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Impact on Livelihoods: Seva Mandir's Integrated Watershed Development Initiative Udaipur, Rajasthan, India

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Poverty-Focused Smallholder Water Management
*Promoting Innovative Water Harvesting and Irrigation Systems
to Support Sustainable Livelihoods in South Asia*

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Section 1: Introduction to the study

1.A. Introduction to DFID's Sustainable Livelihoods Framework ¹

DFID's Sustainable Livelihoods Framework is largely an adaptation of work done at the Institute of Development Studies such as that of Scoones, 1998.

The following definition of livelihood is used for the purpose of the livelihoods analysis framework:

“A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base”.

The central point of the framework is an analysis of the five different types of assets that individuals draw upon to build their livelihoods. These capital assets are:

- **Natural Capital**

The natural resource stock from which resource flows useful for livelihoods are derived.(e.g. land, water, wildlife, biodiversity, environmental resources).

- **Social Capital**

The social resources (networks, membership of groups, relationships of trust, access to wider institutions of society) upon which people draw in pursuit of livelihoods.

- **Human Capital**

The skills, knowledge, ability to labour, and good health important to the ability to pursue different livelihood strategies.

- **Physical Capital**

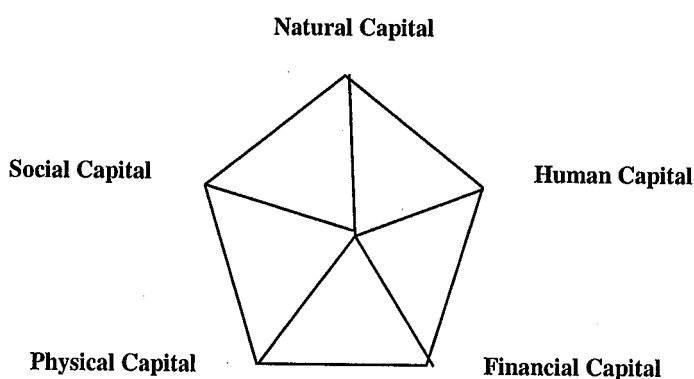
¹ Source: Carney Diana, Sustainable Rural Livelihoods: What contribution can we make?, DFID. 1998.

The basic infrastructure (transport, shelter, water, energy and communications) and the production equipment and means that enable people to pursue their livelihoods.

- **Financial Capital**

The financial resources which are available to people (whether savings, supplies of credit or regular remittances or pensions) and which provide them with different livelihood options.

Figure 1: Capital assets central to the DFID livelihoods analysis framework.



The different types of assets are presented in the shape of a pentagon, indicating the importance of a holistic rather than a sectoral approach to the analysis of livelihoods. The framework is expected to highlight strengths of the households rather than the needs. The framework is generally used in order to identify the most appropriate type of intervention for a particular project. However, sustainable livelihoods approaches have been used in different ways²; in project design, programme design, project review and impact assessment, review of programme, and assessment of sectors.

Within the sustainable livelihoods framework, Scoones³ identifies three broad clusters of livelihood strategies. These are agricultural intensification/extensification, livelihood diversification, and migration. Most rural households pursue a combination of strategies

² Farrington John et al, Sustainable Livelihoods in Practice: Early Applications of Concepts in Rural Areas, Natural Resource Perspectives, Number 42, June 1999, Manage and ODI.

³ Scoones Ian, Sustainable Rural Livelihoods, A Framework for Analysis, IDS Working paper 72.

together or in sequence. The combination of activities that are pursued can be seen as a “livelihood portfolio”. Some portfolios may be highly specialized, with a limited set of activities, while others may be highly diverse. The types of livelihoods pursued will vary by season and could change over the years, as new options replace existing ones. Over generations, substantial shifts may occur as external and local conditions change.

The degree of specialization or diversification of livelihoods is influenced by resources available to the household and the degree of risk associated with the different livelihood options. The livelihood strategies of the households, particularly the poorer households, usually take into account risk factors. It is observed that members of the households take up different activities so that at least one source of income is available to the household at any given time of the year. The mix of activities undertaken by different members of the household protects the household from risk of loss of income that may occur during the course of the year. Rural livelihoods rely heavily upon the natural resource base, and the mix of activities undertaken by a household is influenced by the degree of access and availability of the natural resources on which their livelihoods depend.

Socio-economic factors and livelihood resources are inter-dependent. Socio-economic factors impact access to livelihood resources, and successful livelihood strategies can change the socio-economic status of the household. Within the Indian context, caste, class and religious affiliations can often determine the livelihoods that are pursued by the household and the level of access to various resources. It is important therefore to take these aspects into account while analyzing the livelihood strategies of the household.

Further, the degree of access to resources is either facilitated or restricted by institutional arrangements at the micro and macro levels. Different forms of institutional arrangements exist which support or deny access to households, for example; members of the village governing body at the local level may have greater access to resources, membership to the local cooperative dairy may ensure availability to fodder resources, membership to a savings group may facilitate access to credit from financial institutions, etc. Livelihood strategies of households are influenced by institutional arrangements and processes and

an analysis of these is important to understand why specific livelihood portfolios are pursued by different households.

1.B. Purpose of the study

The purpose of this study is to analyse and understand the livelihood implications of smallholder land and water management innovations. The project sites identified for this study are IWMI's partners in an ongoing research project on smallholder water management and irrigation systems⁴:

1. Paal revival project, PRADAN, Alwar, Rajasthan
2. Five percent technology, PRADAN, Purulia, West Bengal
3. Integrated watershed development initiative, Seva Mandir, Udaipur, Rajasthan
4. Wastewater irrigation, IWMI, Hyderabad, Andhra Pradesh

While the first three research sites are project interventions in land and water management, the fourth site is a research site where no project interventions have been made. Although the methodology used for all the sites is similar, the purpose of data analysis is somewhat different for the research sites where project interventions have been made, and the wastewater usage site where no intervention has been made. This report deals with the impact of the integrated watershed development initiative of Seva Mandir, an NGO based in Udaipur in Rajasthan state.

For the purpose of studying the impact of the project interventions on the livelihoods of the households, the core concept of the framework is used to assess the changes in livelihood assets. The specific purpose of the study was to assess the impact of the project interventions on the socio-economic situation of the households, the importance of various assets in securing the livelihoods of the households, the changes that have taken place in the livelihood strategies after project intervention.

⁴ Livelihoods assessments were carried out for four of the partners' technologies and sites where in-house social sciences capacity was not sufficiently developed. The remaining two technologies (drip kits by IDE Nepal and *ooranis* by Dhan Foundation, Madurai, Tamil Nadu) were assessed internally by the respective project teams.

1.C. Methodology for the Study

1.C.1. Identification of project locations and sample for the study

The locations for the study within the project areas were identified with the project partners at each project site. The locations selected within the project area were more or less representative of the range of land and water management interventions implemented by the project.

The specific parameters for the selection of locations were:

1. Type of interventions implemented under the specific project.
2. Number of interventions implemented.
3. Age of interventions.
4. Institutions set up for the project and whether these are functioning.
5. Homogeneity and heterogeneity of the population.

The specific parameters for selection of households were:

1. Type of benefits derived by the households from the project interventions.
2. Type of interventions implemented on the lands of different households.
3. Main sources of income of the different households.
4. Caste/community of the household.

For the purpose of the study, two villages, Barawa and Ghodiawada were identified for the study during field visits and discussions with Seva Mandir staff. It was felt that these two villages were representative of the area in which the organization works and of the types of interventions that have been implemented by the organization in the region. Ghodiawada has a homogeneous tribal community, while Barawa has a heterogeneous mixed caste community. Watershed development work was completed in Ghodiawada in 1999 and in Barawa in 2000. The specific interventions are described below.

Twenty percent of the total number of households in each village was selected for administering the questionnaire. The selection was stratified random, a proportionate quota was allotted based on separate caste and geographical location of the house. A total of 25 households were interviewed in Barawa village and 20 households were interviewed in Ghodiawada village.

1.C.2. Tools and methods of data collection:

Since the purpose of the study was to study the impact of the project interventions at the household level, the household questionnaire was the primary source of data collection. The questionnaire was tested in the field with at least two households at every location, before it was finalized.

The questionnaire was designed to collect information on the five capital assets which form the center of the livelihoods framework, the livelihood activities or sources of income of the households and institutional affiliations of the household. Since most income generating activities of the rural households are land and agriculture related, the information regarding livelihood activities was collected and analysed by season. In the Indian context there are three main agricultural seasons, *Kharif* or monsoon, *Rabi* or winter, and summer.

Section 2: Introduction to the project and study area

Introduction

Seva Mandir, an NGO, has been working in South Rajasthan, primarily Udaipur district, for the past 35 years. Their work is now spread over 2 districts in 517 revenue villages. The organization began its work with adult literacy, and is now working on Natural Resource Management, Women and Child Development, Health, Education and Village Development Fund. Seva Mandir focuses its work on strengthening sustainable livelihoods of village communities, local capacity building to achieve well-being in terms of health, education and gender equal relations, and creating autonomous village level institutions and supporting organic leadership. Seva Mandir's work in natural resources management began in the 1970s with the construction of an earthen dam. Their first watershed development intervention was initiated in 1982 and the wasteland development program in 1986. Today they have five programs in natural resource management; Watershed Development, Water Resource Development, Silvi-pasture development, Joint Forest Management and Agriculture Extension. The natural resource management initiatives are integrated with the other development initiatives in the village.

Integrated Watershed Development

Local natural resource dependence patterns, agro-ecological conditions (which vary significantly across Seva Mandir's area of operation), topography and soils, and adaptation of traditional land and water management practices determine the specific interventions at the watershed and community levels. In general, watershed development interventions include:

- Soil and water conservation measures implemented on village common land or government wastelands (degraded lands belonging to the Revenue Department, or occasionally the Forest Department), and pasture lands. These interventions start from the upper ridge lines and follow a topo-sequence in order to capture—or minimize erosion resulting from—torrential runoff flows during monsoon rainfall

periods. Despite its location in Rajasthan state with the Thar Desert to the west, Udaipur enjoys relatively high rainfall of 600 – 700 mm annually although this is concentrated in the June – September period during which high intensity cloudbursts generate significant runoff. Particular techniques include contour trenches (usually in support of reforestation, see below), stone gully plugs, and small check dams. In the lower reaches where the dry season moisture availability is adequate, vegetative reinforcement of contour bunds is a preferred option. However, poor soil depth and the prolonged (essentially eight-month) period without rain make this a difficult technique to sustain.

- The traditional system of *medbundi* (earthen field bunds to capture sediment and moisture on private agricultural land, contoured stone walls for larger fields with increased catchment area upstream, and stone gully plugs in *nalas* to minimize erosive flows to downstream fields) has been documented by Seva Mandir with support and technical advice to farmers who continue to innovate with these practices. This involves sediment harvesting on both private and common lands through the treatment of gullies, *nalas* (larger natural waterways), and small streams. A combination of mechanical and vegetative means has been found to be the most effective. Based on sustained community interaction and support through a range of programmes, Seva Mandir has done an impressive job of **outscaling** adoption, i.e., in ensuring the widespread adoption or replication of *medbundi* techniques. Additionally, and more critically for the objectives of this project, Seva Mandir is fully cognizant of the need for, and is actively pursuing, sustainable **upscaling** of *medbundi* at the watershed level, i.e., implementing the techniques in a systematic manner to capture the mutual upstream-downstream benefits of individual applications (simple replication) at the field or plot levels. These are important contributions, although measurement of hydrological and sediment impacts at the watershed level—as distinct from livelihood impacts for the adopters—has been beyond the scope of this project’s involvement. IWMI remains engaged with Seva Mandir through at least one further project on livestock-environment interactions in watersheds in which the biomass growth resulting from integrated watershed

development is hypothesized to have a significant benefit for livestock and the poor (women and landless) who depend on them.

- Reforestation and plantation of rapid growth, multi-purpose trees on private and common wastelands. There are at least three implications of the fact that Southern Rajasthan once supported significant forest cover: first, there is high agro-ecological potential for reforestation; second, there are significant areas of non-private lands, i.e., community, Revenue and Forest Department lands; and third, natural resource dependence includes a high degree of interest in more than timber from trees, e.g., minor forest produce including *mahua* flowers for food and as a source of drink, *dhak* leaves for the Indian equivalent of disposal plates for parties and social functions, *thendu* leaves for making *bidis* or cheroots, etc.. One of the most effective means of encouraging vegetative growth has involved simply restricting grazing access through fencing (particularly thorn brush, cactus or euphorbia) or stone walls. In addition, Seva Mandir has worked out a successful modality of private nursery managers for public and private tree plantation. The community responsibility model of nursery raising was found not to work for lack of participation, insecure access to an assured water source, etc. On the other hand, private nurseries cannot be as large as government ones that count a staff and full-time supervision. As a result, Seva Mandir has found that approximately 5,000 to a maximum of 10,000 saplings per private nursery are feasible. The saplings are subsequently planted on private or public lands. The impact of increased tree and brush growth on integrated watershed development is beginning to be experienced. In the early stages, vegetative growth has little impact on runoff or dry season water availability; however, beginning at about five years and intensifying in later years—Seva Mandir has promoted a number of community reforestation plots in other areas that are now close to 20 years old—the overall water balance is affected with reduced runoff and increased groundwater recharge. The implications of these impacts need further research and documentation.
- From a watershed perspective, there are two ‘last’ uses of water before it flows out and becomes available for communities further downstream; these are surface

outflow and groundwater available in the lowest reaches of the watershed. Seva Mandir's approach to effective utilization of surface and groundwater is based on the construction of larger water harvesting structures including *anicuts* (stone masonry weirs) to capture monsoon runoff and dry season base flow in the larger streams, e.g., with drainage area usually in excess of 1,000 hectares. While occasionally irrigation water is pumped directly from the *anicut*, it serves a more important function of raising groundwater levels and regulating the baseflow in the stream. There is an increase in groundwater availability for several hundred meters to a kilometer or more (depending on the bed slope and depth of water stored) downstream in the stream bed and to a lesser extent in the immediate lateral vicinity of the *anicut* impoundment. Open dug wells are the norm, with bullock-powered mechanical Persian wheels still being used to withdraw the water. Small electrical or diesel centrifugal pumps (5 – 10 horsepower) are increasingly being installed and used. Due to erratic power supply, electrical pumps are constrained to limited hours of operation. These hydrological and associated agricultural productivity benefits are assessed in much further detail for another one of the interventions in this study, i.e., the *paals* of Alwar District, Rajasthan promoted by PRADAN. While local geohydrological conditions in Udaipur are distinct from Alwar, the water use patterns bear similarity (winter wheat, mustard, vegetable crops). Additionally, the livestock benefits of perennial surface water availability in the larger streams are high priority for community members.

- Formation of watershed users committee to ensure the management and maintenance of the interventions as well as the equitable distribution of benefits derived there from. As in most rural development initiatives, the 'software' component of the interventions is critical to their sustainability. Seva Mandir has done remarkably well on this count, given their roots in adult literacy and community organizing. Invariably, and this has been the case in Barawa and Ghodiawada, natural resource interventions and particularly integrated watershed development are preceded by community organizing. As a result, the functioning of a watershed users committee is made easier than in other rural development initiative, e.g., on the part of government,

where committee organization is dissociated from the biophysical interventions. At the community level, watershed committees are linked with the Gram Vikas (village development), which also integrates self-help groups (SHGs) based on thrift and savings and loans membership. Women are particularly active in the SHGs.

Seva Mandir has completed integrated watershed development in 15 villages, covering 4,119 hectares, while work is currently ongoing in another 5 villages covering 1,842 hectares. In Barawa and Ghodiawada villages, development work was initiated in the late 1970s with adult literacy; this was followed by other health and education interventions. After the mid 1980s, reforestation work on private lands was taken up on a large scale. In the late 1980s and early 1990s, community pasture lands were developed. Watershed soil and water conservation activities were promoted in the late 1990s. In addition, an *anicut* was constructed in Ghodiawada village beginning in 1998 and completed in 2001, and a pond was constructed in Barawa village in 2000.

Section 3: Analysis of data

3.1. Barawa village

Barawa village is located in Rajasamand district in Southern Rajasthan, at a distance of 38 km from Udaipur city. The village is 3 km from the Lohsingh-Gothaghatti main road, with most utilities being located at the panchayat headquarters in Needach, which is situated on the main road. Barawa is a multi-caste village with Rebaris (camel rearers), Bhils (tribal community) and Rajputs being the main castes in the village.

Agriculture and livestock rearing are the main sources of livelihood. Since small landholdings yield only subsistence returns at best, migration has become necessary for bringing in additional income.

Average family profile

The average family size in the sample is 6 members (on average 3 males and 3 females). The average number of children below 18 years is 1, and the average number of children above 18 years is 4. The average number of people currently living in the house is 6. The highest education level is 5th standard and the lowest level is 2nd standard.

Land ownership and land use

All households in Barawa own land, but the landholdings are small. Individual land holdings consist of private pasture and agricultural fields. The proportion of irrigated land in the village is less than 30% of the total agricultural land. Most landholdings are highly fragmented and in absence of irrigation facilities, are mainly under rainfed farming. Yields of the predominant maize, millet and wheat are low (< 1 ton/ha). There has been no increase in area of land owned for any of the households. The increase in area under cultivation as a result of project intervention is negligible.

Water resources

Water for drinking, domestic use and irrigation is easily available, although the water table in tubewells situated in the settlements located on small hillocks, i.e., not in the valley bottoms, has fallen from 40 meters to 60 meters over the last five years. Drinking

water is accessed through community handpumps installed by the government. The village is divided into four settlements and each settlement has a handpump. Water for domestic use and irrigation is accessed from privately owned open dug wells. There are 25 wells in the village, which are shared by family groups. Almost every household has access to a well. Electric pumps are used for lifting water for irrigation of small plots almost by all households who have access to wells.

Livelihood activities

Agriculture and livestock rearing are the main livelihood activities of these households. The average total income of the household has increased from Rs. 10,420 to Rs. 12,988 after the intervention. The total income earned by the male member of the family in a year is Rs. 10,404 (approximately 80%), by the female member Rs. 1,358 (10%) and by children Rs. 842 (6%).

Since the landholdings are small and yields are low, members of these households have taken up non-farm based livelihoods such as working in quarries and marble mines, and other permanent jobs in cities. These income sources provide cash resources to the households.

Agricultural production

The crops commonly grown are wheat, maize and millet. After project intervention, they began to grow *rizka* grass for fodder in the summer. More recently they have begun to grow vegetables like coriander and tomato.

Livestock

Livestock composition is different for different caste groups. The Rebaris and Rajputs own more buffaloes and the Bhils mainly own goats. The Rebaris are traditionally camel herders. Over the years there has been a change in the livestock owned by these households. The camel, bullock and goat population in the village has decreased, and the number of buffaloes has increased. The reason for this is that fodder for buffaloes can be

made available from various sources like crop residue, and grass growing on bunds of agricultural lands. Open grazing is being controlled in the village in order to conserve the common lands. Buffaloes can be stall-fed from the grass grown on the common lands. Milk production has increased after project intervention. At present 150 liters of milk from this village is sent to a local dairy everyday.

Social capital

The social relations in the village are harmonious. Household members meet their friends during ceremonies and functions in the village. Generally they discuss issues regarding the development of the village and household problems with their friends. Friends lend each other money mostly for food grains and medicines. Sometimes they borrow money for agricultural activities. They take food grains on credit from the local shopkeeper. The quality of service from the moneylender does depend on the relationship with the moneylender. If the relations are good, the service is better. The farmers share knowledge about the farming practices. The farmers help each other in farming practices like working in the farm without wages. The farmers do not share any kind of investment costs. The farmers do not think that political party affiliation affects social relations or their access to government facilities or services.

Access to infrastructure

Electricity is available for domestic use. Electricity for pumps is available but the supply is poor. The availability and condition of the local transport is good; however, diesel is not available in the village. There is a good school in the village, but no public health center. Households responded that if services are improved and made easily accessible, they will save time and money on traveling longer distances to access these services.

Impact of Project interventions

The main intervention on private lands consisted improved *medbundi* and harvesting sediment by making bunds in the gullies or other drainage lines for creation of cultivable land. Such bunds, in addition to facilitating deposition of silt from upstream also help in

conserving moisture in the newly created fields. Household members contributed some voluntary labour and some farmers paid 20% of the actual cost for the construction of bunds. The positive impact of these treatments according to the farmers is the lessening of soil erosion, increase in soil moisture and recharge to groundwater to a limited extent, availability of more grass and some increase in agricultural production. Those farmers with access to irrigation are able to take two crops a year because of the availability of the water. There is also a change in the practices of using inputs for the agriculture. They have started using fertilizers; urea and manure while some farmers have started using improved seeds (9 farmers).

The main immediate benefit of the watershed treatment on common lands was the creation of wage labour while the work was in progress. Today the regeneration of grass on the common lands has resulted in an increase in fodder even in the dry months. Villagers recounted that more grass was available on these common lands, even during drought years.

Changes in standard of living

The improved groundwater recharge from watershed development has led to increased production and reduced cost of vegetables that are irrigated. Additionally, improved fodder availability has increased the income from sale of milk and sale or consumption of mutton. As a result, integrated watershed development has improved the standard of living. The women voiced the opinion that these benefits have been gender neutral.

Partly as a result of the social mobilization and health promotion activities introduced by Seva Mandir, health and hygiene are said to have improved. Community members have started bathing everyday. The women now socialize more and have become more vocal. Children's school attendance is up.

Institutional support

A Gram Vikas Committee (Village Development Committee) has been set up in the village. This committee has equal representation from all castes in the village and is

headed by respected members of the village. This Committee has played a very important role in the management of the common lands developed as part of the project intervention.

The farmers are confident that they will be able to maintain the land and water treatments done on their land without the permanent presence of Seva Mandir. However they feel that no interventions would have been possible without the help of the NGO. Even now they feel the need for the help of the NGO to introduce new activities.

3.2. Ghodiawada village

Ghodiawada is situated in the Kherwada block of Udaipur district, located 3 km from the nearest road. The village has a population of 700 with 100 households (average size 7) mostly belonging to the Meena caste. The average number of children below 18 years is 3 and the average number of children above 18 years is 3. The average number of people currently staying in the house is 6. The educational level of household members is low with most adults being illiterate.

Agriculture is the main occupation. Male members of the households also work in local quarries and marble mines for wage labour, since income from agricultural production is not enough to meet the needs of the households.

Of the total village area of 200 ha, nearly 40% is wasteland; 12 % of the land belonging to the Revenue Department has been encroached upon. After a stipulated period, encroachers can stake formal claim to the land. The landholdings are small and fragmented. Houses in the village are spread out and most households live close to their agricultural fields. There is a school in the village but no primary health care center.

An *anicut* was constructed in the village and completed in April 2001. Farmers lift water with pumps from the *anicut* for irrigation or from open wells near the *anicut*. Those with access to pumped irrigation grow two crops a year. The main intervention on private

lands consisted of harvesting of silt by making bunds in the gullies or other drainage lines for creation of cultivable land. Such bunds, in addition to facilitating deposition of silt from the upstream also help in conserving moisture in the newly created fields.

As a result of project intervention, maize production increased by 23%. Cropping area for maize increased for 30% of the households and remained the same for 70% of the households. Average maize productivity increased for 65% of the households, with the highest reported increase being 67% of average production earlier. Food security for the households increased on an average by two months.

It should be noted that based on this project, IWMI and collaborators in South Asia have begun to define food security in water scarce conditions as the number of months the household can meet its food needs from its own assets, without recourse to migration. Often, a life-saving supplemental irrigation during the rainy *kharif* season can increase household food security by several months.

Section 4: Learning and Implications for replication

4.1. Shift to non-farm based livelihoods for financial security

Due to the fragmentation of landholdings and limited availability of water for irrigation, agricultural production does not provide sufficient income to meet household needs. At best it provides food security for 3 to 5 months. Land and water interventions on smallholder private lands ensure one crop per year but do not result in substantial increase in income unless irrigation is available. Household members have taken up non-land based activities that provide regular cash income.

4.2. Development plans for common lands for fodder security should take into account all the livelihoods that depend upon the common lands

Seva Mandir's strategy to conserve and develop pasture lands has resulted in increased fodder security for the households that own cattle and buffaloes. Goat herders were adversely affected by this intervention since open grazing was stopped on these pasture lands.

4.3. Importance of local level institutions

This village level institution, the Gram Vikas Committee set up for the management of the common lands has ensured equitable access to fodder from these pastures for the households. One family member per household is permitted to cut the grass for one day for a payment of Rs. 50 per day. The remaining grass is sold in the open market.

4.4. Upscaling and Outscaling of Integrated Watershed Development

Seva Mandir's area of operation—particularly Barawa and to a lesser extent Ghodiawada—is relatively abundant in water resources compared to the density of population. As a result, the potential to meet livelihood needs is high; however, land degradation, poor soil nutrient status and sloping, undulating land exert biophysical limits on production. At the same time, poor extension and marketing arrangements make a shift to non-subsistence crops impossible or difficult.

There is considerable scope for additional implementation of integrated watershed development. *Anicut* construction is expensive, requires major investment in cement, sand and other purchased materials, and provides significant benefits only to a limited number of community members whose land has access to the *anicut* impoundment or downstream well recharge zone. Nevertheless, livestock are primary beneficiaries of the perennial water sources created. It appears that the scope for additional *anicut* development is limited.

Similarly, the potential to expand groundwater irrigation is limited. Even in relatively well endowed Barawa with a higher proportion of upper caste households with means to invest in groundwater development, only 30% of the agricultural holdings were irrigated.

Medbundi, the traditional system of soil and water conservation, on the other hand, is undertaken largely through farmers' own initiative. Given its lower cost, compatibility with local land and water management practices, and routine maintenance (as opposed to less frequent, major rehabilitation in the case of *anicuts*), *medbundi* has considerable scope for outscaling or replication on both private and public (common) lands. Given the relatively high water endowment, particularly during the monsoon, it would make sense to build household livelihood and food security strategies around the maximization of *kharif* season agricultural production. Dry season natural resource dependence is largely based on livestock, except for wheat production (and an increasing but still limited area under vegetables) in *rabi*. Concerns have been raised that indiscriminate watershed development by NGOs or social movements in India's semi-arid regions, e.g., Tarun Bharat Sangh in Alwar, will ultimately deplete river basin water resources. However, from the perspective of watershed-based land and water use intensification observed in Ghodiawada and Barawa, there still exists considerable room for outscaling before flows to downstream users are affected. The challenge remains one of upscaling, i.e., how best to plan and implement individual watershed interventions in order to maximize the watershed or sub-basin benefits.