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**Sustaining Rural Livelihoods in Fragile Environments:  
Resource Endowments or Policy Interventions?**

(A Study in the Context of Participatory Watershed Development in AP)

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# **Sustaining Rural Livelihoods in Fragile Environments : Resource Endowments or Policy Interventions?<sup>1</sup>**

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## **Abstract**

*This paper primarily assesses the status of rural livelihoods in fragile environments with diverse resource endowments and policy interventions. The objective was to examine the effectiveness of resource enhancing policy interventions like watershed development in reducing resource endowment imbalances across villages and regions. Livelihood assessment was carried out using the sustainable rural livelihoods (SRL) framework in the fragile regions of Andhra Pradesh. Qualitative and quantitative approaches were used to assess the rural livelihoods covering all the 555 households in three sample villages.*

*It is argued that resource endowments determine the level and dynamics of livelihoods at the household level rather than policy interventions per se. On the other hand, policy interventions, given the status and structure of the economy, only act as catalysts. Policies for strengthening the resource base are necessary but not sufficient to address the livelihood issues. In the present case it is shown that availability of water (irrigation) is more important than the recent policy interventions like watershed development for improving the livelihoods. Nevertheless, policy interventions towards human capital development (education, skills, etc) could be rewarding in the long run. Unless policies are directed towards bringing changes in natural resource endowments (especially water) at the household level, it is unlikely that the on going policy interventions would transform the rural livelihoods in the fragile environments.*

*Keywords: Rural livelihoods, resource endowments, watershed development, policy interventions, Andhra Pradesh.*

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# **Sustaining Rural Livelihoods in Fragile Environments: Resource Endowments or Policy Interventions?**

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## **I Background**

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, fragile resource regions were left to private initiatives. This has led to regional inequalities in terms of economic and environmental development. However, the fragile regions have started attracting policy attention due to economic and political compulsions<sup>2</sup>. Watershed development (WSD) is being promoted in these 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 (approaches) in the context of resource endowments, resource valuation, market and other institutional mechanisms, technological options, alternative livelihood avenues, etc.

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

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<sup>2</sup> 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).

economic well being of the households, the recently evolved sustainable rural livelihoods (SRL) approach is more comprehensive in the context of poverty alleviation / eradication. 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 capitals, 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.

While WSD 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) has initiated in partnership and the support of DFID, UK, 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 (GoAP, 1999).

This paper is organised in five sections. The following section presents the approach along with the profile of the sample villages thus setting the background for the livelihood analysis discussed in section three 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 four. And the final section summarises the main findings and puts them in the policy perspective.

## II Approach

The five capitals framework of SRL is adopted here<sup>3</sup>. SRL lays stress on livelihood assets, or capitals, 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 capitals include natural, financial, physical, social and human (Carney 1998, Davies 1996, Soussan et al 2000). 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/capitals<sup>4</sup>.

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 less area under irrigation, ii) villages without watershed programme and less 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 strata 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 but less irrigation.
- One village with no watershed programme and less irrigation.
- One village with relatively larger proportion of area under irrigation but without any watershed programme.

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<sup>3</sup> See Campbell, et. al (2000) for an earlier attempt in this regard.

<sup>4</sup> 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.

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	Type	Mandal	No. of Households	PIA
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 focuses 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, small and marginal farmers. Similarly, 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 household. Total population of 555 households in the three sample villages was covered. The fieldwork was conducted during March-July 2002.

**Table 2: Economic Composition of the Households in the Sample Villages**

Village	Percentage of Households belonging to				Total
	Marginal & Small	Medium	Large	Landless	
Mallapuram	11 (30)	28 (74)	18 (46)	43 (113)	100 (263)
Obulapuram	05 (05)	55 (57)	31 (32)	09 (09)	100 (103)
Neelareddy Palle	23 (44)	13 (24)	24 (46)	40 (75)	100 (189)

Note: 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; Landless (LL)= without any land. Figures in brackets are actual number of households in each category.

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. Socio-economic structure differs across the sample villages. In all the villages backward caste communities are in numerical majority. Landlessness (LL) is more in Mallapuram and Neelareddypalle when compared to Obulapuram. On the other hand, 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 closeness to the main connecting roads or towns, access to physical, social and human capitals does not differ much across the villages (Table 3). Mallapuram is located at a distance of 4 kms from the mandal head quarters 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.) is now 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<sup>5</sup>.

<sup>5</sup>. Under this programme financial support is provided specifically for strengthening livelihoods of the poor and vulnerable households

**Table 3: Access to Physical, Social and Human Capital in the Sample Villages (Community level)**

Facilities	Mallapuram	Obulapuram	Neelareddypalle
<b>Physical Capital</b>			
1. Telephone	Yes	No	Yes
2. Bus facilities	Yes	Yes	Yes
3. Approach Road	Yes	Yes	Yes
4. Internal Roads	Yes	Yes	Yes
5. Water Supply	Yes	No	Yes
6. Electricity	Yes	Yes	Yes
7. Provision Shops	Yes	Yes	Yes
<b>Human Capital</b>			
1. Traditional (RMP) Doctors	Yes	No	No
2. Anganwadi Centre	Yes	Yes	Yes
3. Primary School	Yes	Yes	Yes
<b>Social capital</b>			
1. NGO presence	Yes	Yes	Yes
2. Presence of Self-help groups	Yes	Yes	Yes

### III Resource Endowments, Access and Livelihoods

#### a) *Natural and Physical Capitals*

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 landless ness is quite high in two of the villages, which are better off in terms of access to irrigation. On the other hand land distribution is skewed in favour of large farmers. Average farm size is higher in the least irrigated village (Table 4). Proportion of area under irrigation is about 60 percent in Neelareddypalle followed by Mallapuram (25 percent)<sup>6</sup> and Obulapuram (13 percent). There are variations in terms of sources of irrigation also. While Mallapuram and Obulapuram are 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

<sup>6</sup> Relatively better irrigation in Mallapuram is attributed to the watershed programme (Reddy, et. al., 2004).



**Table 4: Access to Land and Irrigation Assets in the Sample Villages Across Size Classes.**

Village/ Size class	Total Owned land(acres)	Total Operated land (acres)	Total Irrigated Land (acres)	No. of Wells Owned			Average area irrigated per well
				Open wells	Bore wells	Total wells	
Mallapuram [263]	921.15	891.82[3.39]	223.02	11	125	136	1.64
a) Marginal & 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 & 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 & 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 '()' indicate the respective percentages. Figures '[']' indicate the respective average farm size.

getting one assured crop but also recharges groundwater on a regular basis. Livestock ownership (in terms of value of livestock per household) is more in Mallapuram village. However, high concentration of milk cattle (buffaloes) is observed in the irrigated village of Neelareddypalle (Table 5). 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 capitals are the most influential in determining the household livelihood strategies. Here we examine household access to land, irrigation and irrigation equipment and livestock holdings.

**Fig 5: Access to Livestock (Rs./ HH)**

	Milch cattle	Other big cattle	Small ruminants	Total
Mallapuram	3290	14365	2567	20222
Obulapuram	1015	12860	587.75	14462.75
Neelareddypalle	5180	5845	3610.5	14635.5

It is clear that land distribution is biased in favour of large farmers in all the villages (Table 4). 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 and small farmers have very little access to irrigation or irrigation equipment. On the other hand, distribution of irrigated area is 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 is also skewed in favour of large farmers in all the villages, as they own more than 60 percent of the milk animals (Table 6). Most of the large and medium farmers own milk cattle. It is the case with small ruminants, except in Neelareddypalle where a quarter of the small ruminants are owned by land less households. However, distribution of small ruminants is less skewed when compared with milk animals. On the whole animal husbandry, big or small, is 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 inter linkages between access to irrigation and other resources.

**Table 6: Distribution of Milk Cattle Across Size Classes**

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

**Table 7: Distribution of Important Assets (Gini-ratios)**

Gini-ratio of	Mallapuram	Obulapuram	Neelareddypalle
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

It is often argued that livestock is more equitably distributed than land assets. In fact, this appears to be true 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-ratios<sup>7</sup> (Table 7). Defying our expectations, 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 later. 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 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 8: Status and Dependence on CPR's in the Sample Villages**

Village	Category	Area/No.	Purpose*	Benefits*	Availability	Dependency+
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

<sup>7</sup> Gini-ratios are calculated on the basis of household level data. Hence, these ratios may not agree with size-class wise averages.

CPRs play a crucial role in supplementing the household requirements, especially of the poor. All the sample villages, except Neelareddypalle, have common pool resources (CPRs) in the form of tanks, forests, temple lands, etc., (Table 8). 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. Sample villages have two important CPRs i.e., tank and forest (unreserved / revenue). Other CPRs include temple lands, roadside plantations, hillocks, etc.

#### **b) Human Capital**

Work participation rates, literacy levels and skills available within the community are taken as indicators of human capital. 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" (Census 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 percent in all the sample villages (Table 9). 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<sup>8</sup>. Low wage rates coupled with lack of alternative and assured employment avenues in Obulapuram might be pushing more people in to work. In other words, more people participate in labour market to eke out the subsistence family income.

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 land less 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

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<sup>8</sup> Obulapuram has the highest participation rates among large farmers but it has only a few large farmers.

we look at the unemployment and wage rates across the sample villages. Extent of unemployment brings out clearly that unemployment is the highest in Oblapuram and Mallapuram while it is the lowest in Neelareddypalle (Table 9). Here, unemployment is estimated based on the perceptions of the 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 un-employment 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 is observed among higher economic sections, which could be due to high participation rates.

**Table 9: Work Participation Rates, Unemployment and Male Wage rates**

	Participation	Unemployment	Male wages	Female wages
<b>Mallapuram</b>	53	57	38	26
Landless	53	50	38	28
Marginal & Small	52	53	39	26
Medium	56	63	38	27
Large	54	69	38	22
<b>Obulapuram</b>	54	57	27	20
Landless	44	53	32	22
Marginal & Small	58	68	25	19
Medium	56	56	25	20
Large	57	62	22	19
<b>Neelareddypalle</b>	59	45	48	27
Landless	60	42	72	27
Marginal & Small	57	51	37	26
Medium	60	53	37	26
Large	59	00	44	31

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

Obulapuram has also reported the lowest wage rate in all seasons and across genders while Neelareddypalle has the highest wage rates (Table 9). In fact, male wage rates are higher by more than 25 percent in Neelareddypalle when compared to the village where watershed works are going on. When compared to Obulapuram where there was no watershed works wage rates in Neelareddypalle were as high as 40 percent. 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 coupled with higher proportion of above primary level of education (Table 10). This may be due to long presence and efforts of the local NGO Accion Freterna / Rural development Trust (AF / RDT) in Mallapuram, which is also the implementing agency for the WSD programme. Low literacy in Neelareddypalle (50 percent) 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, OCs and large farmers have high literacy rates. Gender differences are substantial in all the villages. Gender differentials are more among SC / ST households. Interestingly gender differences seem to be more among large farmers when compared to landless and marginal farmers in most of the villages. These observations hold good even in the case of adult literacy (above 15 years of age population).

**Table 10: Extent of Literacy**

Village	% of Literates (all)			% of Literates (above 15 years age)		
	Male	Female	All	Male	Female	All
<b>Mallapuram</b>	68	45	57	66	31	49
Landless	59	45	52	55	27	41
Marginal & Small	64	45	54	63	35	49
Medium	71	42	56	67	25	46
Large	79	49	64	79	38	59
<b>Obulapuram</b>	57	37	47	46	13	30
Landless	62	40	51	50	20	35
Marginal & Small	60	44	52	40	00	20
Medium	43	34	39	33	13	23
Large	62	28	45	62	19	40
<b>Neelareddypalle</b>	60	43	50	55	32	44
Landless	59	41	48	55	26	41
Marginal & Small	58	42	42	41	24	32
Medium	54	38	43	52	24	38
Large	71	45	65	73	54	63

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 percent). In most of the cases the emphasis is more on the weaker sections like SC / ST, landless, etc. In Neelareddypalle only landless 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 (Table 11). Women feel 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.

**Table 11: Spread of Self-help Groups (SHGs)**

	Govt.	NGO	All
Mallapuram	19	14	33
Obulapuram	10	3	13
Neelareddypalle	11	0	11

### 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 realized 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 will be clear when debt-asset ratios are examined.

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. Percentage of households reporting outstanding debt (% hh in debt) ranges between 70 percent in Neelareddypalle (irrigated) and 86 percent in Obulapuram (Table 12). Among the landed households medium size class farmers are the worst affected in less irrigated villages while small and marginal farmers are 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 cooperatives at low interest rates. All the landowners are eligible for taking loans and hence all the landowners take loans from these cooperatives provided they are not defaulters. Average debt per household is the highest in Mallapuram and lowest in Neelareddypalle.

In terms of debt-asset ratios (D-AR) Obulapuram ranks high followed by Mallapuram and Neelareddypalle. Debt-asset ratio is defined, as the ratio between the total credit taken by the household and the fixed and durable assets the household owns. The assets include land, houses, livestock, machinery (tractors, pump sets, etc), implements, durables like TV, radio, cycles, etc. Debt-asset ratios reflect the debt trap the households are in. 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. 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 Neelareddy Palle 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 is more on lower size class farmers when compared to medium and large farmers (Table 12). Interest rates also vary across villages and size classes. Interest rates are the lowest in Neelareddypalle, which could be due to demand and supply of money. 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 in to debt trap.

**Table 12: Extent of Household Indebtedness in the sample Villages Across Size Classes**

Village / Size class	% of indebted HH	Loan outstanding (Rs/HH)	Total Asset Value (Rs/HH)	Debt-Asset Ratio	Rate of interest (%)
<b>Mallapuram</b>	82	51633	456686	0.11	24.0
a) Land Less	94	10455	45722	0.23	27.0
b) Marginal & Small	57	20333	126322	0.16	28.5
c) Medium	81	30100	337217	0.09	25.0
e) Large	85	123667	1214990	0.10	21.0
<b>Obulapuram</b>	86	39152	312120	0.13	23.0
a) Land Less	57	14555	24272	0.60	24.0
b) Marginal & Small	60	32500	70250	0.46	24.0
c) Medium	96	40000	193663	0.21	22.5
d) Large	78	52118	717083	0.07	24.0
<b>Neelareddypalle</b>	70	33233	894997	0.04	19.0
a) Land Less	78	12416	60241	0.21	23.0
b) Marginal & Small	82	38500	151059	0.25	22.0
c) Medium	25	38500	408318	0.09	19.5
e) Large	54	37679	1678633	0.02	17.0

**Table 13: Sources of Debt and Reasons in the sample Villages Across Size Classes (% households)**

Village / Size class	% of households borrowed from				Reasons for taking loan (% HH)			
	Friends/ Relatives	Farmers	Money lender/ Traders	PACS / RRB/CB	1	2	3	4
<b>Mallapuram</b>	08	58	47	37	73	14	01	12
a) Land Less	00	100	27	00	07	22	00	56
b) Marginal & Small	38	63	38	25	18	00	100	00
c) Medium	00	50	35	38	35	22	00	29
e) Large	13	40	87	73	40	56	00	15
<b>Obulapuram</b>	00	88	07	78	75	08	14	03
a) Land Less	00	10	11	22	05	00	29	00
b) Marginal & Small	00	100	00	75	05	00	00	00
c) Medium	00	90	07	90	50	75	71	00
d) Large	00	94	14	88	40	25	00	100
<b>Neelareddy Palle</b>	05	67	08	60	52	22	07	19
a) Land Less	00	83	00	08	05	00	40	47
b) Marginal & Small	11	89	00	44	11	07	60	15
c) Medium	00	82	18	73	25	20	00	08
e) Large	07	46	11	82	58	73	00	30

Note: Figures do not add up to 100 due to multiple sources and reasons. PACS= Primary agricultural cooperative societies; RRBs= Regional rural banks; CBs= Commercial banks. Reasons include: 1= agricultural input purposes; 2= farm machinery and implements (including bore wells; 3= Livestock; 4= household and social consumption (education, health, marriages, etc).

Four reasons are identified for borrowing money i.e., for purchase of agricultural inputs, purchase of equipment and digging of bore wells, purchase of livestock and for social consumption. The first three categories could be considered as productive investments while the fourth one may be unproductive though necessary. More than 50 percent of the households borrow for buying agricultural inputs (Table 13). The second important reason is purchase of farm equipment in two of the villages and social consumption and livestock purchases are the second important reasons in two of the villages. Greater proportion of farmers in Neelareddypalle

had borrowed money for the purchase of implements and bore wells, which may be due to the better status of water resources. Across the size classes, large farmers tend to borrow for purchase of implements and bore wells while lower size class farmers borrow for purchase of livestock. On the other hand, there is no systematic pattern in the case of borrowing for social consumption across size classes.

Despite the fact that a lions 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. Net returns to agriculture are negative in all the villages except in Neelareddypalle, which is largely irrigated (Table 14). The crop losses are 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 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 14). 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.

**Table 14: Net Returns (Rs./HH) and Benefit-Cost Ratios to Agriculture Across Size Classes**

Village	Marginal&small		Medium		Large		All	
	Net Returns (Rs/HH)	BC ratio	Net Returns (Rs/HH)	BC ratio	Net Returns (Rs/HH)	BC ratio	Net Returns (Rs/HH)	BC ratio
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
N. Reddy Palle	-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.

### Markets

Markets, especially land, labour and capital, play an important role in determining the access to livelihood capitals (natural and financial) and livelihood strategies (employment). In the less irrigated villages land markets seem to be less active though they lease out more land than they lease in from outside the village (reflected in the difference between owned and operated land). Where as, the reverse is true in the case of irrigated village. In majority cases, large farmers lease out their lands while marginal and small farmers lease in land. In Obulapuram, marginal and small farmers have very little access to irrigation. Distribution of irrigated area is 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 equitable distribution.

Credit markets seem to be active and function well in all the villages. Majority of the households borrow from fellow farmers, followed by institutions, moneylenders and friends (Table 13). The presence of moneylenders is marginal in all the villages, except Mallapuram. Dependence on fellow farmers is more among landless and marginal and small farmers. Large farmers depend more on institutions. This explains their low interest rates. Inter as well as intra village variations in interest rates reflect the credit market distortions.

Wide variations are observed between the villages as far as labour markets are concerned. While the less irrigated villages are characterised with low demand for labour, low wages and out migration, the irrigated village is characterised with high demand, high wages and in migration. Often in the peak seasons farmers in the irrigated village have to get the labour from neighbouring villages by offering higher wages. This is another reason for higher cost of cultivation. Agricultural labourers are mainly from backward classes and SC / STs in the village. During kharif season wage rates vary between Rs. 40 and 50 for males and between Rs. 20 and 30 for females though the working hours are same for both the sexes i.e., 8 hours a day (Table 15). During summer season, wage rates range between Rs.25-35 and Rs. 15-25 for males and females respectively. Another important difference is that farmers provide lunch to the male labourers only. This further increases the wage differentials. An interesting aspect of the labour market in Neelareddypalle is that 70 percent of the labour force works on contract basis. For instance, labour gets 4 bags of paddy for paddy harvesting per acre (about Rs. 125 per person day<sup>9</sup>) and for groundnuts plucking they get Rs. 100 to Rs.150 per person day. On contract basis, wage rates work out to be very high compared to normal wages. Another important aspect in Neelareddypalle is that out migration is totally absent. On the contrary people from other villages migrate to this village. In fact, some SC / ST households have permanently migrated to this village when canal irrigation was introduced.

**Table 15: Agricultural Wage Rates Across Seasons and Gender in the Sample Villages**

Village	Season								
	Kharif			Rabi			Summer		
	M	F	C	M	F	C	M	F	C
Mallapuram	37	26	22	40	34	25	28	21	15
Obulapuram	28	25	20	35	30	20	25	20	15
Neelareddypalle	50	40	30	50	40	30	30	25	20

<sup>9</sup> Six to seven persons work for two days for harvesting one acre of paddy.

While it is often argued that markets influence livelihoods and livelihood strategies, resource endowments seem to be crucial for functioning of markets. Markets could be the link between the resources and livelihoods or they act as a catalyst. For, markets are active and mature in the irrigated village than in the less irrigated villages. Markets are neither active nor different in Mallapuram, which is close to the urban centres. Therefore, markets alone may not trigger the livelihood activities in the absence of resource endowments. This makes resource endowments as prerequisite to better livelihoods.

#### **IV Livelihood Strategies**

Livelihoods at the household level are closely linked with the type of capitals / resources available to the household in terms of access. Here our definition of access goes beyond rights and entitlements. While rights and entitlements reflect legal connotations, access represents the reality. In other words, right and entitlement to resources need not guarantee access in the context of common pool resources. This is mainly due to the prevailing technological and legislative externalities in resource exploitation. For instance, though all the households have rights in groundwater resources only a few have access to it, as the available technology to exploit groundwater is expensive. At the same time there is no limit on groundwater exploitation, as the legislation is not clear regarding equitable distribution of the resource. Therefore, access to land alone does not guarantee livelihoods at the household level. On the other hand, having access to a resource like common grazing land is not enough to support livestock based livelihoods in the absence of the potential to possess (own) livestock. Given the access to resources across the villages and households and the market conditions discussed above we examine the household livelihood strategies.

Net earnings from various livelihood activities are the ultimate measure of tangible economic well being at the household level. 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 average household income are more between irrigated and less irrigated villages while the intra village differences are marginal with in the less irrigated villages. Average household income in the irrigated



village (Neelareddypalle) is almost double that of other villages (Table 16). Agriculture is the single largest contributor in all the villages except Mallapuram. 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. Note that income from labour includes migratory labour also<sup>10</sup>. In the case of non-farm activities, more than twenty activities<sup>11</sup> are identified but none of them is a dominant activity. Dairy contributes substantially in Neelareddypalle (12.5 percent) and Mallapuram (10 percent) while its contribution is about 5 percent in Obulapuram. Interestingly, average household income of the landless households is higher in Neelareddypalle and Obulapuram when compared to small and marginal farmers, which is due to the labour market situation. While in Neelareddypalle employment and wage rates are on the higher side, in Obulapuram returns from agriculture are very low (see the discussion on work participation and unemployment). On the whole household income flows from livelihood activities are in line with the physical pattern of household activities.

Average household income is positively related to farm size, which is mainly due to the dominance of agriculture as a livelihood activity (Table 16). This is true even in the case of Mallapuram, where the contribution of agriculture is low. All categories of households, including landless, earn more in Neelareddypalle despite the fact that the share of non-farm income is the lowest there. The share of non-farm activity in the total income tends to be more for the landless as well as small and marginal households. Interestingly, the share of dairy income tends to increase along with farm size in the less irrigated villages, while little variation is observed in the case of irrigated village (Neelareddypalle). This indicates that access and returns to dairy activities will be more in irrigated conditions. Therefore, dairy development in the drought prone conditions

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<sup>10</sup> People going to the neighbouring villages for wage employment on a daily basis are also treated as migratory labour.

<sup>11</sup> 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.

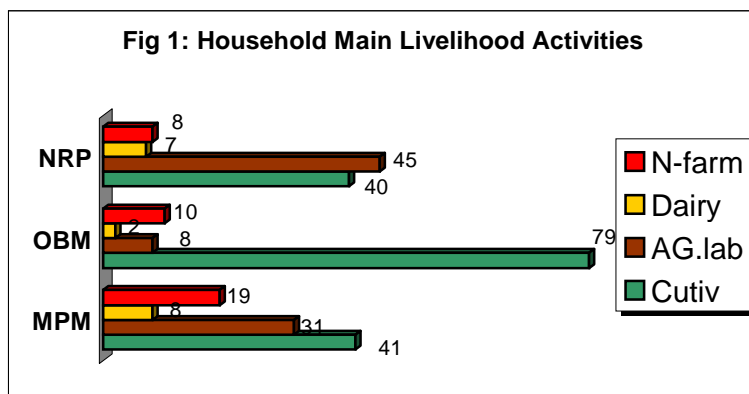
may not be equitable in a natural way. This may be due to the access to complementary resources like fodder, water, etc. In order to make dairy more accessible and remunerative to the poorer households natural resource base, especially CPRs, needs to be strengthened. This can be seen to some extent in Mallapuram. On the other hand, sheep and goat rearing (animal sales) contribute to household income in Mallapuram that too to the extent of five percent only. This indicates that small ruminants do not play an important role in the livelihood activities in the sample villages. Even this activity appears to be concentrated with medium and large farmers rather than marginal, small and landless households (Table 16).

**Table 16: Sources of Household Income in the Sample Villages Across Size Classes**

Village/ Size class	Share of Household income from						Total Income (Rs/HH/ Year)
	Agri- culture	Dairy	Animal sale	Hiring bullocks	Labour	Non- farm	
<b>Mallapuram</b>	22.80	10.14	04.92	02.87	27.85	31.41	21556
a) Land Less	00	02.14	02.58	02.67	50.67	41.93	16421
b) Marginal & Small	16.14	05.84	00	09.63	39.51	28.86	19613
c) Medium	23.45	08.56	11.73	03.66	22.18	30.42	20610
e) Large	49.78	22.55	09.90	01.35	03.21	22.21	37159
<b>Obulapuram</b>	68.11	04.68	00	00.84	14.17	12.20	23543
a) Land Less	00	00	00	00	34.36	65.64	13540
b) Marginal & Small	17.26	00	00	00	82.73	00	5465
c) Medium	63.71	03.00	00	01.76	20.99	10.54	26280
d) Large	78.58	6.75	00	00	09.15	09.15	37770
<b>Neelareddypalle</b>	47.98	12.53	00	01.97	29.80	07.73	39860
a) Land Less	00	06.25	00	01.40	76.40	15.96	25681
b) Marginal & Small	12.62	08.75	00	10.55	59.44	08.65	21119
c) Medium	47.27	16.53	00	01.84	23.95	10.42	35333
e) Large	79.50	15.90	00	00.35	01.35	02.91	84892

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 (Fig. 1). Only a few households mainly depend on traditional activities like *toddy* tapping, washing cloths, 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 they got reasonably good harvest only in one year (2000-2001). Due to the drought conditions all the categories of households like farmers, labourers and petty business people got affected equally. People who were practicing animal husbandry, i.e., dairying, have felt that milk yields were reduced due to the scarcity of fodder though losses were minimized due to the watershed programme. 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. Vulnerable sections like SC / STs and women are also affected in a similar fashion. Watershed programme has compensated for the decline in agricultural employment due to drought. Among SC / STs very few households have irrigated lands and others have either own dry lands or landless.

Impact of drought appears to be very severe in Obulapuram village (unemployment is also high here, see Table 9). Some households even complained about reduced food intake. They revealed that all sections of the society are affected due to the drought, especially in the absence of

WSD. Farmers are the worst hit due to the repeated failure of bore wells. This has resulted in their indebtedness, which in turn leading to migration. More than 70 percent of the households migrate to Ballary, Bommanahal, Kanekal for wage works during the drought years. During 2001-2002 around 70 households have migrated to the above places during the summer season (usually for 3-4 months period). People indicated that there is no economic barrier to migration, i.e., land less labourers as well as farmers migrate to other places where they get labour work. While young and able bodied migrate, old people stay back to look after the cattle and house. Of late, migration has become must for most of the households in order to ensure stable livelihoods. Majority of the people have sold their cattle, (buffaloes, sheep and goats) to avoid food scarcity during the droughts period, according to the villagers. Some people who rear the sheep / goats have completely sold their sheep / goats during the severe droughts. This has further aggravated their livelihood systems.

Being an irrigated village Neelareddypalle portrays a different picture. Though livelihood security is not a major problem, people do have problems. As in the case of other villages here also cultivation, agriculture labour and livestock rearing are the main livelihood activities. Some communities (balijas) follow dairying as 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, farmers are not happy about their yields and also with higher input costs of cultivation. Majority of the people who participated in the discussions has felt that farmers (both large, medium and small) were the most affected due to the debt burden. Labour's position in terms of indebtedness is particularly better than farmers. They revealed that they got reasonably good paddy crop during the year 2000-2001. They also felt that untimely heavy rains spoiled the groundnut crop. Added to this is the limited power supply. Repeated bore well exploration and their failure have led to indebtedness. For instance, during the months of February-March, 2002 farmers have dug around 40 bore wells, out of which only 6 were successful and the remaining failed. 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. One demand people have is the state initiative in developing the dairy in the

village. There is potential for dairy development in the form of fodder availability. 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.

**Table 17: Inter-Relationships between Capitals among Poor and Non-poor (Zero-Order Correlation Matrix)**

Poor					
Capitals	Natural	Physical	Financial	Human	Social
Natural	1.000	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 percent respectively.

As far as access to livelihood capitals 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 capitals further aggravates the conditions of the poor. For, there are strong and positive linkages between natural, physical and financial capitals for both poor and non-poor categories (Table 17). 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 capitals in the case of non-poor category households. These linkages hold good even at the village level<sup>12</sup>. As between the villages,

<sup>12</sup> Village wise zero order correlation matrix is not presented here for want of space.

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 17). Among the non-poor 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 apposite relation with human capital only. Therefore, unless poor gain reasonably better access to natural capital, especially water, their livelihoods may not change much even in the presence of resource based programmes.

## **V 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 less irrigated village (Obulapuram). Less irrigated villages are 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 operation in the less irrigated villages. As a result, agriculture continues to be the choicest livelihood strategy though the share of non-farm income is more in the village near 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 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. 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 critically linked to policy support at the household, community and regional level. 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. The basic idea is to strengthen the household and village economy, which facilitates diversification in a smooth way.

Water complements land and livestock. Therefore, 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 scarcer 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 later 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 ameliorating the conditions in these regions. More importantly, regulating groundwater exploitation and use would help in achieving equity in access to water and sustainability of the resource<sup>13</sup>.

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<sup>13</sup> For more details on this see Reddy (2002).

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