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Sustaining Rural Livelihoods in Fragile Environments: Resource Endowments and Policy Interventions - A Study in the Context of Participatory Watershed Development in Andhra Pradesh

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I

BACKGROUND

While watershed development is a land based technology, over the years it has evolved into a participatory and people centred programme in India through various policy guidelines at the central and state levels. Participatory watershed development is found to be effective due to its emphasis on social capital development. In Andhra Pradesh the Rural Livelihoods Project (APRLP) was initiated in partnership and with the support of DFID, U.K., with an aim to reduce poverty through effective and Sustainable Rural Livelihoods (SRL) strategy in five drought prone districts of Andhra Pradesh (Anantapur, Kurnool, Mahabubnagar, Nalgonda and Prakasam). The SRL strategy is being integrated with the scaling up of watershed activity by supporting capacity building, livelihood support, and convergence of other schemes and services (Government of Andhra Pradesh, 1999).

This paper is set in the context of a larger development policy debate pertaining to regional inequalities in India. Historically some regions had experienced agricultural prosperity due to their resource endowments especially water. The complementarity between modern inputs and water has boosted the public investments in these regions in order to achieve food self-sufficiency. On the other hand, the fragile resource regions were left to private initiatives. This has led to regional inequalities in terms of economic and environmental development. Of late, the fragile regions have started attracting policy attention due to economic and political compulsions.¹ Watershed development (WSD) is being promoted in these

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regions in order to improve the resource productivity apart from enhancing the resources like water. Some even perceive that WSD is an alternative to irrigation development in these regions. However, whether such a policy initiative would enhance the rural livelihoods given the resource constraints in the fragile environments is a moot question. That is, to what extent WSD can boost and sustain the rural livelihoods in comparison with endowed regions, which have enough surface or groundwater potential. The present study is an attempt to examine the potential of watershed policy influence on livelihoods. The main objective is to assess the rural livelihood strategies in the context of resource endowments, resource valuation, market and other institutional mechanisms, technological options, alternative livelihood avenues, etc.

This paper is organised in six sections. The following section presents the analytical framework along with the approach while Section III sets the empirical context. Section IV presents the livelihood analysis where quantitative assessment and analysis of resource endowments, access and livelihoods at the household level is taken up. This section draws mainly from the household data generated through census questionnaire. Differences between poor and non-poor endowments of livelihood capitals and their inter-relationships in the context of their livelihood strategies are discussed in Section V. And the final section summarises the main findings and puts them in the policy perspective.

II

ANALYTICAL FRAMEWORK AND APPROACH

Poverty alleviation programmes (PAPs) in the developing countries are often focused on employment generation and asset support to the targeted populations. While the target group approaches were focused on the economic well being of the households, the recently evolved sustainable rural livelihoods (SRL) approach is more comprehensive in the context of poverty alleviation. The SRL approach reflects the now accepted understanding that poverty itself is a complex, multi-dimensional experience that includes both material and non-material aspects of life (Soussan and Lincklaen, 2003; UNDP, 2003). It lays stress on livelihood assets, or capital, as the basis for the sustainable improvement of people's livelihoods. This is seen as a more effective reflection of development than income as it reflects both the ability to accumulate wealth and the capabilities (or assets) that households can deploy to secure a living. These assets are also under the control of the households and are the basis for giving people greater choice over the directions that their livelihoods take. The concept of sustainable livelihoods is increasingly being accepted as providing both a basis for understanding the nature of poverty and for identifying the types of strategies that can reduce poverty in an effective and sustainable manner using different types of assets/capital.²

The five capital framework of SRL is adopted here.³ These include natural, financial, physical, social and human capital (Carney, 1998; Davies, 1996; Soussan *et al.*, 2000). Sustaining rural livelihoods is critically linked to the enhancement of these capital. Improvement in all these capital could be a function of changes in financial, physical, natural, social and human capital. Improvement in each of these capital is in turn dependent on various indicators. *Financial* capital is dependent on income, employment and savings; *physical* capital is dependent on assets, watershed structures, infrastructures; *natural* capital is dependent on water, land, common pool resources (CPRs); *social* capital is dependent on migration, collective action, institutional strength, equity, and gender; and *human* capital is dependent on health, education, skills. In the present context financial capital is measured in terms of income from various livelihood activities. Physical capital is measured in terms of household's possession of durable assets such as house, machinery, livestock, etc. Natural capital is measured in terms of improvements in land, water, and other common pool resources (CPRs). Human capital is measured through changes in expenditure on education and health. All the five capital are inter-linked, as the indicators closely interact. An attempt is made here to construct a single index of SLR though it has measurement problems.

A major problem in measuring the selected SRL indicators is that some of them are measured at the household level and some are at the village or community/group level. Synthesising these levels in a coherent manner is difficult, though SRL framework is capable of integrating the local and global aspects. Similarly, integrating quantitative and qualitative aspects is also difficult, as quantification is not possible in all the cases. Measurement of change in some of the variables such as collective action and gender empowerment is difficult as is attributing the changes to a particular programme like watershed development.

In order to construct a single index of SRL some of the important indicators are converted into monetary terms. These indicators include benefits from improvements in the availability of fodder, fuel wood and groundwater (natural capital), improvements in household assets (physical capital), total household income (financial capital), changes in the expenditure on health and education (human capital) and changes in income from migratory labour (social capital). It may be noted that social impact, which is measured in terms of impact on migration, is measured in negative terms. That is the increase in migratory labour is treated as a negative impact.

III

EMPIRICAL CONTEXT

Three villages from Anantapur district in Andhra Pradesh were selected to reflect different resource endowments and policy scenarios. The selection of villages was based on the following process. First, all the villages in the district were classified

into four strata, i.e., (i) villages where watershed programme was fully implemented and with smaller area under irrigation, (ii) villages without watershed programme and smaller area under irrigation, (iii) villages without watershed programme but with larger proportion of area under irrigation, and (iv) all other villages. For the present purpose we have selected one village each from the first three strata. Though selection of two villages from each stratum would have been ideal, the number of villages was restricted to three due to cost and time constraints. The selected villages are characterised with the following features:

- * One village with fully implemented watershed development programme but smaller irrigation.
- * One village with no watershed development programme and smaller irrigation.
- * One village with relatively larger proportion of area under irrigation but without any watershed programme.

The idea was to capture the diversity across different levels of policy interventions and resource endowments. This would help in identifying the key factors or resources (say water) that ensure better livelihoods. Details of the sample villages are presented in Table 1.

TABLE 1. DETAILS OF SAMPLE VILLAGES

Village (1)	Type (2)	Mandal (3)	No. of households (4)	PIA+ (5)
1. Mallapuram	Watershed	Kalyandurg	263	AF
2. Obulapuram	No watershed	Kalyandurg	103	---
3. Neelareddypalle	Irrigated village	B. Samudram	189	---

PIA= Project Implementing Agency; AF= Accion Fraterna (a local NGO).

This study primarily focused on assessing and understanding the status of livelihoods under the three scenarios and also across economic classes of the communities. Both quantitative and qualitative methods were used to obtain detailed information. Qualitative research was conducted to assess the livelihood patterns (livelihood analysis) with the help of seasonal mapping, time trends, focus group discussions, key informant interviews and case studies of individuals. Focus group discussions were conducted for groups involved in specific activities and communities such as Development of Women and Children in Rural Areas (DWACRA) groups, Scheduled Castes and Tribes (SC/ST) communities; Backward communities (BCs); landless households, large and medium farmers, and small and marginal farmers. Similarly, the key case study participants represent various vulnerable groups as well as livelihood groups in the sample villages. A detailed survey of all the households (census) in the villages was conducted using an exhaustive schedule comprising socio, demographic, economic and livelihood dimensions of the households. A total population of 555 households in the three sample villages was covered. The fieldwork was conducted during March-July 2002.

All the sample villages fall under semi-arid agro-climatic category with a rainfall of about 500 mm. In terms of soils all the villages are having red soils. The socio-economic structure differs across the sample villages. In all the villages the backward caste communities are in numerical majority. Landlessness (LL) is more in Mallapuram and Neelareddypalle when compared to Obulapuram. On the other hand, the marginal and small (M & S) farmers are proportionately more in Neelareddypalle when compared to other two villages (Table 2). Apart from land, other factors such as physical, human, social endowments, etc., at the village/community level, play an important role in influencing the livelihood strategies. Though the sample villages are located differently in terms of proximity to the main connecting roads or towns, access to physical, social and human capital does not differ much across the villages. Mallapuram scores high on access to all the three capitals, Obulapuram has no access to telephone and water supply (physical capital). Access to traditional doctors like rural medical practitioners (human capital) is absent in Obulapuram and Neelareddypalle. Mallapuram is located at a distance of 4 kms from the mandal headquarters while Obulapuram and Neelareddypalle are located away from the main road. Mallapuram was covered under the watershed development programme supported by the Ministry of Rural Development, Government of India. At the time of fieldwork more than 500 hectares of land was already treated under the programme and the remaining land (about 500 ha.) was being treated under the second watershed. Mallapuram is one of the model villages in the state of Andhra Pradesh, as far as implementation and impact of watershed programme is concerned (Reddy *et. al.*, 2004). Besides, Mallapuram watershed is also selected for the livelihood based watershed development programme under the APRLP programme.⁴

TABLE 2. ECONOMIC COMPOSITION OF THE HOUSEHOLDS IN THE SAMPLE VILLAGES

Village (1)	Percentage of households belonging to				Total (6)
	Landless (2)	Marginal and Small (3)	Medium (4)	Large (5)	
Mallapuram	113 (43)	30 (11)	74 (28)	46 (18)	263 (100)
Obulapuram	09 (09)	05 (05)	57 (55)	32 (31)	103 (100)
Neelareddypalle	75 (40)	44 (23)	24 (13)	46 (24)	189 (100)

Note: Landless (LL)= without any land; Marginal and Small (M&S) = owning an area of less than 4 acres; Medium (Med.)= owning between 4-10 acres; Large (Lrg.) = owning above 10 acres.

Figures in parentheses indicate respective percentages.

IV

RESOURCE ENDOWMENTS, ACCESS AND LIVELIHOODS

(a) *Natural and Physical Capital*

Here natural capital includes land, water, livestock and common pool resources (CPRs). Access to natural capital like land and water is critical for livelihoods in

agrarian economies. As mentioned earlier landlessness was quite high in two of the villages, which are better off in terms of access to irrigation. On the other hand land distribution was skewed in favour of large farmers. The average farm size was higher in the least irrigated village (Table 3). The proportion of area under irrigation was about 60 per cent in Neelareddypalle followed by Mallapuram (25 per cent)⁵ and Obulapuram (13 per cent). There were variations in terms of sources of irrigation also. While Mallapuram and Obulapuram were solely dependent on groundwater Neelareddypalle has surface irrigation (canals) facility. Canal waters are available for one season (October to January), which not only helps in getting one assured crop but also recharges groundwater on a regular basis. Livestock ownership (in terms of value of livestock per household) was more in Mallapuram village. However, high concentration of milk cattle (buffaloes) was observed in the irrigated village of Neelareddypalle. Obulapuram has the lowest concentration in most of the categories. Livelihoods are often determined by access to resources at the household level. Natural and physical capital are the most influential in determining the household livelihood strategies. Here we examine the household access to land, irrigation and irrigation equipment and livestock holdings.

It is clear that land distribution is biased in favour of large farmers in all the villages (Table 3). Distribution of irrigated land and irrigation equipment seem to be less equitably distributed in all the villages except in Mallapuram. Mallapuram seems to be different from Obulapuram village in irrigation distribution, which may be due to greater dependence on non-farm activities. Perhaps income generated through non-farm activities is invested in irrigation equipment. Where as in Obulapuram, marginal

TABLE 3. ACCESS TO LAND AND IRRIGATION ASSETS IN THE SAMPLE VILLAGES
ACROSS SIZE CLASSES

Village/Size class (1)	Total owned land (acres) (2)	Total operated land (acres) (3)	Total irrigated land (acres) (4)	No. of wells owned			Average area irrigated per well (acres) (8)
				Open wells (5)	Bore wells (6)	Total wells (7)	
Mallapuram [263]	921.15	891.82 [3.39]	223.02	11	125	136	1.64
a) Marginal and Small	39.75 (04)	48.05 [1.62]	29.05 (13)	02	13	15 (11)	1.94
b) Medium	301.91(33)	298.27 [4.03]	66.72 (30)	04	50	54 (40)	1.24
c) Large	579.50 (63)	543.50 [12.07]	125.25 (56)	05	62	67 (49)	1.87
Obulapuram [103]	711.55	705.05 [6.85]	95.70	04	43	47	2.04
a) Marginal and Small	10.75 (02)	10.75 [2.15]	0.75 (0.8)	00	00	00 (00)	00
b) Medium	298.80 (42)	294.30 [5.16]	27.45 (29)	03	18	21 (45)	1.31
c) Large	402.00 (56)	400.00 [12.5]	67.50 (70)	01	25	26 (55)	2.60
Neelareddypalle [189]	968.55	985.55 [5.21]	605.30	19	57	76	7.96
a) Marginal and Small	55.05 (06)	58.05 [1.32]	36.30 (06)	03	05	08 (11)	4.54
b) Medium	103.00 (11)	111.00 [4.62]	53.00 (09)	01	04	05 (07)	10.6
c) Large	810.50 (83)	774.50 [16.84]	478 (85)	15	48	63 (82)	7.58

Note: Figures in parentheses indicate the respective percentages and figures in square brackets indicate the respective average farm size.

and small farmers have very little access to irrigation or irrigation equipment. On the other hand, distribution of irrigated area was more even in the case of Neelareddypalle, which is due to the canal irrigation. This is true even in the case of irrigation equipment. Better income levels in this village may be the reason for this equitable distribution.

Interestingly, the ownership of dairy animals was also skewed in favour of large farmers in all the villages, as they own more than 60 per cent of the milk animals (Table 4). Most of the large and medium farmers own milk cattle. It was the case with small ruminants, except in Neelareddypalle where a quarter of the small ruminants were owned by landless households. However, the distribution of small ruminants is less skewed when compared with milk animals. On the whole, animal husbandry, big or small, was the domain of large farmers, though a majority of them do not consider it as a livelihood activity. Mallapuram has more even distribution of ownership of livestock, small as well as big. The high concentration of livestock in Neelareddypalle clearly brings out the interlinkages between access to irrigation and other resources.

TABLE 4. DISTRIBUTION OF MILK CATTLE ACROSS SIZE CLASSES

Village/ Size class (1)	No. of milk animals owned (2)	No. of small ruminants owned (3)
Mallapuram [263]	225	327
a) Landless (43)	14 (06)	57 (17)
b) Marginal and Small (11)	19 (08)	24 (07)
c) Medium (29)	68 (30)	70 (21)
d) Large (17)	124 (56)	176 (55)
Obulapuram [103]	109	97
a) Landless (09)	01 (01)	00 (00)
b) Marginal and Small (05)	01 (01)	00 (00)
c) Medium (55)	40 (37)	38 (39)
d) Large (31)	67 (62)	59 (61)
Neelareddypalle [189]	253	1095
a) Landless (40)	37 (15)	273 (25)
b) Marginal and Small (23)	20 (08)	155 (14)
c) Medium (13)	28 (11)	496 (45)
d) Large (24)	168 (66)	171 (16)

It is often argued that livestock is more equitably distributed than land assets at the aggregate level (Rao and BIRTHAL, 2002). On the other hand, access to irrigation or water resources is more skewed than land in fragile resource regions where groundwater is the main source of irrigation. The variations in the distribution of different types of assets can be seen clearly in terms of gini-ratios⁶ (Table 5). Defying our expectations, the distribution of livestock is more skewed when compared to land and water resources. This happens to hold good even when we separate the milk animals and small ruminants. For, poor households are found to own small ruminants. But, in two of the three sample villages milk animals are more equitably distributed than small ruminants though the difference is marginal. Access to irrigation is more

equitable (in terms of percentage of area irrigated) in Neelareddypalle when compared to less irrigated villages. This indicates that canal irrigation is more equitable when compared to well irrigation due to the high capital-intensive nature of the latter. This argument is well supported by the less equitable distribution of irrigation equipment when compared to area under irrigation in all the villages. This brings out clearly the concentration of all the important assets in the hands of the few rich farmers. This is mainly due to the distortions in the agrarian structure coupled with market distortions. And these distortions are more conspicuous in the less endowed regions, which is reflected in the livelihoods of the households.

TABLE 5. DISTRIBUTION OF IMPORTANT ASSETS (GINI-RATIOS)

Gini-ratio of (1)	Mallapuram (2)	Obulapuram (3)	Neelareddypalle (4)
1. Land	0.62	0.52	0.60
2. Water			
- area irrigated	0.81	0.82	0.68
- irrigation equipment	0.92	0.83	0.88
3. Livestock			
- Total Animals	0.95	0.89	0.95
- Milk Animals	0.96	0.88	0.93
- Small ruminants	0.95	0.91	0.95

CPRs play a crucial role in supplementing the household requirements, especially for the poor. All the sample villages, except Neelareddypalle, have common pool resources (CPRs) in the form of tanks, forests, temple lands, etc. (Table 6). However, there are variations in the management regimes of the CPRs across these villages. Little availability of CPRs in Neelareddypalle is the typical characteristic of the irrigated agriculture. That is, as the extent of irrigation increases commons are converted, legally or illegally, for other purposes. The sample villages have two important CPRs, i.e., tank and forest (unreserved/revenue). Other CPRs include temple lands, roadside plantations, hillocks, etc.

TABLE 6. STATUS AND DEPENDENCE ON CPRs IN THE SAMPLE VILLAGES

Village (1)	Category (2)	Area / No. (3)	Purpose* (4)	Benefits* (5)	Availability (6)	Dependency [†] (7)
Mallapuram	Forest (ha.)	30	1, 2, 3	1, 2, 3	Yes	2
	Tank (No.)	01	5, 7, 8	5, 7, 8	Yes	2
Obulapuram	Forest (ha.)	10	1, 2, 3	1, 2, 3	No	3
	Tank (No.)	01	5, 7, 8	5, 7, 8	Yes	2

Note: *1. Grazing; 2 Fodder collection.; 3 Fuel wood collection; 4. Drinking; 5. Fishing; 6. Livestock; 7. Irrigation; 8. Watering to Cattle.

[†]For Dependency Codes 1 indicates to a large extent, 2 indicates to a limited extent and 3 indicates No.

(b) *Human Capital*

Work participation rates, literacy levels and skills available within the community are taken as indicators of human capital. The work participation rate is the prime indicator of the economically active and healthy population and their livelihood activities. Work participation is defined as per the Census definition: “the percentage of total workers to total population” (Government of India, 1991). Though work participation is mainly dependent on demographic structure (supply side), labour market in terms of demand, wages, etc., also play an important role. Work participation rates are above 60 per cent in all the sample villages (Table 7). Work participation is the highest in Neelareddypalle, which may be due to greater demand for labour from irrigated agriculture. On the other hand, Obulapuram also has high participation rates.⁷ Low wage rates coupled with lack of alternative and assured employment avenues in Obulapuram might be pushing more people into work. In other words, more people participate in labour market to eke out the subsistence family income.

TABLE 7. WORK PARTICIPATION RATES, UNEMPLOYMENT, MALE WAGE RATES AND LITERACY

(1)	Work participation (2)	Unemployment (3)	Male wages (4)	Female wages (5)	Percentage of literates (all)		
					Male (6)	Female (7)	All (8)
Mallapuram	53	57	38	26	68	45	57
Landless	53	50	38	28	59	45	52
Marginal and small	52	53	39	26	64	45	54
Medium	56	63	38	27	71	42	56
Large	54	69	38	22	79	49	64
Obulapuram	54	57	27	20	57	37	47
Landless	44	53	32	22	62	40	51
Marginal and small	58	68	25	19	60	44	52
Medium	56	56	25	20	43	34	39
Large	57	62	22	19	62	28	45
Neelareddypalle	59	45	48	27	60	43	50
Landless	60	42	72	27	59	41	48
Marginal and small	57	51	37	26	58	42	42
Medium	60	53	37	26	54	38	43
Large	59	00	44	31	71	45	65

Note: Unemployment rate is estimated assuming a 300 days working year.

The work participation rates are higher in Neelareddypalle among all economic groups. It is interesting to note in all the sample villages, except Neelareddypalle, work participation among landless and marginal households is low when compared to other groups. This could be due to the age structure of the household members. Across gender groups, there is no systematic pattern across economic groups. The differences in participation rates, demand driven or supply driven, would be clear if we look at the unemployment and wage rates across the sample villages. The extent of unemployment is the highest in Obulapuram and Mallapuram while it is the lowest

in Neelareddypalle (Table 7). Here, unemployment is estimated based on the perceptions of people above 15 years of age. Assuming 300 working days in a year the number of unemployed days ranges from 135 days in Neelareddypalle to 171 days in Obulapuram and Mallapuram. The extent of unemployment is quite high, especially in the less irrigated villages. Added to this would be the problem of under-employment on which we do not have estimates. Neelareddypalle has high participation rates coupled with low unemployment rates. In Obulapuram both participation and unemployment rates are high. As far as variations across economic groups are concerned high unemployment was observed among higher economic sections, which could be due to high participation rates.

Obulapuram has also reported the lowest wage rate in all seasons and across genders while Neelareddypalle has the highest wage rates (Table 7). In fact, male wage rates were higher by more than 25 per cent in Neelareddypalle when compared to the village where watershed works were going on. When compared to Obulapuram where there was no watershed works wage rates in Neelareddypalle were as high as 40 per cent. This clearly indicates that demand factors are in operation in Neelareddypalle where as supply factors are responsible for high participation rates in Obulapuram.

Mallapuram has the highest level of literacy (Table 7). This may be due to long presence and efforts of the local NGO Accion Fraterna/Rural Development Trust (AF/RDT) in Mallapuram, which is also the implementing agency for the WSD programme. The low level of literacy in Neelareddypalle (50 per cent) indicates that economic development need not necessarily guarantee higher levels of literacy. This is also reflected in the case of literacy levels across economic groups vis-a-vis social groups. Differences are conspicuous across social groups than economic classes. On the whole, other castes (OCs) and large farmers have high literacy rates. Gender differences are substantial in all the villages. Gender differentials are more among SC/ST households. Gender differences seem to be more among large farmers when compared to landless and marginal farmers in most of the villages.

Most of the households have skills mostly pertaining to agriculture and other traditional activity related and hence their value outside the agriculture sector is limited. Variations in the proportion of households having skilled persons are marginal across social groups or economic classes. For, these skills are not linked to education or training. Even the variations across the villages are not much. Besides, some training was provided through Self-Help Groups (SHGs) in the areas of group management, leadership, record maintenance, etc. However, the coverage of training is marginal (1 to 2 per cent). In most of the cases the emphasis is more on the weaker sections like SC/ST, landless, etc. In Neelareddypalle only landless classes are trained. It appears that the demand for SHG participation is more widespread in the less irrigated villages, apart from the socio-cultural milieu of the villages and the efforts of the NGOs (here RDT). On the whole, Mallapuram is better-off as far as human capital resources are concerned. It has higher literacy rates as well as non-

traditional skills acquired. Neelareddypalle, which has better access to water, comes next to Mallapuram. This indicates that non-economic factors may be more important in determining the human capital development.

(c) *Social Capital*

Social development is often dependent on factors like community cohesion, networks, leadership, who can overcome the elite domination in the rural communities. Social capital is assessed in terms of participation and formation of networks, self-help groups and women's empowerment. Social networks within the villages are more or less similar across the sample villages. Most of the households depend on friends and neighbours for monetary as well as non-monetary requirements (see financial capital). The advent of self-help groups has further strengthened the group activities apart from empowering the women in many villages. Social cohesion in the sample villages is clearly reflected in the number of SHGs with mixed community membership. Majority of the groups were formed through government programmes, though Mallapuram has substantial number of groups formed through NGO activities. Women felt that they are able to go out to participate in the discussions with officials, banks, etc., after the advent of these groups. They now have a role in decision-making process in the household activities also. They gained credibility with their husbands, as they now contribute to the family earnings. Now they are giving importance to their children's education due to increased savings and awareness.

(d) *Financial Capital*

Financial capital consists of savings, credit and investments (assets and liabilities). While social and human capital can lead to enhanced well-being, their real value addition is realised only when they lead to material benefits. The magnitude and sources of household debt/savings position is examined in order to understand the vulnerability and pressure on households. The burden of debt on the households is assessed with the help of debt-asset ratios. Over the years debt has become an integral part of the rural household economies in the drought prone regions. This problem has aggravated and crossed the acceptable limits in the recent years due to recurring droughts and crop failures in these regions. In fact, excessive debts in the recent years are driving the households towards long term or permanent migration and even prompting suicides among the farmers. This phenomenon is not only limited to poor households but also spreading to medium and large farmers. The percentage of households reporting outstanding debt (percentage of households in debt) ranges between 70 per cent in Neelareddypalle (irrigated) and 86 per cent in Obulapuram (Table 8). Among the landed households the medium size class farmers were the worst affected in less irrigated villages while the small and marginal farmers were the

most indebted in the irrigated village. One reason for the high incidence of debt is the availability of institutional credit to farmers through primary agricultural co-operatives at low interest rates. All the landowners are eligible for taking loans and hence all the landowners take loans from these co-operatives provided they are not defaulters. The average debt per household is the highest in Mallapuram and lowest in Neelareddypalle.

TABLE 8: EXTENT OF HOUSEHOLDS' INDEBTEDNESS IN THE SAMPLE VILLAGES
ACROSS SIZE CLASSES

Village/ Size class	Percentage of indebted households	Loan outstanding (Rs./household)	Total asset value (Rs./household)	Debt-asset ratio	Rate of interest (per cent)
(1)	(2)	(3)	(4)	(5)	(6)
Mallapuram	82	51,633	4,56,686	0.11	24.0
(a) Landless	94	10,455	45,722	0.23	27.0
(b) Marginal and small	57	20,333	1,26,322	0.16	28.5
(c) Medium	81	30,100	3,37,217	0.09	25.0
(d) Large	85	1,23,667	12,14,990	0.10	21.0
Obulapuram	86	39,152	3,12,120	0.13	23.0
(a) Landless	57	14,555	24,272	0.60	24.0
(b) Marginal and small	60	32,500	70,250	0.46	24.0
(c) Medium	96	40,000	1,93,663	0.21	22.5
(d) Large	78	52,118	7,17,083	0.07	24.0
Neelareddypalle	70	33,233	8,94,997	0.04	19.0
(a) Landless	78	12,416	60,241	0.21	23.0
(b) Marginal and small	82	38,500	1,51,059	0.25	22.0
(c) Medium	25	38,500	4,08,318	0.09	19.5
(d) Large	54	37,679	16,78,633	0.02	17.0

Debt-asset ratio is defined, as the ratio between the total debt outstanding of a household and the fixed and durable assets the household owns. That is, higher the debt-asset ratio lower the repayment capacity of the household. Even the credit worthiness is often determined by this ratio. An inverse relation is expected between debt-asset ratio and the credit worthiness. The high debt-asset ratio diverts the household incomes to interest payments keeping the capital debt unchanged. This coupled with low credit worthiness limits the household's productive investments that would help repay the loans. In the process of repaying only interest payments the household gets stuck in the trap. In terms of debt-asset ratios (D-AR) Obulapuram ranks high followed by Mallapuram and Neelareddypalle (Table 8). Debt-asset ratio in Neelareddypalle is less than half that of in other less irrigated villages. This clearly reflects the impact of irrigation on indebtedness. Though farmers in Neelareddypalle also report of high incidence of debts their position is comfortable when compared to other villages.

In all the villages debt-asset ratios are inversely related to farm size indicating that debt burden was more on lower size class farmers when compared to medium and large farmers (Table 8). Interest rates also vary across villages and size classes. Interest rates were the lowest in Neelareddypalle, which could be due to demand and supply of money. The large farmers pay lower interest rates when compared to their counterparts. This reflects the credit market imperfections. Higher levels of indebtedness coupled with high interest rates among poorer households push them into debt trap. Four reasons are identified for borrowing money, i.e., (i) purchase of agricultural inputs, (ii) purchase of equipment and digging of bore wells, (iii) purchase of livestock and (iv) social consumption. The first three categories could be considered as productive investments while the fourth one may be unproductive though necessary. More than 50 per cent of the households borrow for purchasing agricultural inputs. The second important reason was purchase of farm equipment in two of the villages and social consumption and livestock purchases were the second important reasons in two of the villages. A greater proportion of farmers in Neelareddypalle had borrowed money for the purchase of implements and borewells, which may be due to better status of water resources. Across the size classes, large farmers borrowed for purchase of implements and borewells while lower size class farmers borrowed for purchase of livestock.

Despite the fact that a lion's share of the borrowed money is going towards productive investments like agricultural inputs and other investments, indebtedness is increasingly becoming a serious problem. This is mainly due to the fact that agriculture has become a losing proposition over the years, especially due to the recurring droughts and lack of protective irrigation facilities in the region. Besides, greater dependence on groundnut crop has exposed the farmers to risk. Net returns to the important crops during the year 2000-01 amply demonstrate the vulnerability of agriculture as a livelihood support system in fragile environments. The net returns to agriculture are negative in all the villages except in Neelareddypalle, which is largely irrigated (Table 9). The crop losses were mainly due to the failure of groundnut consequent to untimely heavy rains during 2000-01. Among the less irrigated villages Obulapuram fared well because of its poor soils. Losses to groundnut were less in this village due to its rocky soils that resulted in less moisture retention during the heavy

TABLE 9. NET RETURNS AND BENEFIT-COST RATIOS TO AGRICULTURE ACROSS SIZE CLASSES

Village (1)	Marginal and small		Medium		Large		All	
	Net Returns (Rs./ household) (2)	BC ratio (3)	Net Returns (Rs./ household) (4)	BC ratio (5)	Net Returns (Rs./ household) (6)	BC ratio (7)	Net Returns (Rs./ household) (8)	BC ratio (9)
Mallapuram	785	1.21	-183	0.86	-8377	0.69	-1433	0.77
Obulapuram	-26787	0.10	5820	1.22	-257	0.99	-398	0.98
Neelareddypalle	-3757	0.65	4286	1.02	19154	1.40	4334	1.29

Note: Net returns are estimated on the basis of paid out costs, i.e., value of family labour and own land is not included.

rains. While marginal and small farmers have favourable Benefit-Cost (B-C) ratios (>1) in two of the villages, medium and large farmers have reported favourable B-C ratios in the other two villages (Table 9). On the whole B-C ratios are favourable only in Neelareddypalle. Since family labour and land are not included in the costs, farmers would have been net gainers had they hired out their labour for wages and leaving the land fallow or rented out.

V

LIVELIHOOD STRATEGIES

The major sources of income, as indicated in the livelihood analysis are crop production, labour (including migratory), non-farm activities and animal husbandry. Differences in the average household income are more between irrigated and less irrigated villages while the intra village differences are marginal within the less irrigated villages. The average household income in the irrigated village (Neelareddypalle) is almost double that of the other villages (Table 10). Agriculture is the single largest contributor in all the villages except Mallapuram. The contribution of agriculture is the highest in Obulapuram followed by Neelareddypalle and Mallapuram. Income from labour (hiring out) is the single largest contributor while non-farm activities is the largest contributor in Mallapuram. In other villages also income from labour and non-farm activities occupy second and third ranks respectively. Income from labour includes migratory labour also.⁸ In the case of non-farm activities, more than twenty activities⁹ were identified but none of them was a

TABLE 10. SOURCES OF HOUSEHOLD INCOME IN THE SAMPLE VILLAGES ACROSS SIZE CLASSES

Village/ Size class (1)	Share of Household income from						Total Income (Rs./household/ year) (8)
	Agriculture (2)	Dairy (3)	Animal sale (4)	Hiring bullocks (5)	Labour (6)	Non-farm (7)	
Mallapuram	22.80	10.14	04.92	02.87	27.85	31.41	21,556
(a) Landless	00.00	02.14	02.58	02.67	50.67	41.93	16,421
(b) Marginal and small	16.14	05.84	00	09.63	39.51	28.86	19,613
(c) Medium	23.45	08.56	11.73	03.66	22.18	30.42	20,610
(d) Large	49.78	22.55	0.90	01.35	03.21	22.21	37,159
Obulapuram	68.11	04.68	00	00.84	14.17	12.20	23,543
(a) Landless	00.00	00	00	00	34.36	65.64	13,540
(b) Marginal and small	17.26	00	00	00	82.73	00	5,465
(c) Medium	63.71	03.00	00	01.76	20.99	10.54	26,280
(d) Large	78.58	6.75	00	00	09.15	09.15	37,770
Neelareddypalle	47.98	12.53	00	01.97	29.80	07.73	39,860
(a) Landless	00.00	06.25	00	01.40	76.40	15.96	25,681
(b) Marginal and small	12.62	08.75	00	10.55	59.44	08.65	21,119
(c) Medium	47.27	16.53	00	01.84	23.95	10.42	35,333
(d) Large	79.50	15.90	00	00.35	01.35	02.91	84,892

dominant activity. Dairy contributed substantially in Neelareddypalle (12.5 per cent) and Mallapuram (10 per cent) while its contribution was about 5 per cent in Obulapuram. The average household income of the landless households was higher in Neelareddypalle and Obulapuram when compared to small and marginal farmers, which was due to the labour market situation. While in Neelareddypalle employment and wage rates were on the higher side, in Obulapuram returns from agriculture were very low (see the discussion on work participation and unemployment). On the whole household income flows from livelihood activities were in line with the physical pattern of household activities.

The share of non-farm activity in the total income tends to be more for the landless as well as small and marginal households. The share of dairy income tends to increase along with farm size in the villages with smaller irrigation facilities, while little variation was observed in the case of irrigated village (Neelareddypalle). This indicates that access and returns to dairy activities would be more in irrigated conditions. Therefore, dairy development in the drought prone conditions may not be equitable in a natural way. This may be due to the access to complementary resources like fodder, water, etc. In order to make dairy more accessible and remunerative to the poorer households natural resource base, especially CPRs, needs to be strengthened. This can be seen to some extent in Mallapuram (Table 10). The major livelihood activities in the sample villages, as reflected in the sources of income, are cultivation, agricultural labour, dairying, petty-business (running owned and rented autos and provision shops and hotels), etc. Only a few households mainly depend on traditional activities like *toddy* tapping, washing clothes, etc. A few big farmers are growing horticultural crops under watershed development programme in Mallapuram village.

Drought in these fragile environments is the main factor that affects the livelihood systems. During the last five years there was reasonably good harvest only in one year (2000-2001). In Mallapuram migration to far off places has come down after the advent of watershed, though they go to nearby towns for daily work. In spite of severe droughts getting wage employment has become easier due to the ongoing watershed works. Even the wage rates have gone up due to minimum statutory wages paid for the watershed works. Watershed programme has compensated for the decline in agricultural employment due to drought. The impact of drought appears to be very severe in Obulapuram village (unemployment is also high here, see Table 7). Some households even complained about reduced food intake. The farmers were the worst hit due to the repeated failure of bore wells. This has resulted in their indebtedness, which in turn lead to migration. More than 70 per cent of the households migrate to Ballary, Bommanahal, Kanekal for wage works during the drought years. During 2001-2002 around 70 households migrated to the above places during the summer season (usually for 3-4 months period). While young and able bodied migrate, old people stay back to look after the cattle and house. Majority of the people sold their cattle (buffaloes, sheep and goats) due to fodder scarcity during the drought period.

Being an irrigated village Neelareddypalle portrays a different picture. As in the case of other villages, here also, cultivation, agricultural labour and livestock rearing are the main livelihood activities. Some communities follow dairying as the main activity followed by own cultivation. Severe drought conditions seem to have affected the livelihood systems in this village also. Despite the availability of irrigation, yields were low and input costs were higher. The status of labour in terms of indebtedness was particularly better than farmers. Repeated borewell failure had led to their indebtedness. For instance, during the months of February-March, 2002 farmers had dug around 40 borewells, out of which only 6 were successful. They spent around Rs.10 lakhs on these bore wells by borrowing from the moneylenders. There are about 20 farmers (large) who were affected by severe indebtedness. There is potential for dairy development due to good availability of fodder. The economically weaker sections need financial support in the form of loans to buy cattle. They also need infrastructure such as markets, roads and transport facilities.

As far as access to livelihood capital is concerned there is clear bias against the poor. Only in the case of social capital (measured in terms of membership in SHGs) poor households are better off. This may be due to the reason that SHGs are mainly meant for the poor. The inter linkages between different types of capital further aggravates the conditions of the poor. For, there are strong and positive linkages between natural, physical and financial capital for both poor and non-poor categories (Table 11). On the other hand, social capital has a weak relationship with all other capital except human capital, especially for the poor category households. In fact, social capital has a strong negative linkage with financial, natural and physical capital in the case of non-poor category households. These linkages hold good even at the village level.¹⁰ As between the villages, access to natural capital seems to be crucial for having access to other capitals, especially physical and financial. The linkage appears to be stronger among non-poor households (Table 11). Among the non-poor

TABLE 11. INTER-RELATIONSHIPS BETWEEN CAPITAL AMONG POOR AND NON-POOR
(ZERO-ORDER CORRELATION MATRIX)

Capital (1)	Natural (2)	Physical (3)	Financial (4)	Human (5)	Social (6)
Poor					
Natural	1.0000	0.145*	0.157*	0.092	0.067
Physical		1.0000	0.348*	0.155*	0.037
Financial			1.000	0.037	0.055
Human				1.0000	0.091
Social					1.0000
Non-Poor					
Natural	1.0000	0.718**	0.550**	0.221**	-0.224**
Physical		1.0000	0.603**	0.203**	-0.232**
Financial			1.0000	0.172**	-0.155*
Human				1.0000	-0.008
Social					1.0000

Note: ** and * indicate significance at 1 and 5 per cent respectively.

households the positive relations expand to human capital also. On the other hand, social capital (the only capital to which poor have better access) has a positive relation with human capital only. Therefore, unless the poor gain reasonably better access to natural capital, especially water, their livelihoods may not change much even in the presence of resource-based programmes.

VI

CONCLUSIONS

The preceding analysis clearly brings out the importance of irrigation in sustaining rural livelihoods. Despite the policy interventions in one of the sample villages (Mallapuram) and strong institutional presence, this village is only marginally better-off when compared to the other village with smaller irrigation facilities (Obulapuram). Village with smaller irrigation is characterised with high unemployment, low wage rates, migration and unviable agriculture. A low level equilibrium associated with poor resource endowments (water), low incomes, low effective demand, low demand for non-farm activities/products is in evidence in the less irrigated village. As a result, agriculture continues to be the choicest livelihood strategy though the share of non-farm income is more in the village closer to the town. On the other hand, there is demand for non-farm activities in the irrigated village. The share of dairy income is also more in the irrigated village despite the fact that irrigated village does not have any CPRs. This indicates that mere availability of CPRs may not sustain dairy activity.

At the aggregate level only irrigated village has a positive net return from agriculture and favourable benefit-cost ratios. This coupled with the recurring droughts in the recent years the debt burden of the households has increased substantially. Indebtedness is quite widespread in all the villages though the incidence is lower in the irrigated village. And, debt burden measured in terms of debt-asset ratio is substantially less in the irrigated village. All the important resources are concentrated with large farmers, though land is more equally distributed when compared to water and livestock.

Though it sounds obvious that 'water enhances rural livelihoods, what we tried to explore here is whether the watershed interventions would be effective in the absence of this critical resource. This is important because it is often assumed that non-farm or allied activities can provide sustainable rural livelihoods. This does not seem to be the case in fragile regions where drought is a rule than an exception and the carrying capacity is very low. The number of attempts to initiate non-farm activities either failed to take off or sustain in the absence of effective demand or could not survive the competition from mass production. Even the promotion and success of allied activities such as dairy or horticulture requires minimum water availability that can be enhanced through appropriate rainwater harvesting measures. Besides, the success

of these allied activities is critically linked to policy support at various levels. This support should be in terms of financial and technical at the household level; evolution of institutions for collective efforts of production and marketing at the community/village level; and infrastructure support like transport, storage, marketing, processing, etc., at the regional (district) level. The basic idea is to strengthen the household and village economy, which facilitates diversification.

Water complements land and livestock. Water is a critical factor that seems to make the difference. Therefore, water reforms (access to water) should precede land reforms. Water reforms are more difficult than land reforms in the fragile regions where water is scarce than land. The first issue is how to enhance the resource itself. This is possible only through efficient harvesting and utilisation of rainwater and water transfers. While the latter could be a long-term objective given the financial implications and socio-political complexities, the short-term policy focus should be more on the former. Proper implementation of watershed development programme coupled with enhancing the potential of water bodies and creating new water harvesting structures would help in ameliorating the conditions in these regions. More importantly, management of groundwater exploitation and use would help in achieving equity in access to water and sustainability of the resource.¹¹

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NOTES

1. Land productivity has reached saturation in the endowed regions promoting a shift towards fragile regions in order to maintain the per capita production. It is also noted that returns to investments are favourable in the fragile regions when compared to endowed regions (Fan and Hazell, 2000).

2. We deliberately avoided discussing the SRL framework as it is now fairly well established and available in many writings. For details see Sen, 1982 and 1985; Chambers and Conway, 1992; Scoones, 1998; Carney, 1998; Ellis, 2000.

3. See Campbell *et al.* (2000) for an earlier attempt in this regard.

4. Under this programme financial support is provided specifically for strengthening livelihoods of the poor and vulnerable households.

5. Relatively better irrigation in Mallapuram is attributed to the watershed programme (Reddy *et al.*, 2004).

6. Gini-ratios are calculated on the basis of household level data. Hence, these ratios may not agree with size-class wise averages.

7. Obulapuram has the highest participation rates among large farmers but it has only a few large farmers.

8. People going to the neighbouring villages for wage employment on a daily basis are also treated as migratory labour.

9. These include village services, different types of government or private employment (regular), petty business, tractor or auto driving, brick making, tailoring, mechanics, masonry, quarrying, etc.

10. Village wise zero order correlation matrix is not presented here for want of space.

11. For more details on this see Reddy (2002).

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