwards continually	Focus group discussions with specific groups/individuals	Identification and implementation of potential solutions	Project staff, and villagers

2.2.2. PRA Findings

The major findings from PRA in all the three clusters of villages are summarized in Tables 2.2 to 2.4. Full details are contained in Annexure C.

2.2.2.1. Socio-economic and agro-climatic profile

It can be seen from Table 2.2 that the number of households varied from 150 in Pampanur in Anantapur cluster to 528 in Dharmapur in Mahabubnagar cluster. The number of SC families was also found to vary across villages. A majority of land holdings were found to be small (< 1ha) in almost all the villages. The proportion of poor families varied between 21 per cent in Y.Kothapalli to 69 per cent in Pampanur in the same Anantapur cluster. Thus, a conspicuous proportion of households in the villages were poor. A majority of villages are not well placed in terms of infrastructure development. For example, out of eight villages selected only two have veterinary clinics, only one has a hospital and only one village in Tumkur has a milk collection centre (Table 2.3).

Table 2.2. Socio-economic and demographic profile of the three clusters

Parameter	**Anantapur**			**Mahabubnagar**				**Tumkur**
	Pampanur	**P. thanda**	**Y.Kotha -pally**	**Zamista-pur**	**Bukkal-onpally**	**Dhar-mapur**	**Chowder pally**	**Shankarna halli**
Population	770	746	1055	2316	1535	2486	1244	835
Male	373 (48)	372 (50)	531(51)	1112 (48)	770 (51)	1274 (51)	624 (51)	285 (49)
Female	397 (52)	374 (50)	524(49)	1204(52)	765(49)	1212 (49)	620 (49)	295 (51)
No. of families	150	160	220	425	267	528	297	235
No. of SC families	53 (35)	-	47 (21)	250 (58)	52 (19)	150 (28)	85 (29)	54 (23)
No. of ST families	-	160 (100)	3	-	-	-	-	6 (3)
Literacy %	35	37	40	39.9	52.9	40.1	36.6	72.5
Farm households								
Small (<1 ha)	35 (36)	5 (4)	68 (38)	196 (55)	103 (49)	250 (54)	147 (69)	68 (29)
Medium (1-2 ha)	38 (39)	53 (47)	77 (43)	107 (30)	58 (27)	149 (32)	39 (18)	68 (29)
Large (2-4 ha)	22 (23)	42 (38)	22 (12)	35 (10)	36 (17)	44 (9)	17 (8)	66 (28)
Very large (>4 ha)	12 (12)	12 (11)	12 (7)	17 (5)	15 (7)	23 (5)	10 (5)	33 (14)
Landless families								
Wage employment	40	30	11	42	35	31	68	20
Self employment	shepherds	limestone	flowers	20	17	15	19	79
Services: Govt/pvt.			-	8	3	16	2	44
Wealth ranking								
Rich/ upper class	8 (6)	8 (6)	29 (14)	30 (7)	60 (22)	40 (8)	85 (8)	26 (11)
Middle class	33 (25)	40 (28)	135 (65)	110 (26)	41 (15)	190 (36)	105 (35)	130 (55)
BPL/poor	92 (69)	94 (66)	44 (21)	285 (67)	166 (62)	298 (56)	107 (36)	79 (34)

Figures in parentheses are percentages.

Table 2.3. Infrastructure and service facilities available in the clusters (No.)

Particulars	Anantapur	Mahabubnagar	Tumkur
Primary school (No)	3	4	1
High school	-	1	1
Post office	1	1	-
Gram panchayat office	1	4	1
Veterinary clinic	1	1	-
Hospital	-	1	-
Anganwadi	-	4	1
Milk collection center	-	0	1
Self Help Groups (SHG)	2	4	5
DWACRA group	17	-	-
CMEY group	1	-	-
VSS	1	3	-

An assessment of the agro-climatic situation revealed that the three clusters differed in terms of rainfall, soil types and cropping pattern. Whereas the Anantapur and Mahabubnagar clusters were more drought prone because of low rainfall and poor water holding capacity of the soils, the Tumkur cluster was relatively better placed because of better soils and higher altitude. These differences had implications for identifying appropriate solutions. The problems identified by the villagers (Table 2.5) have become the basis for planning other technological interventions that are discussed in the subsequent sections. Further details from the PRA are presented in these sections (Sections 3-5) as relevant to the output and activities being described.

2.2.2.2 CPRs

It came out during the PRA that the use of the CPRs such as tank beds and water bodies are generally regulated by the PRI. The PRI either grants the use rights to a specific user group or individuals. In some cases, the use of CPRs is generally regulated by the conventions that have been in vogue for generations. However, such local institutions are on the decline now. The PRA also revealed that the most of the common property land resources were privatized as a result of government policies. However, a significant part of those privatized lands continue to be *de facto* CPRs because of various reasons (e.g. poor quality of

land which discourages investment by the owner). In such private lands, though they are *de facto* CPRs, it is unwise to plan for community investments. Some opportunities where the existing CPRs could be put to better use were identified. For example, in one village (Chowderpally) in Mahabubnagar cluster, the tank bed was identified as a potential livelihood option for the poor if access was provided for cultivation. Similarly, in one Anantapur cluster village (Pampanur), temple endowment land was identified for use by the poor for their livelihoods. How a combination of institutional and technological interventions proved to be effective in such endeavours is described in subsequent sections and in Annexure G: Case Studies.

Table 2.4 Existing agro-climatic situations in the three project clusters

Particulars	**Anantapur**	**Mahabubnagar**	**Tumkur**
Rainfall (mm)	520	600	600
Soil	Red, sandy, loamy; patches of black soil. Depth: 30-50 cm, moderate in nutrient	Red sandy, patches of black clayey soil, 30 - 50 cm depth, moderate in nutrient content	Red, sandy, loamy, small pebbles, saline soils; depth 20 50cm; moderate in nutrient.
Land use			
Total area (ha)	361	10686	NA
Forest (ha)		3073	Nil
Fallows and waste lands (ha)	51	2027	272
Net Cultivated area (ha)	304	3970	517
Major crops			
Kharif (Rainy season)	Groundnut, pigeonpea, sorghum, castor, other pulses; papaya, sweet lime	Castor, sorghum, maize, paddy, groundnut, pigeonpea	Finger millet, sorghum, pulses, groundnut, castor, sesame, niger, coconut, banana, mango, paddy
Rabi (Post-rainy season)	Groundnut, paddy, horse gram, vegetables	Ground nut, paddy, vegetables	Sorghum
Irrigation sources			
Tanks	2 (55 ha)	25	7

Particulars	Anantapur	Mahabubnagar	Tumkur
Dug & Bore wells (No)	25 + 100	448	65
Check dam (No)	1 (50 ha)	16	1
Percolation tank (No)		5	
Farm pond (No)		15	32

2.2.2.3 Existing rural organizations

The PRA was used to identify the existing village organizations in the three clusters. It was observed that PRI, a local government institution democratically elected, and other CBOs such as SHGs, Youth Clubs, *Mahila Mandals* (Women clubs), *Vana Samrakshana Samithis* (VSS) (Joint Forest Management Groups), etc. were existing in all the villages. Village administration and development are the mandate of the PRI. SHGs are relatively recently initiated under various development projects being implemented by government and non-government agencies. Creating financial assets and making them accessible to the members within the group for investment needs is the chief motive of SHGs. Institutions such as VSS are formed specifically to protect and manage the forest resources by working with the forest department.

No specific groups with an explicit interest to deal with the problems in crop and livestock production were found to exist in the village. Thus a need was felt by the village community and the project staff to form institutions based on specific needs as well as an institution that can facilitate the project activities in the larger interests of the village. The intention was that these institutions, if properly enabled, would be able to start addressing various development needs. Though a PRI exists in all the villages, it is not appropriately placed to mobilize the people's participation given its political nature and its preoccupation with other village administrative responsibilities. The project however did take care to keep the PRI informed from time to time as to what was going on in the project.Involvement of the PRI in project supported interventions was thought to be essential for sustainability.

The PRA also created an awareness of the project activities among the community and helped project staff understand the village dynamics better which subsequently helped in executing the project interventions.

2.2.2.4 Opportunities, issues and problems identified

The problems identified by the villagers (Table 2.5) have become the basis for planning other technological interventions that are discussed in the subsequent sections.

In follow-up meetings, these issues and options for interventions (Table 2.6) were discussed thoroughly within the villages to enable villagers to identify their preferred interventions. This process and the outcomes are presented by output in Sections 3-5.

In addition to the problems mentioned, there were some generic problems expressed by all the villagers during PRA. These included non-availability of quality seeds at affordable prices, unremunerative output prices, escalating cost of cultivation, and deteriorating water availability.

2.2.2.5 Sensitization of CBOs and rural institutions

By involving various institutions existing in the village (Table 2.3) in the PRA and focus group discussions, awareness was created regarding the condition and use of the NRs and possible interventions that could be made for better use of NRs. Thus, PRIs and other CBOs were sensitized regarding the need for better NRM. This process of sensitization and awareness was reinforced during the interactions throughout the project duration as well as during the regional workshops that were conducted in the clusters and attended by representatives of the government and non-government agencies.

Table 2.5. Issues identified in the three clusters

Anantapur	Mahabubnagar	Tumkur
Lack of appropriate village organizations (VO) to support the NR-based livelihood activities	Lack of appropriate village institutions (VI) to support the NR-based livelihood activities	Lack of appropriate village institutions (VI) to support the NR-based livelihood activities
Poor crop yields due to moisture scarcity conditions	Declining *rabi* cropping due to depletion of ground water	
Non-availability of appropriate crop varieties	Poor crop yields because of use of inferior seed	Poor crop yields because of local varieties

Monocropping of groundnut and lack of alternative choices		Lack of crop diversification
Lower profits from crop production due to high costs on seed and fertilizer		Lack of vegetation, soil erosion, low fertility,
Inadequate fodder supply to milch animals	Low milk yields of animals because of local breeds and fodder scarcity	Lack of diversified enterprises
	Non-availability of appropriate implements causing drudgery and lengthy farm operations	Lack of improved agricultural tools and implements
	Poor management of CPRs	Lack of CPR land due to encroachment
		Landless labourers do not have livelihood options

2.3.*Salaha Samithi* (SS)

2.3.1 Formation of SS

Formation of a *Salaha Samithi* (SS) in the cluster is an important institutional innovation developed by the communities and the project and put in place in all the three clusters. The SS, an advisory group of villagers, is formed considering the need expressed by the villages for an institution that can facilitate the implementation of the project activities in association with the project staff (see Box 2.1). The SS is formed by members who are voluntarily willing to work for the common good of the villagers and who are acceptable to the community as a whole. It is an informal and inclusive body in which existing CBOs (PRIs and SHGs) are also represented in order to achieve coherence in the activities and to keep the PRI informed of what is going on in the project. Women and weaker sections (SC, ST) of the society were also included in the SS.

Table 2.6 Intervention choices for cluster villagers

Lack of awareness and confidence [to initiate NRM improvements] among people
Formation and capacity building of people's organizations
Training programmes
Exposure visits
Water scarcity in agriculture
Construction of trench-cum-bunds, farm ponds, water diversion structures, mini-percolation tank, check dam, gully plugs
Testing irrigated dry crops
Poor crop yield
Diversified farming systems (agri/silvi/horti/pasture systems)
Introduction of improved varieties
irrigated dry crops
integrated nutrient management (INM) practices
integrated pest management (IPM) practices
improved implements
Soil and water conservation (se above)
Poor fodder resources
Introduction of agri-silvi/pastoral system
multi-purpose trees
Supply of fodder slips / seeds
Low cattle productivity
Awareness creation about cross-breeds
Establishing local AI (artificial insemination) and pregnancy diagnosis (PD)
Improving livestock management through deworming, vaccination and castration camps
Testing feed supplements

Landless labourers do not have livelihood options	
Introduction of:	backyard poultry
	vermicomposting
	sheep rearing
Improving access of poor to alternative livelihoods	
Introduction of	improved backyard poultry
	vermicomposting
	forest nursery
	bee keeping
Developing sheep-rearing	
Increasing access to CPRs	

Box 2.1. Steps in formation of SS

Arriving at a decision to form an SS. Based on the PRA outcome, both the community and the project staff desired to initiate such an organization.

Identification of individuals willing to participate in SS. Individuals volunteered or were nominated during interactions with the community.

Obtaining the broad consensus of the villagers. The candidature of the individuals for participation in SS was discussed in *gram sabha* and a consensus obtained.

Agreeing upon the roles and responsibilities of the members. Discussions were held with the SS members.

Capacity building of the SS. The members were trained to keep minutes and accounts (to be able to track the cash flow) and on-the-job backup was provided by project field staff (BIRD-K).

In spite of the individuals with motivation and willingness to work for the village development, no organization such as SS had already been formed in the villages. The project experience suggests that motivation and willingness still needed to be inspired around a cause and that an external stimulus (such as a project of this nature) and resources were needed. In the absence of such stimulus, the innate motivation may go unrealized without being crystallized into action. The tendency of the government-initiated development programmes to rely on the PRIs was another reason why organizations such as SS would not evolve naturally. The perceived benefits from the contacts with the external agencies would also stimulate the individuals to participate in such initiatives.

2.3.2. Roles of SS

The SS as an informal body and its members played the following roles during project implementation:

The SS helped *elicit and assure* people's participation in all the project interventions. In doing so, it made the implementation of the project activities more transparent. In those interventions which needed large amounts of earth work and financial investment (e.g. check dam construction, farm ponds, trench-cum-bunds in private and common properties) SS was actively involved in implementation by bringing forth peoples' contribution in terms of money and labour. It was also actively involved in selecting sites for soil and water conservation measures such as check dams, farm ponds, etc.

It acted as a *liaison* agency between the project staff and the village community in general and through open meetings it also facilitated communication and interaction among the community as well as between the community and external agencies including the project. SS played a major role in obtaining the necessary permissions and clearance from the district administration in providing the access to the endowment land by the poor in Anantapur cluster. Similarly in Mahabubnagar cluster, the SS played a crucial role in negotiating with the PRI for providing temporary use rights for the tank bed for cultivation by the poor and, in conjunction with the project staff was instrumental in reaching a written agreement between the users and the PRI. It was also instrumental in negotiating with a farmer whose land was identified as suitable for construction of a check dam in Anantapur cluster. Thus, it helped use the private property for the common good of the community.

Some members of the SS assumed the role of *early adopters* of technological interventions, which helped others to accept the technologies. In Mahabubnagar cluster, people were initially reluctant to take up vermicomposting as an option for better crop nutrient management. Then, some of the members of SS took up the activity following which some others accepted the technology. Thus, SS also helped hasten the technology adoption and diffusion among the village community.

SS was responsible for the final decisions on *targeting* the technological interventions. By identifying the needy and appropriate clientele for different interventions, the SS guided the technology testing to those households that could benefit from the

technology and hence enhanced the chances of technology acceptance and minimized the conflicts.

It also identified people for exposure visits and training programs for capacity building. All these activities were done in a transparent and interactive manner in which the rationale for selecting the participating villagers was openly discussed: this minimized the conflicts. The composition of SS, with all socio-economic groups represented (Appendix 2.1), also ensured that the decisions were equitable. The landless poor were given preference in interventions related to livestock, especially sheep and poultry. In Tumkur cluster, SS organized an exposure visit for farmers without any assistance from the project staff, which is a testimony to the post-project sustainability.

SS also took up the responsibility of *maintaining* the assets created in the project. In Tumkur cluster, the SS was instrumental in discouraging the over-use of ground water by coaxing the villagers not to dig bore wells subsequent to the construction of check dam. By way of providing space and identifying the participants, the SS also provided a foundation to the custom hiring centers that the project initiated for enabling the small and marginal farmers to access the improved tools and implements (see Section 5).

A coincidental but important benefit from the SS is the *time saved* to the project staff. It was felt by the project staff that because of SS they could save 30-50% time in their interactions with the community. It also saved the time of villagers in the sense that they did not have to wait until the next visit of the project staff to obtain the information that they needed and also they could contact the SS for advice at their convenience. The members of SS did have to spend more time in communicating with project staff and the villagers and also in planning for the project activities. However, since most of these activities were carried in an informal manner and within the village, they saw little in terms of transaction costs. Thus, SS proved to be an effective and efficient mechanism for faster communication and technology diffusion.

2.3.3. Inter-cluster differences in SS

The formation and performance of SS differed across the clusters. There were nineteen members in SS in Tumkur cluster compared to 12 (now 14) in Mahabubnagar and 13 in Anantapur. In all the clusters, people from different social strata (OBC, SC, ST, etc.) were represented in the SS (Appendix 2.1). In Mahabubnagar, some members of the SS were nominated by the village president but no women and landless were included as no one came forward voluntarily. (Subsequent to the discussions in the regional workshop, two women came forward to be a part of SS and were included.). The representation of women was more in Anantapur (5 out of 13) compared to other two clusters. In Tumkur, the SS members were selected by the *gram sabha* and it (the *gram sabha*) has the authority to dismember the individual from SS if it feels so. Thus, a conflict resolving mechanism was put in place in Tumkur. The frequency of SS meetings differed across clusters. In Anantapur, SS was more active and decided to meet once every fortnight instead of once a month, which is the practice in Mahabubnagar.

These differences in the functioning and effectiveness of SS were due in part to the differences in individual motivation of the members as well as the effectiveness of the facilitating staff. For example, the villagers in the Tumkur cluster are well aware of the

functioning of the community organizations in the neighbouring villages where BIRD (K) was already working. In Anantapur, one of the project partners had already earned the faith of the villagers because of some past work. In these terms, the situation in Mahabubnagar was not so conducive. However, it was found that the functioning of SS could be improved if the members were sufficiently motivated. This was evident in the case of SS in Mahabubnagar cluster whose performance was found to improve subsequent to an exposure visit to the Anantapur cluster.

2.3.4. Assets of SS

All three SS have built up an asset base. They have done this by charging a membership fee (Rs.100) to their members, who are willing to pay this because of the access the SS gives them to development resources (information, contacts and interventions). As well as this, where the community or participants are mobilized to make cash payment as their contribution to project interventions or are mobilized to make an in-kind contribution whose value is greater than that agreed with the project, the balance is also credited to the SS account. In Tumkur cluster, SS constructed a building, which is being hired out for different needs of the village and also used as a storage facility. This facility is also hosting a Tailoring Training Center and also used to keep the implements. In Anantapur, people voluntarily contributed land for construction of an office for SS and sought project support for construction. In Mahabubnagar, the SS is planning to construct a building and use it as a community hall and Artificial Insemination Centre in addition to using it as a meeting hall for SS. Thus, in all the three clusters, SS could mobilize and create assets. These are used to benefit the community and to provide resources through which the SS intends to survive and operate in the post-project period.

2.3.5 The future of SS

Formation of SS proved to be an effective institutional innovation both from the project's perspective as well as the clientele's (community) perspective. Motivation and commitment of individuals constituting SS, transparency and flexibility in arriving at the decisions, liaison with the existing local organizations especially the PRI and the continuous support from the project staff were the important reasons why the institutional arrangement in the form of SS was successful and likely to be sustainable beyond the project. The feasibility of post-project sustainability of SS is best seen in the way the assets have been created and operated in the three clusters. The continued presence of the NGO beyond the project period, which is very likely, would augur well to these initiatives (Annexure I). Such a continued hand-holding relationship would result in further strengthening of capacity of SS and also ensure fair play in handling the assets created (the NGO and the SS operate a joint bank account for managing the funds).

Whether SS should continue to operate after the project period is a question to be researched upon and answered. The creation of assets is likely to result in continued operation of the SS. At the same time, as the value of assets grows, it may as well result in an undue competition for the control of those assets and may become another source of power and to that extent may result into conflicts with other CBOs, especially the PRI. Another consequence would then be that it might cease to be an advisory body and rather become a 'political' body. In the event that it continues in the village, then there is a need for certain conventions to evolve, (which must be flexible enough to suit each community) as to who should be the members, how and how often the members should be changed, how to resolve

possible conflicts, etc. However, it can be concluded from the project experience that partnerships with existing organizations, which can play the roles that the SS assumed, or the formation of an organization such as the SS would be of great help whenever a developmental project is initiated in rural villages.

2.4. Capacity building of communities

2.4.1 Formation of SHGs

It came out from the PRA that in all the project villages, organizations such as SHGs, UGs, VSS, etc were functioning. However, they were largely limited to thrift and credit. The villages felt it useful to form SHGs based on the specific needs and interests so that it becomes easy for identifying and targeting interventions and technologies appropriate to the needs. Accordingly, specific SHGs were formed for shepherds and wool weavers, dairy farmers, honey bee keepers, etc.

The process for formation of SHGs included identifying the people with similar needs, where SS played a major role, informal discussions with the potential members of the group, negotiating agreements on functional roles and responsibilities, training on book keeping and finally forming a group. The interactions among the members of the group and with the project staff and other external agencies from time to time strengthened the knowledge and confidence of the members and resulted in the groups being better placed to articulate their needs than the individual members were.

By bringing together the people with similar needs, it became easier to work out strategies for technology adoption, bringing forth their participation and monitoring the performance of technological interventions put in place. These groups also provided fora for discussing the merits and demerits of the proposed technological interventions and also helped build up social capital. The effect of forming the SHG is best seen in the way the needs were articulated and resources mobilized for obtaining a wool cording machine in Mahabubnagar cluster. In this cluster, a significant number of people earn their livelihoods by weaving carpets from sheep wool. The wool needs to be cleaned and made into reels before the carpets are actually woven. This process is very cumbersome and time taking. When these persons were formed into an SHG, they raised the need for a wool cording machine, which needed financial support as well as a place for keeping it and the necessary arrangements for operation (an operator with the necessary skills, power supply, repairs and maintenance, etc). The SHG then pursued further with the project and the suppliers of the machine in consultation with the SS. Finally, all arrangements were made to obtain a machine, which could meet the needs of not only the project villages but also those of the surrounding villages.

2.4.2 Exposure Visits and Training

The exposure visits and training were essentially aimed at strengthening the human capital of the individuals. These programs (see Appendix 2.2) were mainly centered around the proposed technological interventions specific to different groups, though there were some ‘general’ exposure visits and training. For example, the wool weavers group in the Mahabubnagar cluster visited the wool clodding facility in the district so that they could learn

the operational details for themselves. Similarly, groups with specific needs for training on fodder production were taken to the research stations specializing in fodder technology. Individuals who came forward to take up the nursery as a livelihood option were trained on nursery raising including the grafting techniques. These visits and training programs by facilitating understanding of the advantages and disadvantages of the technologies by the farmers hastened the process of technology testing and decision making on adoption. A logical process was followed to undertake these activities. Once the needs and groups were identified (where the SS played an active role), the possible place of training/exposure visit was identified and consultations were made with the potential trainees and the trainers to agree up on other details.

In addition, farmers were also taken to different *'kisan melas'* (farmer gatherings) organized by different agricultural research centers including CRIDA, where the farmers had the opportunity to see new technologies in operation. One such exposure to the rainfall simulator helped farmers see how the unprotected top soil got lost taking the nutrients away with it. This subsequently helped them accept the conservation technologies (Section 3).

The effect of training was also conspicuous in the case of maintaining and upkeep of farm implements made available through the custom-hiring center, which is another organizational arrangement, initiated in the project clusters (see the Section 5). Without the necessary training, initiatives such as this would not have been successful. Though no formal attempt to measure the effectiveness of these training programmes was made in the project, the subsequent interaction with the participating individuals did lead to an observation that these interventions were helpful in enhancing the understanding of the specific problem which then stimulates the individual to look for potential solutions.

2.4.3 Awareness Campaigns

In addition to the above, the project also conducted some mass awareness campaigns to generate awareness regarding the need for natural resource management in general. In Tumkur cluster, '*Hasiru Habba*' (green festival) was organized where mass plantation of trees was done with active support from the SS, SHGs, the PRI and the village community as a whole. Similarly, in Anantapur and Mahabubnagar, cycle rallies were conducted displaying placards and posters on the need for natural resource management and protecting the greenery. These campaigns, in addition to creating a general awareness, also helped communicate to the villagers as to what was going on in the project work. In the process, the PRIs and other CBOs were also sensitized. This sensitization proved useful while negotiating for use rights for cultivating the tank bed in Mahabubnagar cluster and temple land in Anantapur cluster.

2.5 Synthesis

The activities undertaken in this output generated the information necessary for building up the activities to achieve the outputs 2-4. The necessary arrangements in the form of institutions such as SS and SHGs were put in place, which proved to be highly helpful in achieving those outputs. By minimizing the possibilities for conflicts and by bringing forth the people's participation, the SS contributed to smoother implementation of the project and faster diffusion of interventions. That the SS could create assets and developed plans to

continue even after the project ends is a testimony to the effectiveness and utility of such institutional interventions. The social capital built through forming these institutions and the human capital strengthened through exposure visits, training programs and regular interaction with the project staff also contributed to the success of the project in improving NR based livelihoods of the rural poor. The OVIs spelt out in the log frame were also achieved as shown below (2.6).

The new institutional arrangements attempted in the project addressed three main issues related to sustainability. These arrangements in themselves are the 'enabling' mechanism as could be seen from the self-initiatives undertaken by the SS in Tumkur. By involving these local organizations in decision-making and managing implementation, project implementation became more transparent. In fact, transparency in the decisions of the SS and the project is the single most important reason why the decisions of the SS were accepted. As all the interventions were identified in consultation with the villagers and the SS, there was enough flexibility to choose the options that responded to their needs, and this maximized the chances of adoption of technologies being introduced and tested. Thus, given the short duration of the project through which these interventions could be tested, it could be concluded that the interventions such as SS could be highly useful in promoting improved and sustainable NRM and livelihood opportunities.

2.6 Achievements

OVI	**Achievement**	**Comment**
1. By 2003, rural institutions (e.g. CBOs, PRIs, other User/Self-Help Groups, development organizations) aware of the need of the measures to provide improved access to specified natural resources.	Achieved	Institutions in the project villages now aware and sensitized. All the PRIs in the project villages are now aware of the CPRs. The existing SHGs in Tumkur represented in SS are aware of the NRM-related issues focused in the project.
2. By 2005 rural institutions in at least two target areas report adoption of some measures/ mechanisms that enhance access of poor to specified NRS.	Achieved	Two poor families were enabled to access the unutilized tank bed in Mahabubnagar cluster and the endowment land in Anantapur. Scarcity of CPRs limited the extent of achievement.

2.7 Key Learnings

- Establishing good rapport with and gaining confidence of the community is the key to success of any development initiative. However, achieving this is a slow process. Inclusion of diverse social groups and transparency and flexibility are very important to achieving the initial acceptance as well as the final outcome of the project. Exercises such as PRA are helpful to achieve the twin objectives of striking rapport with the community and obtaining the information needed for the project.
- Equal importance attached to the social interventions as to the technological interventions is needed. The interventions in terms of formation of SS and capacity building through training and exposure visits contributed to the technology adoption and to enabling the community to take control of their own development. Whereas the former helped in identifying appropriate clientele as well as in ensuring people's participation wherever needed, the latter helped the community to appreciate the benefits of the proposed technological interventions.
- The individuals in the community have the innate capability and willingness to contribute to the welfare of the village. However, they still need an external stimulus and support to organize themselves into a proactive organization.
- More attention and expertise are needed to document the process of enabling the community. In this project, for example, the impact of training and exposure visits could not be measured.
- In summary, transparency, flexibility and enabling factors go hand in hand and are vitally needed to promote better NRM.

Appendix 2.1 *Salaha Samithi* composition

Table A 2.1.1 Composition of *Salaha Samithi* in Anantapur Cluster

Sl. No.	Name of the member	Sex M/F	Age	SC/ST/ OBC/ Others	Present position in village Institution	Village
1.	Y. Raji Reddy	M	52	OC	Gram Panchayat Member	Y.Kothapally
2.	Y.Chinna Obul Reddy	M	62	OC	Progressive farmer	Y.Kothapally
3.	B. Sreeramulu	M	35	BC	SHG Member	Y.Kothapally
4.	Thirupal	M	38	ST	SHG Member	Y.Kothapally
5.	Ramakrishna	M	29	BC	SHG Member	Pampanur
6.	Pulla Redy	M	65	OC	Progressive farmer	Pampanur
7.	Subhadramma	F	30	OC	Vice Sarpanch & VSS member	Pampanur
8.	Ramalakshmamma	F	25	SC	Anganwadi Teacher	Pampanur
9.	Obulpathi	M	25	SC	--	Pampanur
10.	Padmavathi	F	34	ST	VO Leader & Anganwadi worker	Pampanur Thanda
11.	Kiramma	F	40	ST	VO Member	Pampanur Thanda
12.	Jyothi	F	25	OC	Anganwadi Teacher	Y.Kothapally
13	Narasamma	F	29	SC	Anganwadi Teacher	Y.Kothapally

Table A 2.1.2 Composition of *Salaha Samithi* in Mahabubnagar Cluster

Sl. No.	Name	Sex M/F	Age	SC/ST/ OBC/ Others	Present position in village Institution	Village
1.	B. Venkat Reddy	M	53	Others	Member Rythu Sangam	Dharmapur
2.	Narayan Reddy	M	62	Others	Member Rythu Sangam	Dharmapur
3.	Gopal Reddy	M	65	Others	Member Rythu Sangam	Dharmapur
4.	Anjaneyulu	M	32	SC	Sarpanch	Zamistapur
5.	Yadaiah Goud	M	38	OBC	Member Rythu Sangam	Zamistapur
6.	Balakistaiah	M	40	OBC	Vice Sarpanch	Zamistapur
7.	Bucha Reddy	M	50	Others	Member Rythu Sangam	Bukkalonipally
8.	Balanagaiah	M	55	SC	Vice Sarpanch	Bukkaloni
9.	Ramulu	M	52	OBC	Member Rythu Sangam	Bukkaloni
10.	Dayanand	M	38	OBC	Member Rythu Sangam	Chowderpally
11.	Krishna Reddy	M	32	Others	Member Rythu Sangam	Chowderpally
12.	Bheemaiah	M	38	OBC	Chairman Vidya Committee	Chowderpally
13	Saraswathamma*	F	27	SC	SHG Member	Zamistapur
14.	Venkatamma*	F	33	SC	SHG Member	Zamistapur

***** Joined subsequently.

Table A 2.1.3 Composition of *Salaha Samithi* in Tiptur Cluster

Sl. No.	Name	Sex M/F	Age	SC/ST/ OBC/ Others	Present position in village institution	Village
1.	S.R. Marulappa	M	57	OBC	President (Salaha Samithi)	SHK
2.	S.H. Vishwanathappa	M	57	OBC	Vice President	SHK
3.	S.M. Gurumarulasiddappa	M	43	OBC	Secretary	SHK
4.	S.V. Mallikarjunappa	M	48	OBC	Member	SHK
5.	S.M.Jayanandamurthy	M	43	OBC	Member	SHK
6.	S.H. Mrutyunjayappa	M	57	OBC	Member	H.M. Kaval
7.	S.R. Mayashetty	M	58	OBC	Member	SHK
8.	Govindanaik	M	40	SC	Member	SHK
9.	Marulasiddanaik	M	45	ST	Member	SHK
10.	S.C. Halappa	M	50	OBC	SHG Member	SHK
11.	S.S. Basavaraju	M	38	OBC	SHG Member	SHK
12.	S.B. Basavaraju	M	43	OBC	SHG Member	SHK
13.	Shashidhara	M	30	OBC	SHG Member	SHK
14.	S.C.Mallikarjun	M	30	OBC	SHG Member	SHK
15.	S.C. Marulasiddappa	M	30	OBC	SHG Member	H.M. Kaval
16.	Ganeshappa	M	50	OBC	SHG Member	H.M. Kaval
17.	Susheelamma	F	33	OBC	SHG Member	SHK
18.	Maheswaramma	F	40	OBC	SHG Member	SHK
19.	Leelavathi	F	32	OBC	SHG Member	SHK

SHK: Shankaranhalli

Appendix 2.2 Training and exposure visits

Table A 2.2.1 Training programmes in Anantapur Cluster

Training on	Place of training	No. of farmers attended
Improved practices for cultivation of groundnut, pigeonpea, castor and papaya	Y. Kothapalli	75
-do-	Pampanur	35
-do-	Pampanur Thanda	30
Ethno-veterinary training	BIRD – K, Tumkur	3
Nursery raising and grafting	BIRD – K, Tumkur	10
Vermi composting	Y. Kothapalli	25
Dryland agricultural implements	Tractornagar, Garladinne	10

Table A 2.2.2 Exposure visits in Anantapur Cluster

Place visited	No. of participants	Activities observed
BIRD–K, Tiptur	17	Watershed, agroforestry, horticulture, composting, medicinal plants, participation in community mobilization
CRIDA, Hyderabad and BIRD–K Jedcherla	21 (5 women participants)	Farmers' field day, rain simulation, agro-forestry, cropping pattern, horticulture, dye and *sugandhi* oil plantation, mulching, Agricultural equipments, watershed, people's organization

Table A 2.2.3 Training programmes in Mahabubnagar Cluster

Training on	Place of training	No. of farmers attended
Nursery raising and maintainence	S.Lakkihally BIRD – K, Tumkur	9
Ethno-veterinary training	BIRD – K, Tumkur	5
Cultivation aspects of Mango	BIRD-K, Jadcherla	10
Orchard (mango) management	BIRD-K, Jadcherla	22
Capacity building of rural youth for breed improvement (Cow & Buffalow)	BIRD-K, Jadcherla	16
Demonstration and training of paddy reaper	Bukkalonipalli	10
Dryland agricultural implements	Hayatnagar Research Farm , CRIDA	16
Action learning exercise using rainfall simulator	Chowderpally	500

Table A 2.2.4 Exposure Visits in Mahabubnagar Cluster

	Subject	Place	Participants	
			Male	Female
1	R8192 work in Anantapur	Project villages in Anantapur	16	2
2	'SRI' method of rice cultivation	On-farm demonstration of ANGRAU at Bhutpur village	0	5
3	Fodder crops and production practices	Regional Station for Fodder Production and Demonstration, Mamidipalli	15	5

Table A 2.2.5 Training Programmes in Tumkur Cluster

Sl,No	Participants		Total	Places visited
	M	F		
1.	26	--	26(batch 1)	Visit to Lakkaihalli farm and existing watershed on soil and water conservation methods.
2	28	--	28 (batch2)	
3	20	7	27(batch3)	
4	6	4	10(3 days)	Bee keeping technique at Shankarnhalli.
5	2	--	2	Ethno-veterinary practices at Lakkaihalli
6	--	27	27	Training on nutrition programme at Lakkaihalli.
7	28	6	34	Soil and water conservation at Shankarnhalli.
8	16	--	16	Kitchen herbal garden training at Shankarnhalli.
9	19	3	22	Training on INM,IPM practices at Handhankere.
10	22	27	49	Training on IGA, at Shankarnhalli.
11	40	--	40	Training on after care technique for Horticulture plants.
12	11	--	11	Fertility management on coconut.
13	9	12	21	Training on commercial nursery making at Lakkaihalli.

Table A 2.2.6 Exposure visits in Tumkur Cluster

	Participants		**Total**	**Places visited**
	M	F		
1	32	13	45	Krishi mela at UAS, Bangalore.
2	18	6	24	Kasargode, ICCRI (Institute for Coconut research Center.) andProgressive farmer' Ramachanderiah's Organic Farming fields at Cherkadi.
3	10	0	10	Krishi mela at UAS, Bangalore.
4	15	0	15	Krishi mela at UAS, Bangalore to learn adopt new technologies.

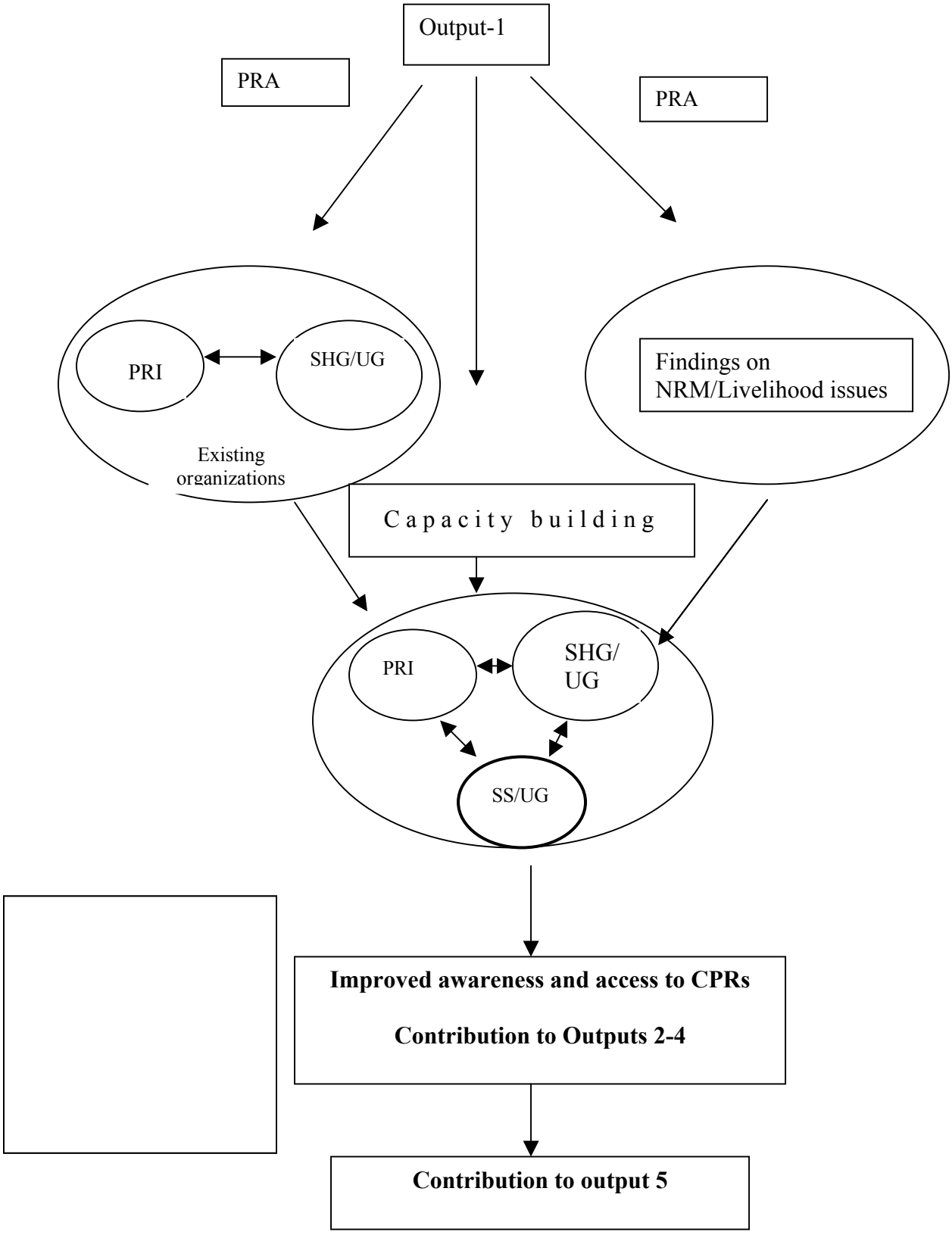

Figure 2 Schematic diagram of output-1 and its linkage to other outputs

PRA Exercises

Social mapping

Group meeting

PRA Exercises

Resource mapping

Interaction with farmers

Salahasamithis / SHG's meetings

Salahasamithi Meeting in Mahabubnagar

Central Project management committee meeting at Shankarnahalli cluster

CAPACITY BUILDING

Through Awareness programmes, Exposure visits, Training etc,.

Exposure visit to LRS Bandameedipalli

Exposure visit to BIRD-K, Tiptur

Nursery training at S.Lakkihalli for Mahaboobnagar farmer trainees

Inauguration of Animal Health Camp

Demonstration of fodder species at Animal Health Camp

CRIDA Scientists explaining about use of biofertilizers to farmers

Awareness programmes

Sensitization Meeting with villagers

Section 3

Soil and Water Conservation

Link to project logframe

Output II: Conservation and sustainable use of natural resources (soil, water, vegetation, organic residue) in CPRs and PPR improved with special emphasis on specific targeted groups

OVI

1 By 2005, at least 25% of the target groups adopt soil and water conservation measures.

2 By 2005, at least 25% of the target groups adopt INM practices to sustain soil health / fertility.

3 By 2005, CBOs in at least 2 project sites report improved productivity of CPR through specific interventions.

Activities

1 Action learning exercise using rainfall simulator: awareness building on resource losses

2 Treatment of CPRs with location specific soil and water conservation measures and blending recommended technologies and indigenous knowledge for sustainable use through user groups.

3 Promotion of *in-situ* moisture conservation and soil fertility management practices in CPRs and PPRs to target groups.

4 Promoting regulatory mechanism to avoid over exploitation of CPRs through participatory groups and rural institutions (CBOs etc).

3.1 Introduction

This project (R8192) belongs within the semi-arid production system portfolio of NRSP projects. One of the OVIs of output from the semi-arid system portfolio is the development and promotion by 2005 of strategies for improving the livelihoods of poor people, by increasing the productivity of water in rainfed agriculture, through use of appropriate rain water and/or soil fertility management practices. It is in this context that the water harvesting and soil fertility management interventions described in this section have been promoted in the project sites.

The natural resource base in semi-arid areas has undergone degradation because of neglect and over-exploitation. The most important natural resources, i.e. soil and water, hold the key for improving the livelihoods of the rural poor located in semi-arid areas. Nearly 67% of the cultivated area in India comes under rainfed agriculture and supports 40% of the population and 60% of the livestock (CRIDA 1997). The project sites selected typically represent the semi-arid areas in India. The project districts are very frequently affected by droughts due to failure of monsoons. The rainfall distribution, which is primarily uni-modal results in heavy rains in a short period causing high runoff and soil loss. Prolonged dry spells between two rains during the monsoon can occur, resulting in drying of the sown crops. The

soils are also very poor and degraded. Farmers report that the ground water is over-exploited resulting in lowering of the water table and drying of open wells (PRA findings). Crop cultivation in most of the area is restricted to a single season i.e. rainy season.

In view of the above situation, proper harvesting of the rain water received during the monsoon and storing it to utilize later is one opportunity for improving livelihoods. *In-situ* conservation of the rainfall and moisture would also help crop growth and productivity. Accordingly, a number of rain water harvesting technologies were offered to the farmers in the selected clusters. These technologies included farm ponds, trench-cum-bunds, check dams, gully plugging and diversion channels. Preliminary indications suggest that these NRM based interventions yielded immediate results in terms of water resource development: farmers reported that dry wells were filling and the water table was rising. However, verification of this needs further scientific assessment, monitoring and documentation. Similarly, soil fertility management practices like vermi-composting, bio-fertilizers, and planting bio-mass generating trees were introduced to improve soil fertility, which is expected to increase the productivity of crops and further the livelihoods of small and marginal farmers.

A PRA specific to the NRM interventions was followed in the planning process. Since S&WC issues and causes are watershed or community based rather than person based, emphasis was placed on the interest of the villagers as a community while deciding S&WC measures to be taken up by each cluster. For interventions such as vermi-composting and forest nursery raising, which use private resources for private benefit, stress was given on the interventions' potential for contributing to the livelihoods of the poorer households in the community, and on encouraging the community, through the *Salaha Samithi* (Section 2), to target these interventions on the interested landless and poor. Feedback on the outcome of the intervention was collected using prepared checklists (e.g. Appendix.6.2) and the data used to assist analysis of the interventions is presented below.

The details of these interventions on rainwater harvesting and soil fertility are presented in Table 3.1 and some preliminary indications of results are described in sections 3.2 and 3.3 respectively.

Table 3.1 Soil and water conservation activities by cluster and village

S. No	Activity	Number of beneficiaries/area covered*							
		Anantapur			Mahbubnagar				Tumkur
		Pampa-nur	Pampa - nur Thanda	Y Kotha-palli	Chowder -pally	Bukkalo nipally	Zamista-pur	Dharma-pur	
1	Farm pond unlined	7 + 1 lined	-	19 + 1 lined	7	5	3	-	45
2	Mini perco-lation tank		1	2					
3	Checkdam			1	1	-	-	-	1
4	Gully plugs				-	-	-	36	25
5	Trench cum bund	2	1	16	3947 m	3411 m	-	890 m	222 11791m^3 105 ha
6	Roof water harvesting				-	-	-	1	
7	Diversion channel for dried wells	4	2	8	10	10	-	-	
8	Participatory water table monitoring				10	10	-	-	
9	Tankbed CPR development				-	-	2 women, 1.6 ha		
10	Biomass plantation				13	6	-	-	
11	Soil testing and advise	20	20	20	20	20	18	24	42
12	Vermi-compost	8	-	4	5	6	6	6	9

* Where units are not mentioned, numericals are number of participants

3.1.1 The process

3.1.1.1 Awareness building on resource losses using rainfall simulator:

A portable rainfall simulator was used as an action learning tool for creating awareness and understanding on resource losses to the villagers in the selected clusters. During the action learning, the farmers could see the runoff water coloured with soil moving out. This led to discussion in the field about the approximate amount of soil displaced from the villagers' lands over years and its implication on agricultural production and land degradation. The farmers asked many questions on mulches etc. to contain runoff, soil loss and for conservation of moisture. The simulator exercise convinced the villagers of the need of soil erosion control. Farmers from Mahbubnagar and Anantapur clusters realized that loss of soil and water was more when rain falls on soil without vegetative cover as compared to soils with vegetative cover. This created awareness of the need to check the rainfall-induced runoff to prevent the soil erosion that causes considerable damage to their crops. Farmers were also able to understand that if runoff is properly harvested, it could be utilized for saving their crops during the dry spells. This change in their attitude was helpful in promoting NRM related interventions.

3.1.1.2 Exposure visits and training

In two of the project sites viz. Anantapur and Mahabubnagar, farmers initially were reluctant to adopt some of the water harvesting structures like farm ponds and trench-cum-bunds for fear of losing part of their land. But exposure visits to other cluster at Tiptur, interaction with farmers and also the visits to research stations at Anantapur and CRIDA helped them to understand the beneficial effects of water harvesting through farm ponds and trench-cum-bunds. The proverb 'seeing is believing' played a key role in the acceptance of technologies. Besides this, training given on production of vermicompost and explaining the benefits of INM in focus group interactions helped the farmers to take up the technological interventions for improving the natural resources. The *Salaha Samithi* and PRI played active role in carrying out the interventions and also helped in improving the access of CPRs to poor and also conversion of PPR's to CPRs.

3.1.1.3 Participant contribution

The participants' share of the intervention cost was decided by the *Salaha Samithi* in consultation with the field team. In Anantapur and Mahbubnagar clusters, participants of soil and water conservation activities contributed 10% of the cost of interventions in the form of cash or labour, while in Tumkur cluster, the participants contributed 25-30% in the form of cash or labour. In case of vermicomposting, participants at Anantapur contributed 35% of the cost in the form of labour and shade provision, and participants at Tumkur cluster contributed 30% in the form of labour while at Mahbubnagar, the full cost was borne by the project. The level of contribution indicates the level of awareness and interest among the participants and the bargaining power of the *Salaha Samithi*, which became the beneficiary of the contribution.

3.2 Rain Water Harvesting Technologies

3.2.1 Anantapur cluster

3.2.1.1 Introduction

The normal rainfall of Anantapur district is about 540 mm, which, as indicated in Section 3.0, is characterized by erratic distribution and long dry spells during the cropping period. The soils in the cluster of villages are red sandy loams with shallow depth and poor water holding capacity. Heavy rainfall goes unutilized *in situ* in the form of runoff. There are not enough water harvesting structures in this area. The major crop in the district is rainfed groundnut, which frequently encounters long dry spells during the critical growth stages. Due to this, the groundnut crop often fails to produce an economic yield. Earlier research results showed that one supplemental sprinkler irrigation of 10 mm at pod development stage increased the yield by 33% (AICRPDA, 2003). If the runoff water is stored in dug-out ponds and trench-cum-bunds at suitable locations, it could be utilized to irrigate the crops at critical stages.

In the beginning, the farmers were reluctant to adopt farm ponds and trench-cum-bunds (TCB) due to their earlier experience with contour bunding, which typically took a lot of land and created a problem for field operations like ploughing. Exposure visits to other clusters viz., Tumkur, where water harvesting structures have been widely adopted by the farmers, and interaction with the Tumkur farmers helped the Anantapur farmers to understand the benefits and costs of such structures. Initially, three farmers came forward to take up the rainwater harvesting structures. One of these farmers successfully used the farm pond for supplementary irrigation: this convinced another three farmers to construct farm ponds. The success of the first farm ponds also helped the farmers to accept other technologies. The following water harvesting technologies were adopted by farmers in Anantapur cluster.

3.2.1.2 Diversion of runoff water into dry open well

During the PRA, it was observed that 45 open wells were all dried up and left unused due to the drought conditions and heavy use of borewells. With a view to recharge these drywells, one option was to divert runoff into the wells in the farmers' fields through laying of PVC pipes and stone pitching. Fourteen farmers came forward willingly to adopt this. With summer showers and early monsoon rains, this technology resulted in filling up of the wells, some of which were lying dry for the last 20 years. The farmers were very happy to see their dried up wells filled up by 30 to 70% and they were able to make use of the water for irrigating their crops. In some cases, the area irrigated from the filling of these wells was almost doubled. For example, a farmer named Mr. P. Bhale Naik increased his area under irrigated groundnut to 3.2 ha from 1.2 ha, due to the diversion of water to his old dried well of 324 m^3 capacity. During the two years of project interventions, all 14 wells were treated successfully.

3.2.1.3 Farm ponds

Two types of farm ponds were advocated and adopted by the farmers for harvesting the runoff in farmers' fields, viz., farm ponds with lining and farm ponds without lining. Unlined ponds are dual purpose, serving both as percolation ponds for groundwater recharge and as an irrigation source.

Twenty eight farm ponds were constructed in the farmers' fields, 26 without lining and 2 with lining. This was done in a participatory cost sharing mode wherein farmers contributed their share of 10% of the total cost in the form of labour. A storage space of 4156 m^3 was created by digging the farm ponds. The average pond size was 115 m^3 and it ranged from 62 m^3 to 179 m^3. All the ponds were filled from 90 mm of rainfall received in two consecutive days. In a matter of 4 to 10 days the unlined ponds dried up, due to the porous nature of the soils. This indicates good groundwater recharging potential but poor water holding capacity and hence limited potential for use of the farm pond for supplementary irrigation during dry spells. The farm ponds with lining could store the water for more number of days, typically for at least one month. These farmers could make use of the stored water for life-saving supplementary irrigation of their groundnut crop during any long dry spells in the summer months i.e. May & June (case study-2 Annexure-F). This water was also used for pot watering of the horticultural plants in their fields.

Informal agreements in the community allowed some of the stored farm pond water to be seen as a common property in terms of drinking water for livestock. The community agreed this in recognition of the pond being constructed with project resources.

3.2.1.4 Trench-cum-bunds (TCB)

Trench-cum-bunds are constructed around individual plots to check runoff and soil erosion and are advocated in farmers' fields having mild slopes. A series of TCBs of 5 m x 2 m x 0.3 m (3 m^3) size across the slope were dug on farmers' fields. Multipurpose and agro-forestry tree species like *Gliricidia* and *Subabul Leucaena* were planted in the trenches and these showed excellent survival. The average cost of construction was Rs.1880 ha^{-1} with an intensity of 24 m length of TCB per ha of area.

3.2.1.5 Check dam

A check dam (24 m length and 2 m height) was constructed in CPR land in the village Y. Kothapalli as it was found that water was flowing through this area unutilized. About 20% of the cost of the structure was borne by the villagers in the form of labour contribution. The beneficial effects of the check dam were observed by the farmers in the first year itself as the dam got filled during May, 2004 rains a few months after construction. The check dam also served as a source of drinking water for cattle and helped in growth of forestry trees like *Prosopis juliflora* that are used by the villagers as firewood. Farmers reported that the construction of the check dam helped in recharging 10 surrounding bore wells. Seeing the benefit, now the farmers are demanding for more number of check dams. But, with the type of rainfall prevailing in the area, on farm conservation and harvesting rather than building more numbers of check dams is recommended.

3.2.1.6 Mini percolation tank

In 2003, three mini percolations tanks, one at Pampanur thanda and two at Y. Kothapalli were constructed. Because of these tanks, the availability of drinking water for cattle has improved and the surrounding bore wells (18 nos.) were recharged, which enabled the cultivators to draw more water for agriculture. Besides harvesting eroded fertile soil, these tanks were sources of drinking water for the animals.

3.2.1.7 Assessment

Due to the construction of harvesting and recharging structures, farmers reported rise in water level in about 30 borewells. A ground water level rise of up to 2.25 m was recorded in a defunct well due to check dam construction in a 32 ha catchment. About 4070 workdays of employment was generated for the needy by construction of farm ponds, TCBs and mini percolation tanks. Farmers used the stored water for their groundnut crop, or horticultural crops, for livestock watering and reported better establishment of trees and crops near or on the TCBs.

3.2.2 Mahabubnagar Cluster

3.2.2.1 Introduction

Dharmapur cluster of villages near Mahaboobnagar covers a geographical area of 10686 ha: the majority of the cluster farmers are marginal (56 per cent having less than 1 ha land). The normal rainfall of the mandal is 549 mm received through southwest monsoon. The rainfall is erratic: for example, the actual rainfall received during 2003 and 2004 was 815 mm and 383 mm respectively. Due to the hilly terrain, the unchecked rainwater flows downstream causing severe soil losses. Therefore, effective utilization of run-off water is essential for higher crop productivity.

In this cluster of four villages, Dharmapur and Zamistapur are already covered under earlier watershed programmes and also the livelihood programme of APRLP. The other two villages Bukkalonipally and Chowderpally were not exposed to any development programmes in the past and hence more focus was given to the latter two villages.

With the help of the PRI, and SSs, interventions in this cluster were successful in providing the poor access to CPRs (village tank bed for cultivation, see section 3.2.2.6). The water in a check dam constructed on PPRs was also made available for the benefit of the whole community.

3.2.2.2 Check dam

A check dam was constructed in Chowderpalli, one of the non-watershed villages. The location of the dam was finalized in consultation with the SSs and villagers. The dam is located on PPRs, i.e. on poor quality land owned by three farmers that has remained fallow for quite some time. The owners readily agreed to spare their land for the construction of the check dam which would help the entire village community by storing the runoff water. This

is a typical case of an unused PPR being used (as a CPR) for the benefit of the whole village. The construction of check dam helped in storing runoff water. The check dam has a catchment area of 50 ha and storage capacity of 2600 m^3 with an upstream space of 300 m: and held water for more than one month after the monsoon.

The villagers found the construction of the check dam very useful as the water could be used as drinking water for cattle and they observed that the dam also helped in recharging ground water in the surrounding 10-15 bore wells in the area. During the 2004 monsoon, the water flowed over the dam: this led to the villagers requesting the dam height to be increased. The need for this was discussed and analysed with the villagers. They realized that overflow was likely to be a rare event, that downstream farmers could be deprived of water and that upstream in-situ water harvesting would be a better alternative.

3.2.2.3 Farm ponds

Fifteen farm ponds were constructed on farmers' fields in the villages not covered under the watershed programme. Farm ponds were constructed for a catchment area of about 2 ha: each pond had a capacity of 250 m^3 (average depth 2.5 m) and each beneficiary contributed 10% of the cost, usually as labour.

In the 2005 monsoon, two innovative farmers have deepened their ponds to rear fish. They observed that the water in their ponds could stay longer without seepage because of the rocky bottom. They also noticed considerable seepage water coming to the ponds from the nearby fields. Hence, they have decided to take up fish rearing in these ponds (see 3.2.4; Table 3.3 for a cost analysis).

3.2.2.4 Trench-cum-bunds

An area of 51 ha of land in non-watershed villages was covered under TCBs during the project period with active participation of farmers and a 10% cost contribution from them. The intensity of bunding was 64 m per ha of area. Farmers could observe the collected soil and water in the TCBs and became motivated to plant horticulture, forestry, fodder crops, which in the long run would yield some returns.

3.2.2.5 Gully plugs

Gully plugging was carried out at 36 places, especially near hillocks, to arrest the flow of water and soil for recycling. The farmers observed that the gully plugging, while preventing soil erosion, also helped in recharging ground water. They are demanding more such structures.

3.2.2.6 Tankbed CPR Development

It was observed during the PRA exercise that in Zamistapur village, the village tank which has a total area of 8 ha was silted up and that only up to 30% of the tank area is filled even in years of normal rainfall. The remaining area is full of weeds and remains unutilized. From the village records, it was known that the tank has not filled completely even once in

the last 25 years. Hence, the unfilled area of 4-5 ha might be brought under cultivation, by growing crops with residual moisture. The idea was discussed with the PRI and SS who decided to allot this land to landless poor so that they can cultivate the tank bed and generate some income. Initially 1.6 ha of land was to be brought under cultivation as a trial.

The first group of villagers to express interest in cultivating the land wanted a borewell to be dug for them. They were not satisfied with the open well agreed by the SS and project and gave up the idea. Two landless women then came forward and the PRI accorded them user rights through a written agreement. The women grew fodder crops like *jowar* and maize, vegetables and chickpea, and generated income from sale of fodder (Rs. 100) and vegetables (Rs. 250). This shows that with proper mobilisation, the village institutions can respond favourably to enabling access of the CPRs to landless people. This arrangement is being tested by the landless women as well as the community. Based on the outcome, the mechanism for granting usage right to the land can be strengthened. (Policy Brief-IV Annexure F).

3.2.2.7 Diversion channels (recharging through dried-up wells)

The farmers from two of the villages viz., Chowderpally and Bukkalonipally, came forward voluntarily for construction of 20 units of diversion channels to divert runoff water to dried-up wells for recharging the ground water and rejuvenating the wells. They did so after their exposure visit to assess the usefulness of such structures in Anantapur cluster.

3.2.2.8 Roof top water harvesting

For creating awareness about rainwater harvesting for use as drinking water, a roof top harvesting structure was constructed in the high school (having 11 staff and 370 students) located in Dharmapur. The estimated storage volume is 24 m^3. This structure was the first of its kind in the area and therefore evoked great interest among the villagers.

3.2.2.9 Participatory ground water monitoring

One of the main problems in semi-arid areas is excessive exploitation of ground water, which is both a CPR and a PPR. Hence, to create awareness on proper utilization of ground water, a participatory monitoring mechanism was introduced in this cluster. Chowderpalli village was given a water level indicator for measuring the depth of the water level in the bore wells. The project officials and the 10 participating farmers monitored the depth every fortnight and maintained a record. The data were recorded for a season and discussed during open SS meetings which other farmers attended. A sample data set on water level rise in a bore well (80 m deep) in Chowderpalli village is depicted in Figure 3.1.

This participatory monitoring gave excellent insight to farmers on rate of depletion of ground water and its recharge and made them aware of the need for judicious use of ground water. Formalizing this process and encouraging the SS to take full responsibility of the groundwater monitoring would provide the PRI with a useful crop and village development planning tool.

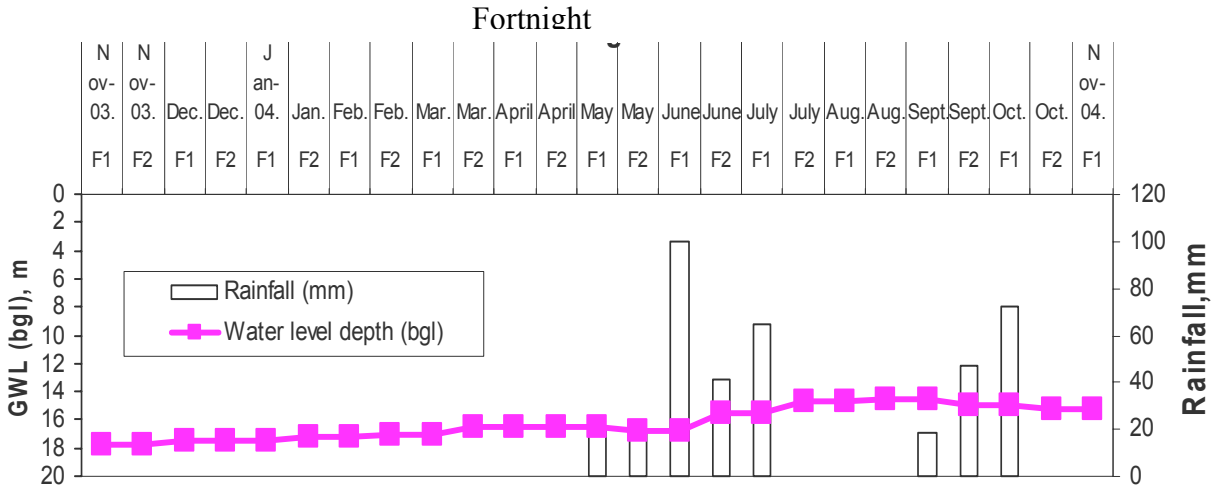

Fig. 3.1 Groundwater level fluctuations in a typical irrigation well

3.2.3 Tumkur cluster

3.2.3.1 Introduction

This cluster has a total geographical area of 711 ha. The annual rainfall varies from 600-650 mm. The monsoon commences in the month of May and ends in December with the peak rainfall period between September-October. The area has been experiencing continuous drought for the last three years. In uplands soil erosion, poor fertility, ground water depletion, lack of vegetation and gully formation are common problems. Most of the rainwater runs off unchecked in the watershed area, carrying a lot of topsoil with it. This tremendous loss, which has a direct bearing on the economic condition of the people, can be checked through appropriate soil and water conservation measures. After discussions with scientists and BIRD-K officers during PRA, the farmers chose to take up soil and water conservation measures like trench cum bund, farm pond, gully plugs, check dam, *nala* (stream) bund etc.

3.2.3.2 Trench-cum-bund (TCB)

According to the farmers' NR development preferences, TCB is a second choice after planting forestry seedlings. Traditionally, farmers follow the practice of opening trenches in coconut gardens for safe disposal of water from fields. They were exposed to the new concept of opening the trenches as a soil and water conservation measure in drylands. However, marginal farmers who own small pieces of fragmented land are not interested in constructing TCBs as it removes land from cultivation.

TCBs have been implemented in 105 ha of land in 2003. The beneficiaries contributed 30% share of the total cost in the form of labour. The typical trenches are 5 m long, 1 m wide and 0.3 m deep respectively with a storage capacity of 1.5 m^3 (1500 liters). Depending

on the soil condition, a labourer can dig 4-5 trenches per day. Such trenches (55-60 per ha) can harvest 148 m^3 to 162 m^3 water. Both the trenches and bunds are utilized for plantation of forestry seedlings, fodder, with good survival and establishment.

3.2.3.3 Farm ponds

Before farm-ponds were introduced in to this cluster, the people were not aware of the concept of digging ponds specifically for water harvesting. They were familiar with water collection in pits, since in this village, many small dugout pits were seen in the farmers' fields. The soil from the pits was used for coconut plantation to improve the soil fertility and the dugout pits then acted as water-storage structures. Normally, the dugout pits are 1 to 3 m deep with varying volume (3 to 5 m^3). Farmers came to know about the concept of farm ponds and their role in rainwater harvesting and recharging of ground water through the earlier work of the NGO project partner BIRD-K, which had already made considerable impact in neighboring villages. So, farmers readily accepted the concept of farm ponds after field visits and interaction with the beneficiaries of the neighboring village.

Forty five farm ponds were dug with partial contribution from the farmers. The *Salaha Samithi* members in consultation with BIRD-K officers selected the site for excavation of farm ponds**.** For every 2 ha area, one farm pond was proposed in lands having 2-3% slope.

When dug out manually, the side slopes were cut into steps around the pond boundaries. The capacity of the ponds varied depending on the size and location of the farmer's plot. On an average, the ponds were of 10 m long, 10 m wide and 3 m deep with 1:1 side slope. This means creating a water storage of 170 m^3. The dug out soil was used to build a mound of 1-1.5 m high around the pond to protect the pond and act as wall around it. Protective grasses, forest tree species and vegetables were planted on the mounds. Each pond has inlet and outlet channels. The inlet channel has a silt trap and stone pitching was done to protect the inlet from erosion. Due to the farm ponds, the ground water level has improved considerably.

Informal agreements in the community allowed some of the stored farm pond water to be seen as a common property in terms of drinking water for livestock. The community agreed this in recognition of the pond being constructed with project resources.

During the visit of farmers to *Krishi Mela* (Agricultural festival) at GKVK (*Gandhi Krishi Vigyan Kendra)*, UAS, Bangalore, farmers came to know about the lining of the farm ponds. Some of them were ready to take up lining activity, but under the project, only one farmer was selected for this in consultation with *Salaha Samithi.* A pond of 243 m^3 capacity was dug and lined with soil cement (8:1). The performance of the lining material is to be observed.

Because of the ponds, there was recharge of ground water and the dried open well was rejuvenated. The ponds were also serving as drinking water source for cattle, and supported nursery activities and watering of vegetables and fruit trees. The extent of ground water

recharge is being monitored in open wells and tube wells using a water level indicator designed by ICRISAT.

3.2.3.4 Gully plugs

Gully plugs were constructed in the coconut plantation of the farmers to arrest soil erosion. Twenty five gully plugs were constructed under this project with 30% contribution from the farmers. The total catchment area covered was 8 ha and average gully depth ranged between 1 to 1.5 m.

3.2.3.5 Check dam

The land in the project area has an average slope of 1-6%. During the PRA, it was noted that, as in the other clusters, considerable runoff is flowing from the village into streams. The community and project decided to construct a check dam to store water in the lower reaches of the farms. Though the site selected for construction of the check dam was in PPR, the land owners readily agreed for constructing the check dam for the benefit of the whole village community. The farmers contributed their 30% share towards the cost of the construction of the check dam.

The check dam benefited more than 30 families in the village. Its benefit extended over an area of 16 ha of land besides making water available for washer men, animals and household use. The check dam also helped in increasing the soil moisture availability to the coconut plants surrounding the check dam.

3.2.4 Cost and benefits from water harvesting structures:

The cost and type of benefits expected from the water harvesting structures are presented in Table-3.2. The benefits varied depending on the structures and the purpose for which they were used: meaningful and reliable quantification of the benefits is not possible at this time due to the short run of the project and due to the long time that is required to see some of the anticipated impacts as in the case of ground water recharging, etc.

Table 3.2 Cost-Benefit analysis of water harvesting structures

Structure	Cost (Indian Rupees)	Benefits**
1. Farm ponds	Rs.6,000 to Rs.15,000/-*	i) Ground water recharge ii) Supplementary irrigation iii) Raising of vegetables and horticultural plants iv) Rearing of fish
2. Check dams	Rs.1,00,000/-	i) Prevention of wastage of run-off water i) Prolonged availability of water ii) Availability of drinking water for cattle, household purposes, washing clothes etc. iii) Ground water recharge
3. Trench-cum-bunds	Rs.2,000/ha	i) Prevent soil loss ii) Better establishment of fodder and agro-forestry trees on the bunds/trenches iii) Increased soil moisture availability in the surrounding area for crops/plants

* This varies depending on the pond size and whether it is lined or unlined

**Varies according to the purpose for which the structures are used

The cost benefits expected from different harvesting structures are briefly discussed below: wherever possible, quantification was attempted.

3.2.4.1 Farm ponds:

The primary use for which farm ponds were constructed varied from cluster to cluster. In Tumkur cluster, the farm ponds were mainly used for percolation and recharging. Hence, the farmers decided not to pump water from farm ponds for irrigation purpose. The water was used sometimes for manually watering a few plants planted around the farm ponds using pots filled from the pond.

In the case of Anantapur, some of the farm ponds were used for giving supplementary irrigation by pumping water. In Mahabubnagar, two farmers decided to use the ponds for fish rearing.

3.2.4.2 Cost and returns from using farm ponds for fish rearing

The estimated cost and benefits from this activity (3.2.2.3) based on the information provided by the two farmers is given in Table 3.3. It can be seen that farmers need to invest around Rs.9,300/- (additional to the original construction cost of farm pond) and can expect around Rs.34,000/- net income in a period of 8 months. Thus, the farm ponds in the farmers fields can be put to very profitable use by efficiently using the harvested rain water during the rainy season, if the water can supplemented to some extent by water from other sources to prevent drying of the pond.

Table 3.3 Estimated cost and returns of fish rearing in existing farm ponds

(Mahabubnagar cluster)

Size of farm pond : 10 m x 10 m x 3 m

Cost of farm pond : Rs.8000/- (dug as project activity)

A. COST			
Input cost			
	i) Cost of 3000 seed fish	Rs.	300-00
	ii) Cost of transport	Rs.	50-00
	iii) Feed cost:		
	a) Rice bran 320 kg. (10 kg. per week for 8 months) @ Rs.3/kg	Rs.	960-00
	b) Sorghum flour 256 kg (8 kg/week for 8 months) @ Rs.10/kg	Rs	2560-00
	iv) Cost of labour for feeding 60 days (2 hr/day for 8 months) @ Rs.30/day	Rs.	1800-00
	v) Cost of harvesting 16 labour @ Rs.40/day	Rs.	640-00
	vi) Transport cost & packing material	Rs.	3000-00
	Sub total	Rs.	9310-00
Fixed cost:			
	Amortised farm pond cost (based on 5 years life)	Rs.	1600-00
	Total cost	**Rs.**	**10910-00**
B. RETURNS:			
	Yield 2250 kg @ Rs.20/kg	**Rs**	**45000-00**
C. NET RETURNS		**Rs.**	**34090-00**

Note: For farm ponds which can store harvested rain water for 4-5 months and/or having facility for supplementary water from another source

3.2.4.3 Cost and benefits from farm ponds for supplementary irrigation:

One farmer in Anantapur, who had dug an unlined farm pond, sowed 2 ha of land with groundnut during early rains but observed soil crust formation due to which there was poor germination. From the water collected in the farm pond during the May and July rainfall, he gave a light irrigation to one hectare of groundnut crop. This resulted in crust breaking and good germination of the crop, and a harvest of 1050 kg/ha yield from the supplementary irrigated plot as against 525 kg/ha from the plot for which no irrigation was given. The cost and benefits from using the harvested rain water in farm ponds for giving this supplementary irrigation to the groundnut crop are given in Table 3.4. It can be seen that one light irrigation for crust breaking resulted in additional net income of Rs.5375 per ha, which is almost double the income as compared to the plot without supplementary irrigation.

Table 3.4 Cost and benefits of supplementary irrigation from unlined farmponds for crust breaking in a groundnut crop on sodic soil.

Size of Farm Pond:	10x10x2.5 m
Cost of the Farm Pond:	Rs.8000/-
Total area under the crop :	2.00 ha
Area irrigated from farm pond:	1.00 ha

A COST :	(per ha)
Additional cost for giving supplementary irrigation (hiring cost of sprinkler and pump set, diesel, etc.)	Rs 400-00
B. Fixed cost: Ammortized farm pond cost (based on 5 years life)	Rs. 1600-00
Total cost	Rs. 2000-00
C RETURNS:	
Additional yield	525 kg.
Additional returns	Rs. 7375-00
NET RETURNS:	Rs. **5375-00**

Another farmer who had a lined farm pond in his field also took advantage of runoff water collected in the farm pond for giving a supplementary irrigation to his groundnut crop The farmer took up early sowing of the groundnut crop taking advantage of the May rains and provided one supplementary irrigation through sprinklers during pod formation stage

using the water collected in the farm pond during July rains. This farmer also would have reaped substantial benefit from the farm pond but his crop was badly damaged by wild pigs from nearby hillocks, which caused a loss of 70% of the expected yield (nearly 1000 kg/ha).

3.2.4.4 Check dam:

The check dams are highly capital intensive and cost around Rs.1,00,000 as they are masonry structures built with sand, cement and stones to withstand the force of runoff water during rains and to hold the water. The check dams were mainly used for recharging of ground water, for drinking water for animals, for washing clothes, etc. All the check dams constructed in the project sites resulted in prevention of runoff and also helped in recharging the ground water. Although the benefits can not be quantified, the farmers expressed that the duration of availability of water for pumping in the tube wells has increased by 1 or 2 hours and there is perceptible increase in the ground water levels due to the check dams. In Tumkur and Anantapur clusters, the water retained by the check dams helped the washer men by prolonged availability of water: the washermen were very happy as they could increase income and save a lot of time which previously was spent in the search for water.

3.2.4.5 Trench-cum-bund :

The main benefit accrued from the trench-cum-bund was accumulation of soil in the trenches, thus preventing the soil loss from the fields. Besides this, the water in the trenches helped in better establishment of planted trees and grasses on the bunds along the trenches. These benefits could not be directly quantified due to the short duration of the project.

3. 2. 5 Synthesis: water harvesting

- The action learning tool (rainfall simulator, 3.1.1.1) was effective in creating awareness and interest among farmers about soil and water conservation measures. This change in their attitude was helpful in promoting NRM related interventions.

- The exposure visits to different land and water development programmes (at CRIDA farms, BAIF centres and Anantapur) were very effective in building confidence among farmers and bringing change in their attitude towards conservation programmes. They readily accepted to have farm ponds, trench-cum-bunds, check dams, and gully plugs, etc. in their fields with suitable vegetative cover wherever needed. The farmers in Anantapur cluster wished to have lined pond after visiting Regional Research Centre of the State Agricultural University at Anantapur. They reaped the benefit of stored runoff water in lined pond and gave supplemental irrigation to save drought affected groundnut crops. The unlined ponds helped in recharging ground water. These were the outcomes of exposure visits that created conservation awareness.

- The interest of farmers in farm pond construction was stronger than expected by the project staff. The technology has been available and promoted for over a decade in the past but with limited uptake. The exposure visits, availability of funding and increasing occurrence of drought in recent years could all have contributed to the better uptake in

this project. This highlights that uptake of a technically viable intervention is dependent on the context in which the farmer operates.

- In two communities (Pampanur, Anantapur and Zamistapur, Mahabubnagar), the villagers could find ways to use CPRs (temple land and tank bed respectively) for the benefit of a poor landless family and landless women, respectively. This process is unconventional and brought a change by increasing the livelihood opportunities for three needy families. Promoting agro-forestry in CPR and degraded lands has started the process of changing them to productive lands. The facilitation of this process by the *Salaha Samithi* was very much effective.

- Participatory monitoring of ground water created awareness among the villagers on the depletion of ground water resources. One outcome is that a farmer in Chowderpalli village switched from paddy to irrigated dry (I.D) crops for arresting the depletion of ground water.

3.3 Soil fertility related interventions

3.3.1 Introduction

Soils of the Indian semi-arid tropics are poor in fertility due to their inherent properties traceable to their origin and formation, and are exposed to degradation due unfavourable climate and inappropriate use. They are low in organic matter and deficient in nitrogen, phosphorus, sulphur and zinc (Srinivas *et al*., 1999). While privately owned lands can be impoverished by poor management, common lands become degraded by unregulated overexploitation, resulting in unproductive soils leading to ever-declining livelihood support to people dependent on them. In the project, it was hypothesized that this situation can be prevented or reversed by promoting sustainable use and management of soils in both PPRs and CPRs, which would eventually lead to improved livelihoods of the people dependent on them. This hypothesis is also based on the findings of an earlier project (NRSP R 7974, 2002) which showed that farmers of the Indian semi-arid tropics (SAT) have an active interest in managing their soils, and that there are markets for organic matter, from which poor people can benefit.

Improvement in the organic matter status of the soils was construed as a generic solution to the problem of poor soil fertility. Although soil samples from several farmers' fields were tested, there was no specific attempt to correct nutrient deficiencies through strategic fertilization, because chemical fertilizers are expensive and unlikely to be used by poor farmers. The major approach used in the project to improve the fertility of the soils was to promote biomass yielding tree species in both PPR and CPR lands. The biomass produced in PPRs could be used as fodder and as organic manure for soil application, while the biomass produced in the CPRs could be used as fodder for livestock owned by the landless and also for composting by the landless. The manure/compost produced by the landless, using inputs drawn from the CPR plantations, could be sold by them to landowners and used to improve the fertility of the PPRs, while the fertility of the soils of the CPR lands would be improved by the trees planted and raised on them. This approach is schematically shown in

Figure 3.2 below. Other approaches were introduction of legumes in the cropping systems, promotion of bio-fertilizers and soil test based fertilization, where nutrients are used in excess of the crop requirement.

The cluster-wise achievements relating to these approaches except introduction of legumes in the cropping system, which is discussed under Output 3 (see Section 4.3.3.1.3) are described hereunder.

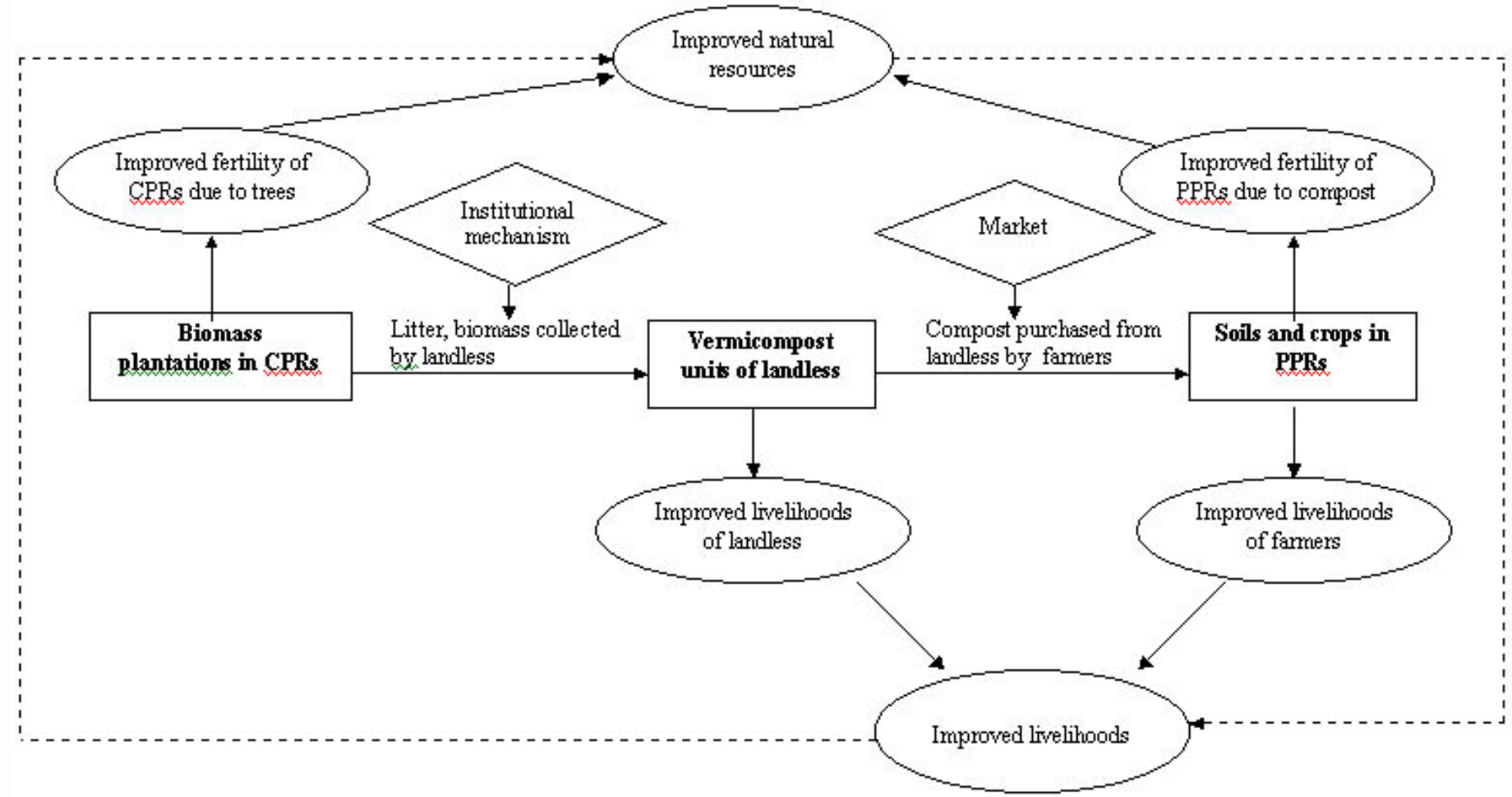

Figure 3.2 A framework for improving natural resources and livelihoods through biomass plantations and vermicomposting

3.3.2 Anantapur cluster

3.3.2.1 Biomass plantation

In September 2003, 62 families from the three villages in the cluster took up plantation of around 2300 mixed seedlings of neem, pongamia, custard apple, casuarina, eucalyptus, gliricidia, etc., in their backyards and fields. Women played an active role in the plantation, The following year, on world environment day (5th June 2004), with the active involvement of the *Salaha Samithi* members, a plantation programme was taken up in the temple endowment land at Pampanur that was converted into CPR. About three hundred people participated in the programme and 250 seedlings of soil improving green manure yielding, leguminous tree species (gliricidia (100), sesbania (25), pongamia (100), dalbergia (25)), along with 85 mango, 25 emblica and 25 casuarina seedlings were planted. A landless person was appointed to take care of the plantation, thus creating a livelihood opportunity for his family. As the trees grow, the soil of the temple lands will be improved and green biomass is expected to become available for livestock and for composting. Biomass plantations were also taken up in the trenches of trench-cum-bunds and the perception of the farmers is that the survival of the saplings is good. Harvestable biomass from the trees can be expected from 2006 onwards.

3.3.2.2 Vermicomposting

Vermicomposting was proposed as an income generating activity for the landless, but when the matter was discussed with the *Salaha Samithi*, the members expressed that landless people may not be able to find a market for the product. The SS proposed that the activity be given to small and marginal farmers, who would have the option to sell the compost or to use it on their own farms. The SS identified 12 small and marginal farmers for vermicomposting. The project supported the construction of vermicompost tanks and supply of earthworms, all of which cost up to Rs. 2000 per unit. Seeing these units, three farmers constructed cheaper vermicompost units on their own. The participating farmers successfully produced between 100 to 500 kg of vermicompost, mainly using cattle and farmyard waste. Since the raw material used for composting was from the participating farmers' own farms and households and the labour was their own (roughly about an hour a day), there was no paid-out cost in the production of vermicompost. The farmers produced and applied the vermicompost to their crops, which included groundnut, papaya and other horticultural crops.

The farmers who applied vermicompost to groundnut expressed that the groundnut pods in the part of the field where compost was applied were bigger in size compared to groundnut pods in the part of the field where compost was not applied. The farmers felt that the compost produced was insufficient to meet the requirements of their farms. The vermicompost units promoted in the project were intended to expose the participants to the technique of vermicomposting, not to produce enough vermicompost to meet the requirements of the participants' farms, For any future support to vermi-composting, the size of vermicomposting unit would need be optimized to suit the farmers' requirements and resources.

3.3.2.3 Soil testing and advice

From each of the three villages in the cluster, soil samples from 20 farmers' fields were collected and tested at ICRISAT, and soil test based fertilizer recommendations were provided. The soils were acidic to neutral in pH, non-saline, medium to high in potassium, low to medium in organic matter, nitrogen and phosphorus, and low in sulphur, zinc and boron. It was found that some farmers were applying more phosphorus to groundnut than the crop's requirement. Simple experiments were conducted on 8 farmers' fields to demonstrate the usefulness of soil test based fertilizer application. Soil test based fertilization not only reduced the cost of fertilizers by Rs. 110 per hectare but also increased the pod yield of groundnut by 200 kg per hectare (Table 3.5).

Table 3.5 Comparison of farmers' practice and soil test based fertilization

Fertilization	Fertilizer applied (kg/ha)		Cost of fertilizer (Rs/ha)	Pod yield of groundnut (kg/ha)
	Diammonium phosphate	Muriate of potash		
Farmers' practice	62.5	62.5	825	2111
Soil test based	50.0	62.5	715	2311

3.3.3 Mahabubnagar cluster

3.3.3.1 Biomass plantation

In 2003, before the start of the monsoon, farmers in the cluster were explained the benefits of growing green biomass yielding trees on field bunds and boundaries. The farmers showed little interest and no plantation was undertaken except on a small piece of PPR wasteland in Chowderpalli village, where 100 leucaena saplings were planted. After soil and water conservation work began and trench- cum-bunds were laid, farmers showed more interest in planting trees in the trenches. A total of 5140 seedlings of teak, cassia, dalbergia, leucaena and gliricidia were planted in farmers' fields and backyards in Chowderpally and Bukkalonipally villages in 2004. The saplings were sourced from the nursery units promoted in the project (see Section 4.3.5). Biomass plantation was also taken up in the tankbed CPR of Zamistapur, where 350 gliricidia and 350 pongamia seedlings were planted in trenches around the boundary on three sides of the land allotted to the two women entrepreneurs.

3.3.3.2 Vermicomposting

In this cluster also, the *Salaha Samithi's* inclination was to select only farmers for vermicomposting, but the project team was keen to promote the activity among the landless to see whether they can successfully produce vermicompost and sell it. The *Salaha Samithi*

indicated that it would be a good idea to select landless persons owning cattle, so that availability of raw material for compost would not be a constraint. Vermicomposting was readily accepted and adopted in the cluster, where it was promoted among small and marginal farmers as well as landless with cattle. A total of 18 units (14 farmers and 4 landless cattle owners) were established in the cluster initially. Five more farmers came forward to take up the activity and they were also supported by the project, taking the total number of participants to 23.

The participants successfully produced 2-3 batches of vermicompost and applied it to their paddy, fruit and vegetable crops. Venkatamma, a small farmer of Zamistapur village, produced 4 quintals (1 quintal = 100 kg) of vermicompost. She used two quintals on her own farm, sold one quintal to the project, and sold one quintal to another farmer at a price of Rs. 3 per kg. The farmers who applied the vermicompost to vegetable crops reported better crops with vermicompost application. Excepting Venkatamma, there was no sale or purchase of vermicompost. All the landless participants and some participating farmers have expressed that there is no internal market for vermicompost in the villages, and have stopped producing it. Thus, promoting vermicomposting among landless people appears to be unsustainable unless external markets are explored and market linkages are established.

3.3.3.3 Biofertilizers

The concept of using biofertilizers was not known to the farmers earlier. An effort was made in the project to create awareness among them regarding the use of biofertilizers. The potential benefits of biofertilizers were explained to the farmers and the methods of their use were demonstrated. Subsequently samples of biofertilizer were provided to farmers, but they showed very little interest in using them on their crops. Recognising that this might be due to the unfamiliarity of the farmers with biofertilizers, in 2004, simple field experiments were laid out in farmer's fields to allow the farmers to assess the benefits of biofertilizers. However, due to the poor monsoon, the crops failed and the objective was not fulfilled.

3.3.3.4 Soil testing and advice

Soil samples were collected from 20 farmers' fields in each of the four villages and analysed at ICRISAT. The analysis revealed that soils are acidic to neutral in pH with a few samples being alkaline, non-saline, medium in potassium, low to medium in organic matter, phosphorus and zinc and low in nitrogen, sulphur and boron. The results of soil analysis and generalized fertilizer recommendations were provided to the farmers. Demonstration experiments, one in each of the four villages, with improved varieties, soil test based fertilization, use of vermicompost and biofertilizers were planned in 2004 in a maize-pigeonpea intercrop, but due to the poor monsoon, the experiments could not be carried out.

3.3.4 Tumkur cluster

3.3.4.1 Biomass plantation

Mass plantation involving the community was taken up during 2003 and 2004 by creating awareness among the people regarding the potential benefits of planting and growing trees in PPRs and CPRs. The planting was done for two years and 49000 seedlings were planted, 36000 in PPR's and 13000 in CPR's. The nursery units promoted through the project (Section 4.3.5) supplied 4200 seedlings of gliricidia and 1800 seedlings of cassia for the Green Festival. The plantation process was institutionalized by celebrating the planting programme as '*Hasiru Habba*' (Green Festival). The species planted were jointly chosen by the village community and the project team and included casuarina, silver oak, gliricidia, leucaena, pongamia and teak, a diverse group of species each with its own specific utility such as fodder, timber, green manure, aesthetic value, etc. Existing self help groups in the villages were active in the plantation and at present they are taking care of the seedlings. Biomass plantation was also taken up in the trenches of trench-cum-bunds @ 120-160 plants per ha of different species, an average of 85% have survived.

3.3.4.2 Vermicomposting

In Tumkur cluster also, vermicomposting was identified as a potential livelihood activity for the landless, but as per the *Salaha Samithi's* suggestion, only small and marginal farmers were selected for the intervention. Nine units of vermi-compost were initiated and all the participating farmers successfully produced a total of 1650 kg of vermicompost. The farmers applied the vermicompost to chilly, tomato, coconut, and other commercial crops in their farms and were unwilling to sell the compost to others although the price of vermicompost in the market is Rs. 2.50 per kg. Mr. Shanthaveerappa, who applied vermicompost to gherkin, tomato, chilly and napier grass has reported an estimated 25% increase in the yields of these crops with vermicompost. The vermicomposters are selling earthworms at a price of Rs. 250 per kg to others intending to start their own vermicomposting units. Farmers with cattle are finding it easier to produce vermicompost because of the availability of cow dung, which is a key input in vermicomposting.

The activity was a big hit and many farmers have started vermicomposting on their own, using the cheaper pit method (the method promoted in the project was the tank method). As the farmers themselves are multiplying the earthworms and sharing the earthworm culture, there is no need for external supply of the worm culture. Farmers having vermicompost units report that they have cut down their chemical fertilizer use.

3.3.4.3 Soil testing and advice

Soil samples were collected from 42 farmers' fields in the cluster villages and analysed at ICRISAT. The soils are acidic to neutral in pH, non-saline, medium in potassium, low to medium in phosphorus with a few samples being high, and low in organic matter, nitrogen, sulphur and boron. The results of soil analysis and nutrient recommendations were provided to the farmers.

3.3.5 Synthesis: Soil fertility related interventions

Four activities were taken up in the project to maintain/improve soil fertility in the target areas – biomass plantation, vermicomposting, soil testing and advice with soil test based fertilization in Anantapur, and legumes in the cropping system and biofertilizers in Mahbubnagar.

Biomass plantation was promoted in all the three clusters, and participants were encouraged to plant multipurpose biomass yielding plants in both private and common lands. Biomass plantation had more success in Tumkur cluster, where it was institutionalized as a green festival and is therefore likely to be continued in the future. This success is a testimony to BIRD-K's strong advocacy and leadership in the area of tree growing and village greening and demonstrates the community mobilization that can be achieved. In Anantapur, biomass plantation was taken up in temple endowment land and in private lands. In Mahabubnagar, people's response to biomass plantation was lukewarm initially, but once soil and water conservation measures were implemented, farmers took up plantation in trenches of TCB's. The nursery units promoted in the project had a positive influence on the plantation activity.

Although it was hypothesized that biomass could be generated on CPR lands and utilized by the landless for improving their livelihoods and the fertility of the private lands through, e.g. the production and sale of vermicompost, this did not happen to any significant extent. This was primarily due to the absence of large areas of common land in the project villages, which has become a common phenomenon, due, among other reasons, to the government's policy of distributing land to the landless.

In all three clusters, some plantation did take place on common lands. Temporary arrangements for access to the CPR land and care of the trees (SHGs in Tumkur, landless person employed in Anantapur and poor women cultivating the tankbed in Mahabubnagar) but no regulatory mechanism for long term care and maintenance of the CPR or usufruct rights was instituted through the project. Once the field crops and trees begin to yield economic products, the need for a regulatory mechanism would become evident. Had the project been of longer duration, and/or more CPRs been available for the poor to access, situations warranting a regulatory mechanism would have arisen. Due to the short duration of the project, and the scarcity of productive CPRs, the issue did not justify being made a primary focus of project support.

Vermicomposting was promoted in all the three clusters. Initially, the activity was intended for the landless, but considering the non-availability of CPR lands and the *Salaha Samithis'* concern regarding the lack of market for vermicompost within the villages, the SS in Anantapur and Tumkur directed the activity towards land owning farmers. In Mahbubnagar, project staff negotiated with the SS to include four landless cattle owners among the participants. While the farmers have produced and utilized vermicompost on their own farms, the landless had problems disposing of their product and have stopped producing the compost. Vermicomposting was more successful in Tumkur cluster where farmers are growing commercial crops, which can produce better returns from the money and labour invested on vermicompost production and application.

Through the continuous interaction between the cluster communities and project staff during intervention planning, implementation and evaluation, the agreed interventions represent the outcome of the combined knowledge of project staff and the indigenous (technical) knowledge of the community members. Specific examples are the advice of the SS not to prioritise the landless poor for vermicomposting, adaptation of vermicompost method to pit composting; the use of farm ponds for fish farming, the uptake by farmers of biomass planting on TCBs, once increased soil water availability was assured.

3.4 Achievements

OVI	Achieved	Comment/justification
By 2005, at least 25% of the target groups adopt soil and water conserve-ation measures.	Achieved	More than 25% of the target groups in the three clusters adopted or benefited from soil and water conservation measures
By 2005, at least 25% of the target groups adopt INM practices to sustain soil health / fertility.	Achieved partially	In deference of farmers' felt and expressed needs for soil and water conservation and enhancement of water availability, and improved varieties of crops and forages, soil fertility aspect was given less emphasis. Awareness was created in all clusters regarding biomass plantation, vermicompost preparation and utilization, soil test based fertilization, introduction of legumes in the cropping system (Section 4) and biofertilizers. All clusters have tested two or more of these soil fertility management practices but how far the participants will continue with these practices is not known. Once the results of soil and water conservation measures become evident to the village community on a sustainable basis, widespread adoption of soil fertility management practices is likely to happen as a result of awareness created in the project.
By 2005, CBOs in at least 2 project sites report improved productivity of CPR through specific interventions	Achieved	CPRs at two project sites, the tankbed in Zamistapur, Mahabubnagar and the temple endowment land in Pampanur, Anantapur were brought under use and their productivity has been improved

3.5 Key learnings

From the interventions carried out in different clusters on rainwater harvesting and soil fertility management the following lessons were learnt.

- The farmers responded well to extension messages and are willing to take up technological interventions for sustainable use of natural resources if they are convinced about their usefulness.

- The exposure visits and farmer to farmer interaction played an important role in changing the mindset of farmers.

- The rainwater harvesting structures are capital intensive and need external funding for their adoption through government programmes and others forms of support

- Participatory groundwater level monitoring is a tool with potential to be used by communities to assist their water management. Any further support to its use should assist its institutionalization and application within the community structures (PRI, SS, User Groups).

- All the technological interventions of rainwater harvesting and soil conservation had beneficial effects as perceived by the farmers, but they could not be quantified due to short duration of the project.

- CPRs, wherever available, can be made accessible to the poor through dialogue with the concerned PRIs and the village communities. However, the extent of the contribution that CPRs can make to improving the livelihoods of the rural poor is uncertain in the project areas because of the scarcity of productive CPRs.

- By properly interacting with and convincing the village community, PPRs can also be used as CPRs for construction of check dams, etc. which will benefit the farmers.

- Bunds and biomass plantations have a functional and interdependent relationship. The formation of bunds creates the scope for biomass plantation and the plants strengthen and stabilize the bund. The two should be promoted together.

- Vermicomposting is not always an appropriate livelihood opportunity for the rural poor. It is likely to be more successful in locations where large areas are planted to fruits, vegetables, flowers and other commercial crops that create a demand for

compost. In such areas, even landless persons can take up vermicomposting to meet the demand from the farmers, possibly even through a purchase contract.

- When the output of an activity is a saleable commodity, e.g., vermicompost, nursery seedlings, the activity should be promoted only after scoping for markets. In other words, the activity should be preceded by a market linkage, preferably a forward market arrangement.

- A group of people within the village, already existing or newly formed (e.g., *Salaha Samithi*), should be identified for implementation of development activities during and after project/programme support. A small payment to the group should be contributed by the people who stand to benefit from the development activities, to create a fund that is managed by the group to carry the activities forward. The group and the fund available with them should be made accountable to the participants and the whole village community. This arrangement can significantly enhance post-project sustainability of activities.

References

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FARM PONDS

Farm pond at Chowderpalli village in Mahaboobnagar

Form pond filled with rain water in Mahabubnagar

Farm pond with harvested water in Tumkur cluster

FARM PONDS

Farm pond with silt trap in Tumkur cluster

Digging of farm pond by villagers at Anantapur cluster

FARM PONDS

Vegetables cultivation near farm pond in Anantapur

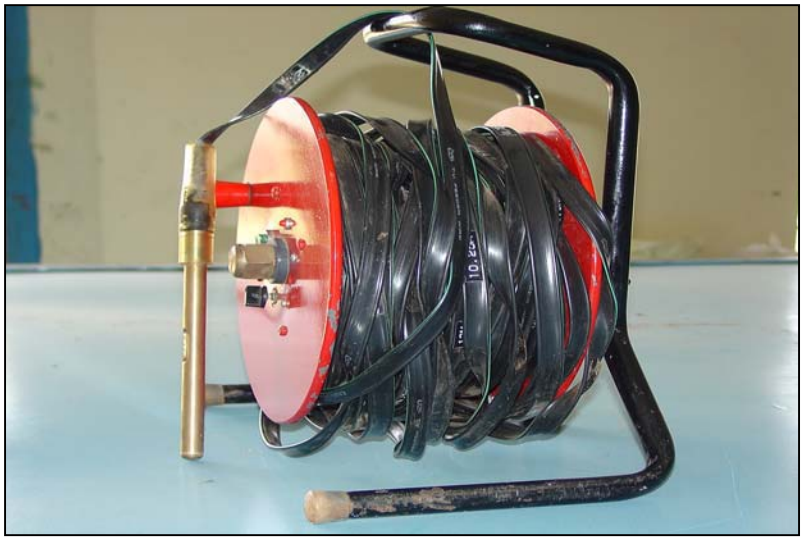
Supplementary irrigation from farm pond to groundnut crop using sprinklers irrigation in Anantpur

Check dams

Check Dam at Chowderpalli in Mahaboobnagar

Check dam filled to brim during first rain in M'nagar

Ground water conservation



Ground water level measuring device

Farmers measuring level of ground water through measuring device

Trench cum Bunds

Trench-cum-bund in Tumkurcluster

Trench-cum-bund in Tumkur cluster

Trench cum Bunds

Trench cum bund in Mahabubnagar cluster

Trench cum bund for conservation of soil & water in M'nagar

Gully plugging for and water conservation in

Recharging defunct wells through rain water diversion in A'pur

Defunct well filled with rain water through diversion pipes in A'pur

CPR Development

CPR Development

Fodder maize in tank bed in Zamistapur, M'nagar

Vegetable cultivation in CPR land (tank bed) in Zamistapur, M'nagar

Chilies in tank bed in Zamistapur, Mahabubnagar

CPR Development

Chickpea in CPR land (tank bed) in Zamistapur, M' nagar

CPR (temple land) planted with fruit trees in A'pur

CPR (temple land) planted with fruit trees in Anantapur

CPR Development

Farm pond in CPR land in Anantapur

Vegetables cultivation near farm pond in CPR (temple land) in A'pur

Flowers and vegetables cultivation near farm pond in CPR (temple land) in A'pur