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Biophysical and Institutional Factors in Watershed Management

A Comparative Analysis of Four Pilot Watershed Projects in India's Tribal Belt

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The authors: R.Sakthivadivel is an IWMI Senior Fellow and Honorary Visiting Professor at Anna University, Chennai, India; Kamal Bhattacharya is a former advisor (Agriculture), Catholic Relief Services (CRS), New Delhi and is currently an Agricultural Consultant with CRS in Afghanistan; Christopher Scott is Regional Director, (IWMI) South Asia, Hyderabad, India.

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Please direct inquiries and comments to: iwmi@cgiar.org

Contents

Summary

Watershed development and management are actively promoted by governments and nongovernmental organizations alike in India and other water-scarce developing countries as a means of providing rural livelihood and as a response to natural resource degradation. Finding the right balance between technical, managerial, and institutional thrusts of watershed projects in order to "deliver the goods" in a sustainable manner, remains a principal challenge. This paper reports on four such pilot projects, implemented in watersheds in India's tribal (*adivasi)* belt by Catholic Relief Services (CRS) and associated partners, with analytical support for data collection and interpretation, coupled with recommendations by the International Water Management Institute (IWMI). Factors that were found to have a profound influence on the projects' ability to meet the livelihood and natural resource objectives of the projects included: social homogeneity to ensure the equitable distribution of benefits and inputs (principally labor), appropriate entry point activities to build community awareness and trust, water availability/scarcity as a determinant of the relative importance of agricultural versus livestock (grazing) activities, local organizations and institutional arrangements to support project objectives and activities, and information dissemination on biophysical indicators and institutional arrangements to ensure transparency and ownership at the community level. Finally, watershed project up-scaling must be considered not only in view of potential complementarities and tradeoffs, particularly in upstream-downstream water resources availability, but also for inter-community relations. A "clustered" approach to watershed projects that invites focusing on the meso-watershed or subbasin as the unit of analysis and planning will internalize and thereby, mitigate the potential conflicts.

Introduction

The resource endowment for agricultural production in India's semi-arid tropics is rather poor and as a result a sizable fraction of the population, which depends on agriculture for a livelihood, lives below the poverty line. Low and erratic monsoon rainfall, poor soils, a short cropping season and migration make agricultural production uncertain and low in productivity. The green revolution that took place in parts of India where agricultural intensification and increased productivity had reaped the benefits, did not have much impact in Central India's tribal belt, where more than 300 million rural people depend, for their survival, on the natural resource base of this region; about 30-40 percent of these people can be classified as poor (Phansalker and Verma 2004). Population growth has increased the pressure on the natural resource of land, water and forest; in the last two to three decades, water scarcity, land degradation and a shrinking forest area have, in fact, become the main constraint for improving the livelihood options of the rural poor. As a result, there is large scale migration. Migration is both an outcome of natural resource degradation, and also is a limiting factor in reversing degradation, i.e., seasonal and permanent labor shortages for management interventions to reverse degradation and increase productivity.

Presently, watershed as an approach and strategy has been receiving increasing focus in India to sustain the livelihood of the rural poor. The need to enhance the food / livelihood securities of the marginalized and vulnerable communities in arid and semi-arid areas have been widely acknowledged. That there is a very delicate balance and the eco-fragile areas are crumbling under the sustenance pressure of the community is also evident and noticed.

Water and land as entry points to and support points for the natural resource base has become the main focus of development and an integral part of the lives of the poor communities. Effective land and water management regimes progressively enhance the productivity of the natural resource base, but the question of sustainability remains unclear unless the survival needs of the poor communities are integrated with other livelihood support systems.

For Watershed Development through sustainable natural resource management, the Catholic Relief Services (CRS) with its South Asia Office at Delhi has programed to implement 200 Watershed Development Projects in the States of Gujarat, Rajasthan, Uttar Pradesh(UP), Madhya Pradesh (MP), Chattisgarh, Jharkhand and West Bengal through the assistance it received from USAID for the period 2002-2006. In order to brainstorm and arrive at some guidelines for implementing integrated and sustainable watershed development projects in India, the Catholic Relief Services (CRS) organized an international workshop at the Institute of Rural Management (IRMA), Anand, for which IWMI was invited as a resource person to provide input on the hydrological aspects of watershed development. The deliberation during this workshop has strengthened the need for collaboration between IWMI being a research institution on water management and CRS, a primarily development-oriented nongovernmental organization. The outcome of this deliberation is the present pilot study where both IWMI and CRS expertise will be used to develop and implement integrated and sustainable watershed development projects.

Among the 200 and odd projects to be implemented by CRS, four pilot watershed projects (Nakna in Chhatgisgarh, Nayagaon in Rajasthan, Karaighat in UP and Dundlu in West Bengal) were selected in association with the International Water Management Institute (IWMI), Colombo, for learning watershed development process and forming guidelines relating to institutional arrangements and technical requirements with a requisite information base for sustainable watershed development. In selecting these pilot projects, considerable time and energy was spent to select those projects representing the geographic, agro-climatic and socioeconomic situation of the watershed projects being implemented by the CRS.

The pilot projects that were started in 2002 are currently at different stages of planning, development, and implementation. This paper explains the process adopted in developing the projects and the lessons learned so far in implementing these pilot projects. The process adopted and the lessons learned will be valuable not only for implementing CRS projects but for similar projects being implemented in the Asian region.

2. Brief Description of the Pilot Projects

2.1 Nakna Watershed

This watershed is located in Surguja District in Northern Chhatisgarh and is primarily a tribal dominated area. The topography of the rugged terrain is characterized by hillocks with approximately 41.85 percent of the watershed covered with forestland in the upper reaches. There are three perennial streams with other sources of water being wells, ponds and springs. The long-term average annual rainfall is 1,400–1,500 mm with a high coefficient of variation. The average annual rainfall received in the watershed during the last 2 years (2002 and 2003) were within 1,000 mm. with about 40 percent of the rainfall occurring during the month of July alone.

There are six hamlets within this watershed having mainly two predominant groups of tribals (Uraon and Gond). The tribal population of the area lives in close association with their natural resources. This relationship is, however, getting strained because of the fragile conditions of the ecosystems, which no longer seem to be catering to their sustenance.

Even with rain-fed agriculture being their primary occupation they are still not able to sustain themselves beyond 4 to 5 months of food requirements. The lack of irrigation facilities affects productivity and the crippling drought situation only makes things worse. Thus, the easy option for them is to migrate to other places in search of livelihood opportunities.

The tribal communities have their own inherently cohesive systems of institutions for managing their affairs and resolving conflicts in an amicable way. Tribal leadership has a strong influence on the societal processes involved in upholding norms and values pertinent to their culture. This has had a bearing on the Nakna Watershed Project by ensuring the inclusion of all sections of the community in the project processes as seen from the experimental sharing.

2.2 Nayagaon Watershed

This watershed is located about 15 km from Ajmeer in Rajasthan. The area is covered by Aravalli Hills on three sides with forestland on the upper reaches. The watershed covers an area of 915 ha, which includes the two villages: Nayagaon and Devpura. The population of the watershed area belongs to other backward caste (OBC) groups. The average annual rainfall is 185–200 mm; the rainfall is so erratic with a high coefficient of variation that it receives annual rainfall as high as 400 mm and as low as 50 mm. The low and erratic rainfall makes the area highly drought-prone. The phenomenon of migration to nearby towns and cities is a prevalent feature. This is because of the low productivity of the rain-fed agricultural land, which is not sufficient for year-round existence. The forestland in the upper reaches is destroyed and denuded due to mining. The pastureland is in a similar degraded condition. Water resources in this area have been developed through four *talabs* (ponds). There are also 30 dug wells in this watershed of which 6 are used for irrigation purposes. The major source of livelihood in this watershed is from livestock rearing. Water scarcity and the consequent low productivity of land coupled with nearness to big cities make migra-

tion for the daily wage laborer and others seeking white collar jobs, the most attractive source of income earning.

In this watershed, situation-specific constraints like persistent droughts, stress migration, and contribution of watershed to their livelihood have conditioned the community to be at the receiving end without assurance of any contribution from their side. Seeking community participation is difficult under such dire conditions. The Catholic Relief Services (CRS) implements these watershed projects in partnership with collaborating (CP) and operating (OP) partners through food for work programs. In this case, the operating partner (Implementing Agency) is relatively new, does not belong to that place and does not have adequate staff strength to carry out the pre-watershed phase activities in a systematic manner so as to convince the community about the collective action and benefits that accrue from it. In a watershed occupied by a heterogeneous group of people in terms of socioeconomic conditions, wherein a sizable section of the group is working outside the ambit of the watershed boundary and getting a wage much higher than that which the watershed work can immediately offer, utmost effort is needed to convince the community on the long lasting benefits of watershed development and mobilize them for watershed development work. Such efforts were not forthcoming from the implementing team, especially from the OP.

The major issue in this watershed is mobilizing the participation of the people and convincing them about the long-term benefits of the watershed program when they are having access to easy money through migration. The main concern is how to deal with the opportunity cost associated with migration vis-à-vis participation in watershed development activities, especially when it is involved with food for work. Access to drinking water from a nearby pipeline source is another reason for their lesser concern towards watershed development. It is very difficult to find many able-bodied males staying in the village during day time as they all move out of the watershed for work; only women stay behind and take care of the livestock and other household activities. One way to promote watershed development is to plan watershed group exclusively for the women-folk, as they are available for interaction and relate more closely to issues, which directly affect their livelihood.

2.3 Karaighat Nala Watershed

This watershed is situated near Harshpur, one of the largest villages in Lalitpur District of Uttar Pradesh (UP). The watershed, which was once abundant in natural resources like forest, land and water has become resource-poor due to unplanned management and the indiscriminate felling of trees, excessive tillage and restructuring of water courses for short-term gains causing land degradation, which has in turn caused poor soil health, ecological imbalance from water resource scarcity, and poor agricultural and livestock production resulting in drought and the migration of families.

Harshpur village consists of 22 hamlets with a total population of about 6,000. The 22 hamlets are occupied by 5 castes of people mainly Thakur, Barar, Kushwaha, Chamar and Saheriya. In this watershed, the Saheriya caste is more in population followed by the Kushwaha caste.

Saheriya community is considered a scheduled caste in UP. The total cultivable land owned by this community is significantly small when compared to their population, and their landholdings are in the upland area, which is far away from their settlement. The agricultural income is sufficient only for 2 to 3 months of their livelihood requirement. For rest of the months, they depend on firewood selling and farm labor. The main occupation of the Kushwaha community is agriculture followed by livestock rearing and petty business. The Thakur community is the ruling community; although less in number, they influence the decision-making process in any program of the village; they have a major control over the low caste people and their land and other resources. They own all the prime cultivable lands along water sources and ponds, which provide assured irrigation sources.

Apart from these lands, they also own drylands with a minimum of 10 acres per family. But 60 percent of these dry lands remain uncultivated and barren. The Barar and Chamar communities' primary occupation is goat-rearing followed by agriculture and basket-making.

The total watershed area is around 940 hectares. The slope within the watershed ranges from 20 percent to nearly level (0 percent). The 10-year mean annual rainfall is 890 mm, but varied from a minimum of 423 mm to a maximum of 1,628 mm. Approximately 90 percent of the rainfall occurs between the monsoon months of June to September. About 360 ha of land is reserved forest, and 225 ha is used for grazing, which comes under the Panchayat, and the rest 355 ha is private land. The entire village land is located over undulated rough terrain characterized by red gravel with patches of out-cropping rocks. Though there are 40 wells in the watershed, maximum irrigated area from these wells would be around 30 ha only.

The poor quality of land along with the traditional practices of agriculture result in a poor yield. Hence, most of the villagers migrate to the nearby towns for their survival on a seasonal basis. The weaker section of the society who got their land through government distribution are located in the upland and around the hillocks, which are mostly undulating terrain and unproductive. They do not even have a legitimate record to show that the land allocated belongs to them.

This (Karaighat Nala) is a large watershed comprising 16 hamlets of the Harshpur village with different caste-groups and having a skewed socioeconomic and political clout. The implementing agencies in this case (both CP and OP) are one and the same, called HBM Hospital (HBMH); they live 40 km away from the proper watershed although they have already established an office in the watershed where periodically one or more of the HBMH staff visits take place. Moreover, the HBMH staff are considered as foreigners because they do not belong to that watershed and not even to that district. The real problem in this watershed lies mainly with the implementing team; there was a large turnover of operating staff; every time one goes to the field, he/she sees some new faces and there is no continuity in the persons who are responsible for implementing this project, except for the head of the team. Also, as the watershed is big, much of their concentration is in one or two hamlets with the result that many of the hamlets cannot be brought together to act as a monolithic unit.

2.4 Dundlu Watershed

The Dundlu watershed comprising Dundlu, Dighi, Gobardih, Tamakhun, Noadih, and Metaldih hamlets lies in Manbazar 11 block of the Purulia District. The watershed is inhabited by 343 households with a total population of 1,737 of which 852 belongs to scheduled tribe (ST), 75 to scheduled caste (SC), 190 to other backward caste (OBC) and 620 to a general category. The majority of ST people belong to Santhal, Majhi, and Mahato. About 61.4 percent of the people are literate; however, the female literacy rate is relatively lower. The number of households involved in various occupations is given below:

Occupation	No. of households
Rural handicrafts	5
Agriculture	187
Agricultural laborers	112
Service	27
Small business	5
Pisiculture (Fish Rearing)	4
Miscellaneous	3
Total	343

Historically, forests were a source of primary occupation of the tribal people of the Purulia District for the collection of minor forest produces. Due to indiscriminate deforestation and uncontrolled grazing, the forest is now almost non-existent. Since people of the tribal community do not consider cultivating uplands remunerative due to its poor productivity compared to earning relatively higher wages in and around the well-developed industrial and agricultural areas, they migrate to nearby industrial cities and flourishing agricultural areas.

Because of the undulating terrain and indiscriminate felling of forest trees, the land is a victim of soil erosion and its capacity for water retention is poor. In this area, no surface water irrigation exists; groundwater availability is low and no electricity is provided for agriculture. Thus, agriculture depends on rain, and the small and marginal farmers who constitute majority of cultivators suffer most with mono cropping (paddy).

Livestock in this part of the country thrives by grazing throughout the year. The quantity of cattle feed available is not very significant with respect to the requirement. Paddy straw is fed as a basal diet everywhere. The major constraint for increasing milk production is the low level of feeding. Even the availability of paddy straw is very minimal in the watershed area. An estimated 8,000 quintal of additional paddy straw is required to feed the existing animals. Most tribal families rear a few pigs or goats or poultry birds in the open courtyards adjoining their tiny household plots. Lacking technical or managerial input, such animal husbandry activity is hardly capable of producing any surplus.

Combination of all the factors discussed above has driven the people of this area to a grim struggle for existence, the Dundlu watershed like so many other watersheds of this region suffers from gross unemployment and under-employment. The poor remain hungry during workless days and hunger intensifies in the years of drought when opportunities for work diminish further.

2.4.1 Water potential and land status of Dundlu

Variation in the seasonal amount of rainfall and the timing of their occurrence during the crop growth season are major constraints in the mono-cropped rice-based economy of the region. A study undertaken by the Central Water Commission (CWC) reveals that the inter spell duration between two rainy periods extends upto 4 consecutive weeks or more in this district, particularly between May 15 to October 15. These long inter-spell durations become critical during important phases of crop-growth, and thereby affecting the yields.

The micro watershed covers an area of 605 hectares and has mostly undulating rugged hilly terrain and limited valley portions. There are seven drainage lines within the watershed all of which drains to Dundlu nala, a tributary to Kumari river flowing near the Dundlu watershed. Red laterite soils which are susceptible to large scale erosion are found in the watershed area. Soil fertility is very low. The area comes under semi-arid climate with average annual rainfall of 1,200–1,300 mm. Sixty percent of the land area is covered by hilly terrains with a shallow soil depth of sandy loam having excessive drainage characteristics. The midland area with sandy loam to loam is occupied by 25 percent, while the rest is lowland with deep ‘clayey’ soil suitable for paddy cultivation.

The watershed area (605 ha) receives 2,420 ha ft of rainfall of which 50 percent evaporates away from the watershed according to the Survey of India Report. With the watershed having only 50 ha ft of water storage facility, nearly 96 percent of run-off drains away to Dundlu nala. This suggests that there is a tremendous potential and scope to store some of the water as soil moisture storage and surface storage to improve water conservation and use.

Dundlu watershed consists of the following land classification:

Classification	Area(ha)	%
Hillocks	65.7	10.9
Tanr	159.1	26.3
Baid	236.6	39.1
Kanali	49.2	8.1
Bahal	79.1	13.1
Water bodies (ponds)	15.3	2.5
Total	605	100

Tanr is sloppy upland with gravelly surface and is not terraced. This land is hardly put in to use except for growing some oil seed crop during Kharif. Baid is medium upland, and was reclaimed as a paddy field after terracing and bunding. It retains some moisture with a soil depth varying from 10 to 15 cm., the crop growth is very sensitive to rainfall distribution. Kanali is a terraced and bunded medium land to harvest runoff of upper catchment. Kharif paddy is grown here and productivity is sensitive to rainfall pattern. Per bigha,(2.5 bigha = 1 acre) paddy production is around 10–12 maunds(40 kg per maund). Bahal is a valley bottom land where rain water and silt from the upper catchment accumulate. The alluvial fill is most suitable for assured Kharif paddy. The productivity is about 15–16 maunds per bigha. Summer paddy is also grown in this tract.

The percentage of irrigated area in this watershed is only 5.5 percent. More than 99 percent of the households have agriculture as a primary occupation. Poverty ranking, indicated that nearly 50 percent of the households have food availability for only 3 months. The average annual rainfall of this area is in the range of 1,000 mm. Even with this amount of rainfall, agricultural drought occurs during the month of September and a meteorological drought was observed once in every 3 years. There is an acute shortage of drinking water during the summer season. Fuel wood availability has decreased considerably and women have to cover long distances for the collection of fuel wood.

Rice is the staple food of the tribal people. The total cultivable area of the watershed is around 300 ha. At the present rate of yield potential, a total of 59.93 tonnes of paddy can be grown if the entire cultivable area is brought under paddy. However, the present production is only 41.95 tonnes as against the requirement of 61.74 tonnes. The above figures point to two important inferences: one is that there is a 40 percent gap in present production as against the requirement for self-sufficiency and two, that the present yield potential is very low, which has to be increased significantly to meet the food requirement of the watershed.

The four pilot studies undertaken under this collaboration, are under different stages of development. Among the four projects, Nakna and Dundlu Watersheds have progressed well and they have finalized their detailed watershed development proposals and are in the process of implementation. The other two namely Nayagaon and Karaighat nalas have not made much headway for various reasons. This paper looks at the reasons as to why two projects have progressed satisfactorily while the other two have not made much headway. What are the lessons that we can learn from these four projects to improve and sustain the development projects which are on the pipe line?

3. Methodology Adopted

This paper is based on the information collected during the periodical field visits undertaken by a team of experts drawn from CRS (HQ and Regional Office) and IWMI. During field visits, intimate interactions and discussions were held with field implementing teams (CP, OP, Village Institutions, Government and nongovernmental agencies, working in the watersheds and the communities at large). One thing that these pilot projects were trying to do differently from other conventional projects is collect hydrologic data at the local watershed itself, rather than using district level data. This made a marked difference in formulating a detailed watershed proposal with reliable local data, rather than looking to design watershed development work based on district level data. Another aspect that these pilot projects laid emphasis is in preparing a detailed map of the watershed on different aspects with the close involvement of the community, which proved to be very useful during conflict resolution between the communities, when it came to convincing the community about certain interventions and to have a better perspective by the watershed communities of the overall development within the watershed.

Each year, the team made at least two field visits and stayed in each watershed for at least 2 days and observed the process of watershed development activities with intense interaction with all the stakeholders of the watershed. The field-visit notes formed the basis of information for this paper.

4. Factors Contributing to Watershed Development

4.1 Importance of Homogeneity in Watershed Communities

In the case of Nakna watershed, the Coordinating Partner (CP) is located at Ambikapur, and includes two skilled professionals (with an engineering background) from the same tribal community who also speak the local languages. The Operating Partner (OP) is located at Shantipara, which is very near to the watershed with one agricultural assistant stationed there who is also a local and from the same community. He was involved previously in developing one of the best performing watersheds in that region. Both CP and OP heads are Christian fathers; in fact, the village community from Nakna come to Shantipara every week for Sunday prayer. The team of this three professionals understands each other so well and had the capacity to convince the community about the importance of watershed development project to improve their livelihood and living standards. This team and their interactions with the community have helped to a great extent to mobilize and unite the people in the watershed and create awareness of the watershed development project. Both Nakna and Dundlu has more or less homogeneous community whereas Karaighat nala has a very heterogeneous, community and Nayagaon has other OBC castes whose main income comes from other sources. Both Dundlu and Nakna are predominantly small and marginal farmers, while in Karaighat nala 20 percent of the population is owning 80 percent of the land and the remaining 80 percent of the people own 20 percent of government land for which no land deed documents are given to them; they are not sure whether after watershed improvement to their lands, will the land remain with them or it will be taken away by the government. The results of these pilot studies indicate that much more efforts are needed to prepare a group for collective action when the group is heterogeneous in terms of caste, landholding pattern and skewed in socioeconomic conditions thus having different expectations from watershed development.

Equally important is the homogeneity and collective effort of the implementing team, its origin and nearness to the watershed and to the people and the confidence that it reposes on the community for successful watershed development. One important consideration is that the OP's and CP's dealing with the community should speak the local language of the watershed community.

4.2 Agro-climatic Conditions

The agro-climatic conditions of a watershed can be a deterrent for the effective development of a watershed. For example, in the four pilot watersheds studied, Nayagaon watershed has the lowest annual average rainfall of less than 200 mm with a high coefficient of variation. Such a low rainfall with arid and drought condition for 2 or more consecutive years is not conducive for extensive agricultural development and institution building. Much of the watershed area is used for grazing; as a result, the productivity of the watershed is low and is not sufficient for meeting the livelihood of a large number of households living in that watershed. When a natural resource base such as water is low in a watershed, only limited agricultural-related productive activities are possible and in the absence of any extensive non-farm activities, the only alternative is to migrate in search of livelihood options. This is what had taken place in the Nayagaon watershed in which the community paid the least amount of attention to watershed development. Moreover, the year 2002 in which watershed development started was a drought year with an annual rainfall of less than 50 mm. The lack of rain resulted in an acute shortage of fodder for the livestock. The whole village was confronted with fodder shortage and many households were trying to save their animals by moving them outside the watershed to places where fodder and water were available. Under these conditions, the farmers were not in a mood to form an organization to develop the watershed. When a meeting is convened during daytime, it is difficult to get the male members to participate. Such watersheds need a strategy different to the conventional one. Even after 2 years of implementing watershed projects, not much progress has been made in carrying out the pre-watershed activities and establishing viable watershed groups.

4.3 Entry Point Activities

Entry point activities play a vital role in creating awareness among the communities of the watershed and uniting them together for the purpose of carrying out work in common village land and work which is of relevance to the community as a whole. The community also volunteered to do *shramadan* work on common land, which benefit all in the watershed. Both in Nakna and Dundlu, the entry point activities were carefully designed to benefit most of the watershed communities. No entry point activity was undertaken in private lands in these two watersheds. An activity which benefits a large number of people has a marked effect in their perception about watershed development benefits. On the other hand, entry point activities in both Karaighat and Nayagaon were undertaken on private lands and only a few benefitted by such activities. These kind of activities on private lands instead of uniting the village community, give a false impression that watershed development will benefit only a select few and that too, if the beneficiaries are influential, as such who have not much land and other resources keep distant from watershed activities; the desired impact of entry point activities, which is to create a unified group to invest their time and energy in watershed activities is not felt under these conditions. Entry point activities must also be targeted to satisfy the community's long felt need and they should be of immediate use to them.

4.4 Formation of Hamlet Committee and Watershed Committee

Both Nakna and Dundlu watersheds followed a systematic procedure in creating hamlet and watershed committees; they used grass-root organization such as SHGs to select committee members giving representation to all. This broad-based representation in the committee had a good impact in bringing the community together. On the other hand, in Nayagaon effective organization could not be constituted because of ineffective entry point activities and not forming of any SHGs. In Karaighat watershed, SHG, youth club and farmers club were formed and they were used to select hamlet and watershed committee members. However, the committee formed did not have sufficient entry point activities to participate and bring the community together. Hence they become defunct.

4.5 Institutional Arrangement

The basic institutions created for watershed development are the hamlet level committee and the watershed level committee. Then there is a project facilitation team (in the case of CRS, it is OP and CP supervised by the funding agency CRS). From the government side, the grass-root organizations, which come in contact with the watershed committee are: Village Panchayat, and Revenue and Forest Departments. For effective implementation of a watershed project, the cooperation among all these units must be high and the interface between these units must be clearly crafted, specifying the roles and responsibilities. These are all nested institutions with a forward and backward loop of decision-making and implementing mechanisms. Unless, these units act as a monolithic, the progress of watershed development activities will be hampered. If we look at the interface and cooperation, this was highest both in the case of Nakna and Dundlu watersheds, which is one of the reasons for their very high and efficient performance, followed by Karaighat and Nayagaon.

Let us look at these institutional arrangements in a little more detail both in Nakna and Dundlu. In Nakna, both the hamlet and watershed committees were formed meticulously giving representation to all and building their capacities to take decisions and work as cohesive and collaborating units. For this endeavor, both OP, CP and CRS provided the needed assistance and they worked as a unit. Above all these things, the *Sarpanch* of the Nakna Panchayat took personal interest in the watershed development works. As a proof of their interest, it can be stated that in all the supervisory meetings undertaken by CRS, IWMI Staff, all the heads (hamlet committee, watershed committee, OP and CP heads and *Sarpanch* from Panchayat) were present and participated actively in the discussion. This shows their keen interest in watershed development activities.

The following incidence that took place in the Nakna watershed is an indication of how cooperation among various units of watershed and implementing team would help accelerate the development process. One of the hamlets in the Nakna watershed wanted to divert a stream passing out from a forest area to their hamlet to irrigate their land. Given the elevation considerations, the diversion has to take place some 10 m inside the forest area. The CRS officers informed the watershed committee that unless they get permission from the forest department, CRS would not be able to offer any financial assistance to construct the supply channel. The *Sarpanch* of the Panchayat took the responsibility on her shoulder; she met the forest department officials and explained the situation; the forest officials permitted the watershed committee to put a check dam and take a canal for 10 m without cutting any trees. Then a resolution was passed in Panchayat for taking up the work on the channel, based on which the supply channel was undertaken with financial assistance. The loose boulder check dam and the 10-m long canal were constructed under *shramadan* by the watershed committee. Had the *Sarpanch* not taken interest in this matter, the whole activity could not have

been completed in time. This is a classic example of what cooperation among different units of watershed-implementing teams can do to accelerate the watershed development process.

One of the strengths of the Dundlu watershed program is the existence of a strong OP (SEVABRATO) consisting of local people who have been working in this area for nearly a decade; they are very familiar with watershed development activities, they know how to use the process to create awareness among communities, to build and train local level institutions and to manage and implement the program in a systematic manner with built-in monitoring mechanisms.

Based on "brain storming exercises" involving all the stakeholders of the Dundlu watershed, the OP identified the following as problems faced by the community and grouped them under the following three broad categories according to their priorities.

A. Problems related to production of crops

- Shortage of food
- Nonavailability of irrigation water
- Soil erosion
- Wasteland not developed
- Lack of resources for production
- Nonavailability of modern agricultural implements

B. Socioeconomic Problems

- Lack of facilities for education and training
- Early pregnancy of adolescent girls
- Population increase
- Support services inadequate
- Limited awareness for women development

C. Infrastructure problems

- Lack of health facilities
- Problems of drinking water
- Nonavailabilty of electricity
- Weak transport and market facilities

To solve these problems, the multifarious activities planned by this team can be grouped under five activity areas with their objectives, which are given below:

Activity area	Objective
Capacity building of SEVABRATO (SVT) personnel	To strengthen the human and institutional capacity as well as technical skills of the project team of SVT
Formation and strengthening of community-based organizations	To encourage and empower community-based organizations to initiate and control their own development
Land development, soil and water conservation	To improve the availability and productivity of cultivable land through sustainable soil and water conservation measures
Crop production	To ensure food security and additional income through diversification and enhanced production of crops
Other income generating activities	To generate purchasing power and supplement food resources

The key watershed development work arrived at after detailed discussion with the Village Institutions consists of the following activities, which formed the basis for a detailed watershed development proposal.

Activities	Purpose
Land treatment: upland and medium land	To reverse the degradation process, conserve soil and moisture in-situ for enhancing crop production
Renovation of water harvesting structures	To conserve rain water for utilization during lean period for irrigation purposes
Construction of dug wells	For providing irrigation during rabi cultivation (vegetables)
Lift irrigation	For increasing the cropping intensity
Plantation of indigenous trees, sabai cultivation, and fodder cultivation	Increased availability of fuel wood , fodder and sabai for income generating activities
Training of SVT project personnel	To make SVT staff more confident on water-shed development
Capacity building of Village Institutions	To impart knowledge on watershed development and income generating activities
Crop production	Introduction of kitchen garden, fodder cultivation, and fish rearing etc.

The project organizational set up established to carry out this work is as follows:

Joint Project Committee (JPC)	Program Management Unit (PMU)	Village Institutions (VIs)
The JPC consists of CRS, IWMI, CP, VI representatives and the SVT. The objective of this committee is to guide and monitor the implementation of watershed development proposal; to identify constraints in the implementation of the program and to determine corrective measures	The PMU consists of one project officer, two agricultural extension workers, two project implementers, one accountant and one office attendant. This committee is to plan and coordinate implementation of all programs	The Village Committee consists of two persons from a cluster of ten households. Watershed Committee consists of all Village Committee members. Core committee consists of two members from each village within the watershed (out of two members one is a woman).The Village Committee will be involved at the local level in planning, coordinating Watershed Committee (WC) Core Committee (CC) and Jagmoria Sevabrato (SVT).WC will be in charge of the plan from the stage of monitoring, review of the progress, accounting and ensuring people's involvement in the program. WC would also supervise and control the CC, which will carry out day-to-day activities.

The field-level implementation of the watershed development program when undertaken in a variety of agro-ecological and socioeconomic conditions leads to a variety of issues viz., technical, institutional, people participation and contribution, working of VC and WSC's, equity in sharing returns, gender issues etc. It is amazing to see how the project implementing team in Dundlu think through these issues carefully and tackle them in a manner suitable to all affected.

The government-sponsored programs in general include building of roads, small dams and buildings, de-siltation of tanks, afforestation, soil and water conservation works involving a large amount of wage labor; these projects and programs have been criticized for their failure to involve people; although people derive short-term wage employment benefits, the overall expenditure becomes unproductive as the assets created are of poor quality or are not used.

On the other hand, the soil and water conservation program envisaged and implemented under the watershed development project by the Dundlu team is developed, implemented and maintained by the people. Two wage rates exist in this area. One is the government rate, which is Rs 52 per day and the other is the local rate, which is Rs 40 per day. Participants in this program are paid only Rs 40 per day, in that they forego a part of their wage as they are working on their own lands, and when productivity improves, they will receive a a steady stream of benefits. The part of the wage foregone is considered the contribution of the beneficiary to the community. This contribution is put in a village fund, which is used for agricultural loans. This system of transparent contribution ensures that the participating households in the program are committed to its success since it will benefit them at a later date.

4.6 Information Base

Presently, the whole exercise of watershed development is being undertaken without really estimating how much water is received in the watershed, how much of it is stored, where and how

much of it can be used in a drought year, in a normal year and in a surplus year. What we really do not know is the flow paths taken by the various components of the hydrological cycle both spatially and temporally; we would like to know these flow paths before and after the development of the watershed to match the supply and demand situation. A hypothetical situation of flow paths before and after the development of the watershed is depicted in figure.1a and figure 1b, by taking watershed as a unit of analysis for a time period of one year. This figure is called a finger diagram since it is similar to a hand with five fingers. The width of the figure is an indication of how much water is stored or used in different components of the hydrological cycle. For example, after the development of the watershed, one would expect evapotranspiration to go up and runoff to decrease compared to what they were before the development of the watershed. There is a need to continuously monitor the magnitude of the flow paths in the finger diagram to know how much water we are utilizing now in this watershed; how much water we will be using when it is fully developed and what will be the impact of such development on the downstream clustered watersheds?

Figure 1A.

Before Development

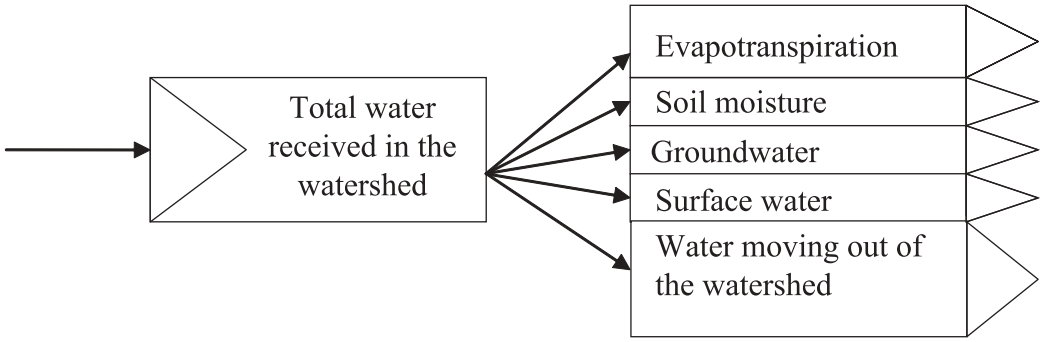
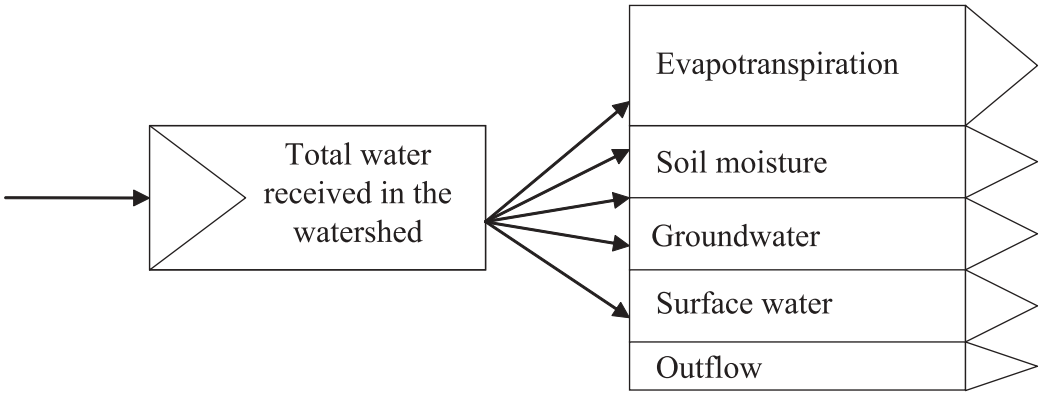


Figure 1B.

After Development



In order to change the flow paths, first, we must know how much water is received in a watershed by way of rain and second, how much water is exported, if any, from other watersheds. We take that this quantity will remain the same before and after the treatment. To compute this inflow, we need to know the reliable rainfall occurring in the watershed. Many a time, we use the rainfall record available in a nearby rainfall station, which is very much different to what is occurring in the watershed. Therefore, any watershed program should start with the measurement of rainfall, groundwater depth, evaporation, and depth of flow in the nalas and the outflow of water from the watershed. These measurements will give us an estimate of the flow within a watershed. These hydrological measurements (although crude) will provide initial values with which to compute the various components of flow paths. From the water that is received in the watershed, a portion of it goes as evapotranspiration, a portion is stored in the soil as soil moisture, a fraction is stored as groundwater in the underground aquifer, some quantity is stored in ponds, tanks, check structures and farm ponds as surface storage, while the remaining water leaves/flows out of the watershed. If there is some water moving out of the watershed, we say it is an open watershed, otherwise we call it a closed watershed. Once the watershed becomes closed, careful management is needed in order to use the water more productively. During the pre-watershed development period, we arrive at a rough estimate of the various components of the finger diagram. These were estimated in the case of Nakna watershed with 2 years of hydrologic data. The next question is how do we alter these flow paths during the watershed development process? What factors constitute and control this transformation? It is herein the technical aspect of the watershed and the socioeconomic conditions of the people living in the watershed, including their hamlet location and landholding location, that will play a vital role in making the decisions. This means that we need to get a detailed map of settlement, landholding pattern, soil map, land use map, existence of groundwater, surface storages, types of crops grown (rain-fed and irrigated), wells etc., for which the necessary data needs to be collected. With these maps and the finger diagram, the hamlet and the water users group can better discuss and make rational decisions of watershed planning, development and management.

Detailed map preparation is extremely essential in order to develop and implement a good watershed proposal. Village communities are able to understand more clearly if we discuss with them the development plans with the use of various maps, which will make it easy for them to understand the development proposals and arrive at a feasible solution for the problem faced which is acceptable to all of them. For example, construction of field bunds to arrest runoff and soil erosion in steeply sloped areas which is a felt need by all the stakeholders. Also, these maps can help considerably to remove some of the existing wrong notions in the minds of the community as regards watershed development, by way of the project facilitating team.

Here is an example of how this information base in the form of maps was effectively used for decision-making by the local communities. Majhar Para is one of the six hamlets in the Nakna watershed. Among all the six hamlets, this is the poorest in terms of landholding and natural resource base such as water and land. Near their settlement, they have elevated common land for grazing, which is denuded. Presently, they are involved in rain-fed farming and grazing of livestock in the denuded upland area. There is a large-scale erosion from denuded grazing area due to the existence of steep slope between grazing upland and rain-fed cultivated mid-land Several discussion meetings were held with this hamlet community and the project facilitation team. The community used these maps as aids and identified two major interventions, which would improve their livelihood opportunities. They are (1) diverting the spring and floodwater through a contour canal from a far-off nalah by constructing a check dam.

The community walked through the whole area and marked on the map the location at which the check dam and the contour canal should be constructed. (2) They wanted a ring bund at the interface between upland (grazing land) and rain-fed cultivated medium land to prevent floodwater causing erosion and to divert the floodwater to a neighboring nala. To arrest the flood, they have also indicated farm bunding, which is to be undertaken by the individual landowners. Work is currently in progress to implement these suggestions. While construction is going on, another important aspect of their planning is to think ahead of creating water-user groups to frame rules and regulations for the operation and maintenance of structures created under the entry point program, which is another important aspect of their planning.

The water-user groups have already started thinking about creating a *corpus* fund for emergency repair to which they will contribute regularly every year. To achieve all these things, the project implementation team must provide the necessary information in the form of charts and maps, which the community could easily understand. The following are some of the maps provided for making decisions by the community. These maps were prepared with the close involvement of the community.

(i) Migration pattern of Nakna watershed (fig. 2)

(ii) Settlement pattern (fig. 3)

(iii) Micro watershed zoning with flow direction (fig. 4)

(iv) Hydrological measurement sites (fig. 5)

(v) Land use pattern (irrigated, rain-fed, grazing, forest, single crop area, double crop area, denuded area etc.) (fig. 6)

(vi) Topographical map (fig. 7)

(vii) Existing nala, ponds, wells, etc. (fig. 8)

(viii) Proposed intervention plan (fig. 9)

Figure 2 shows the migration pattern in the Nakna watershed. In this watershed, about 80 farmers do not migrate at all. Although migration takes place for different periods of time, most farmers (nearly 70) migrate for a period of either 3 months or 6 months. Those who go out for 3 months are those having lands and who go out in the off season in search of employment and come back during the harvest/ sowing time. Those who go out for 6 months are those who do not have lands and who are unable find any work within the village; they go out for 6 months to work outside the village, while during the remaining 6 months of the year, they are able to find employment within the village. In our interview with farmers we found that none of them wanted to opt for employment outside the village, if they could get work within the village. This sentiment is universal among both men and women. They do not mind even getting lower wages if they have an opportunity to work within their village.

Figure 2. Migration pattern.

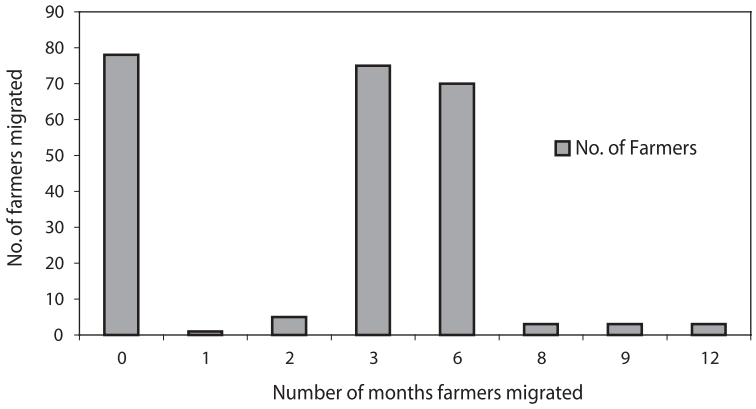


Figure. 3 presents the existing pattern of settlement of various tribes. Among the various tribes, two (Uraon and Goan) are predominant. These tribal groups have settled in separate hamlets and act as homogeneous units. Originally, most of the settlements were in the lowland area and nearer to the roads; with population pressure, however it is seen that the settlements have dispersed and we can see some of the tribes are even settling within the forest zone. They are the poorest of the poor who are in dire need of livelihood enhancing activities through watershed development.

Figure 3. Existing settlement pattern (social map)—Nakna watershed.

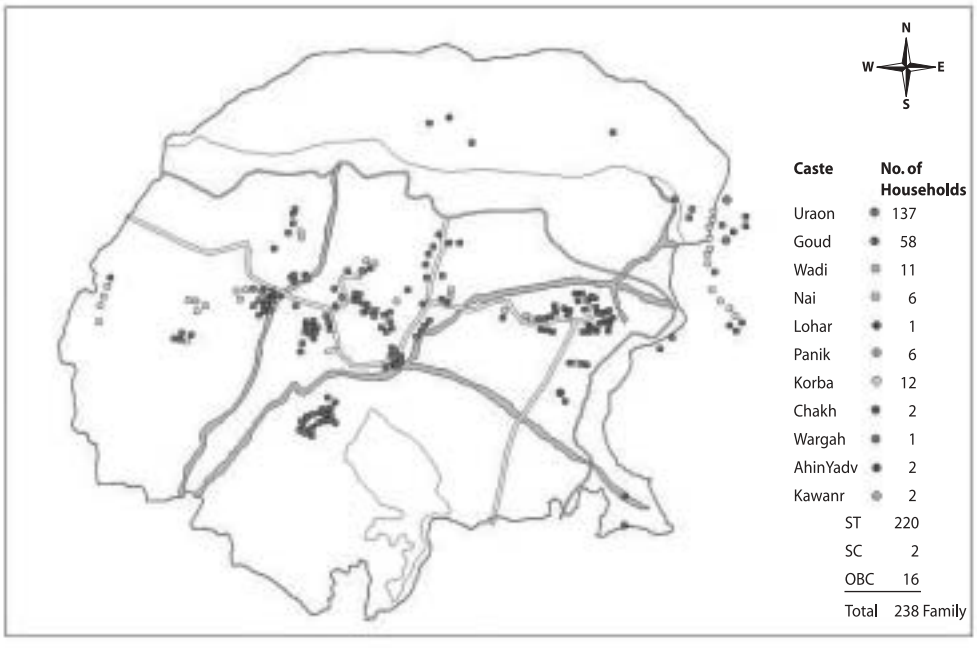
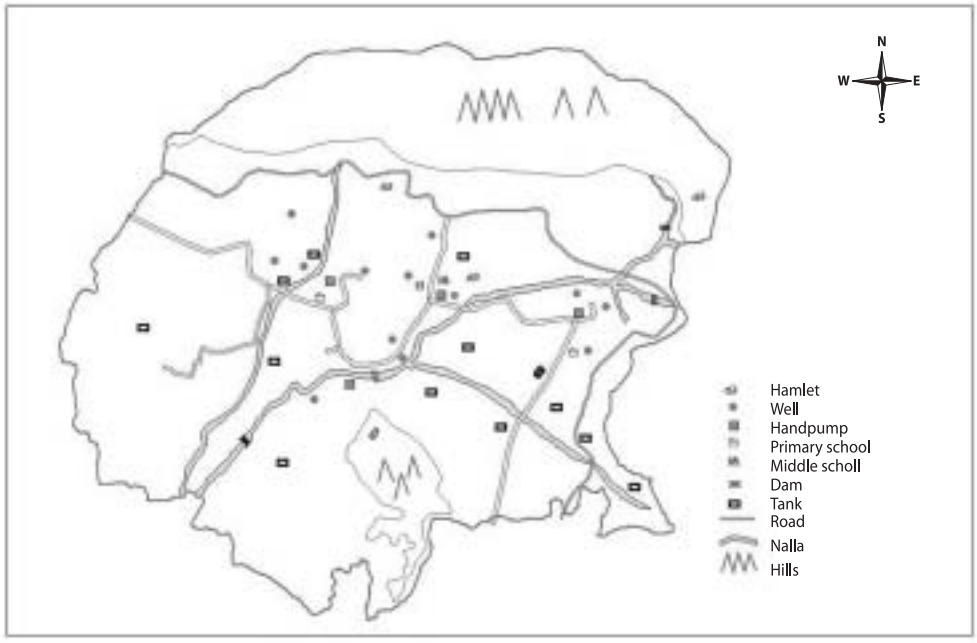


Figure 4 is a natural resource map of the Nakna watershed depicting, especially those of water-related structures. It indicates the existing tanks, dug wells, hand pumps and regulators found across the streams. One observation from this map is that most of these structures are located adjacent to the streams and settlements. The upland area is devoid of any water retaining and water conservation structures.

Figure 4. Natural resource map—Nakna watershed.



The hydrological measurement sites established under this project are indicated in figure. 5. This map was used to sensitize the community about the importance of hydrological measurements for watershed development and how the data collected through these instruments can be used to design watershed interventions. The importance of safeguarding and maintaining these instruments has also been focused on by using this map.

Figure 5. Hydrological measurement sites—Nakna

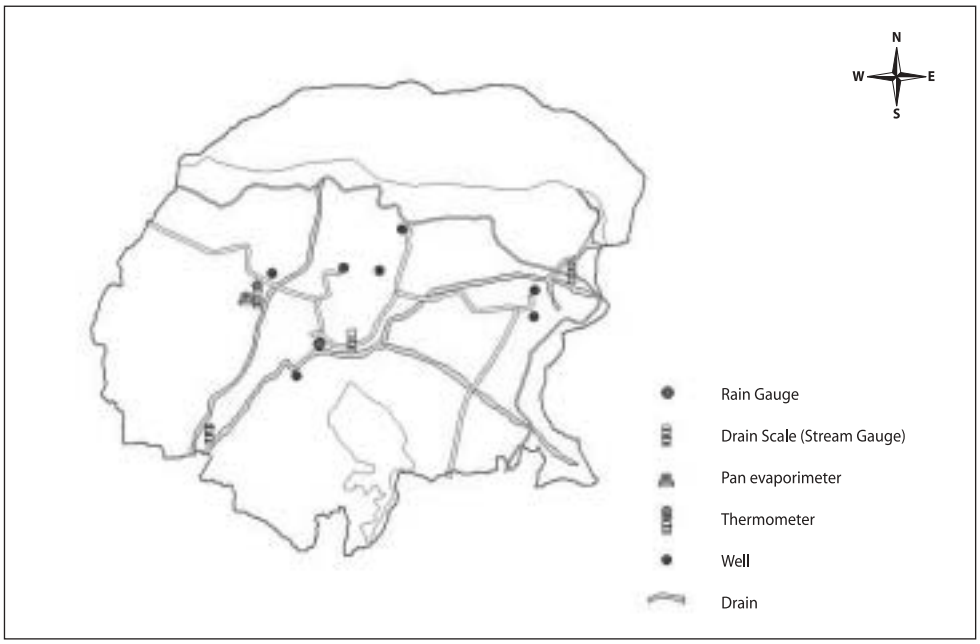


Figure 6. Present land use pattern—Nakna watershed.

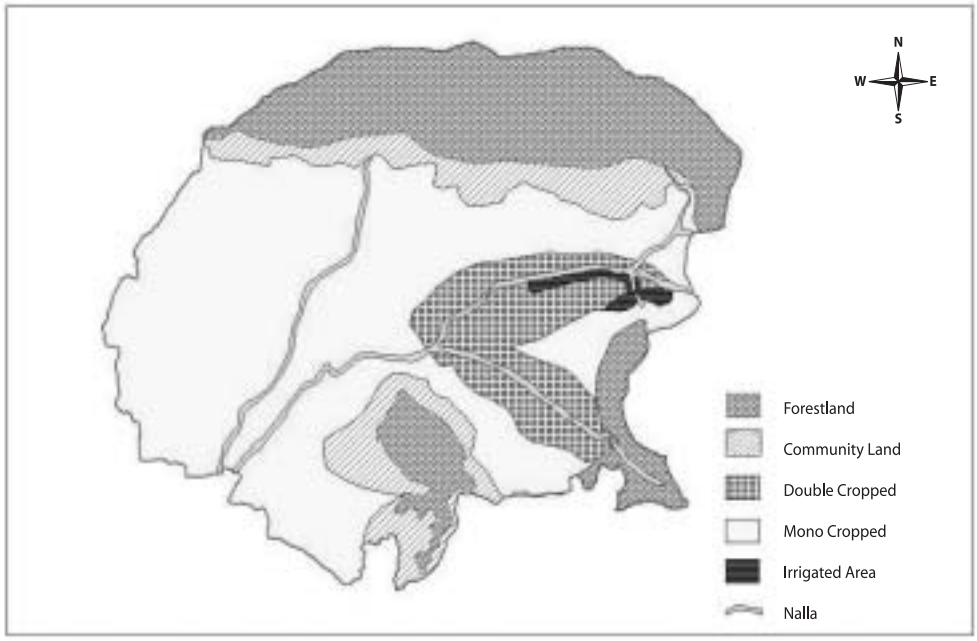


Figure 6 depicts the present land use pattern. It presents an overview of the land-use and makes the community think in terms of what types of intervention can be designed and where they can be located.

Figure 7. Land situation map—Nakna watershed.

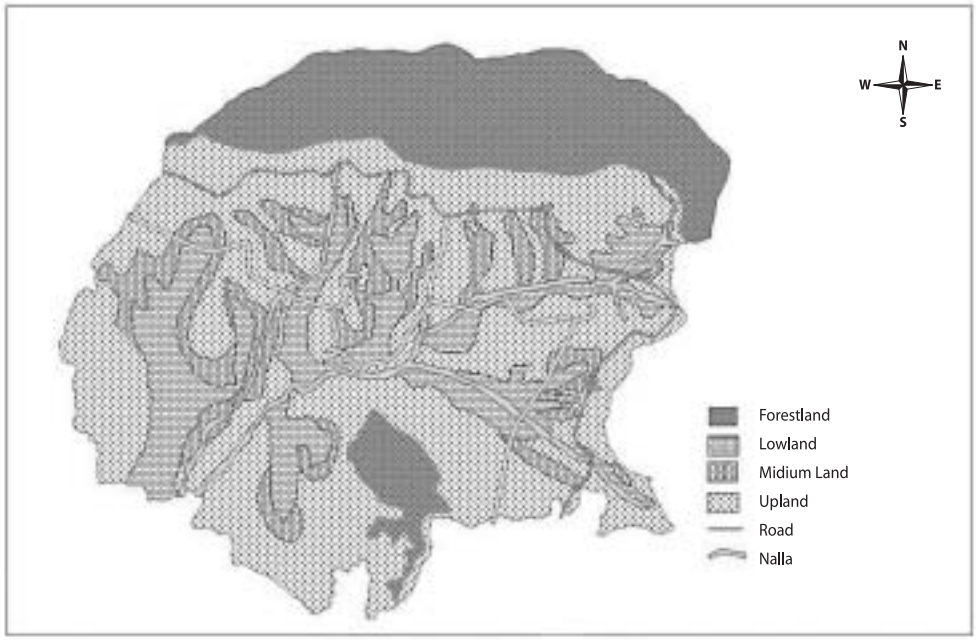
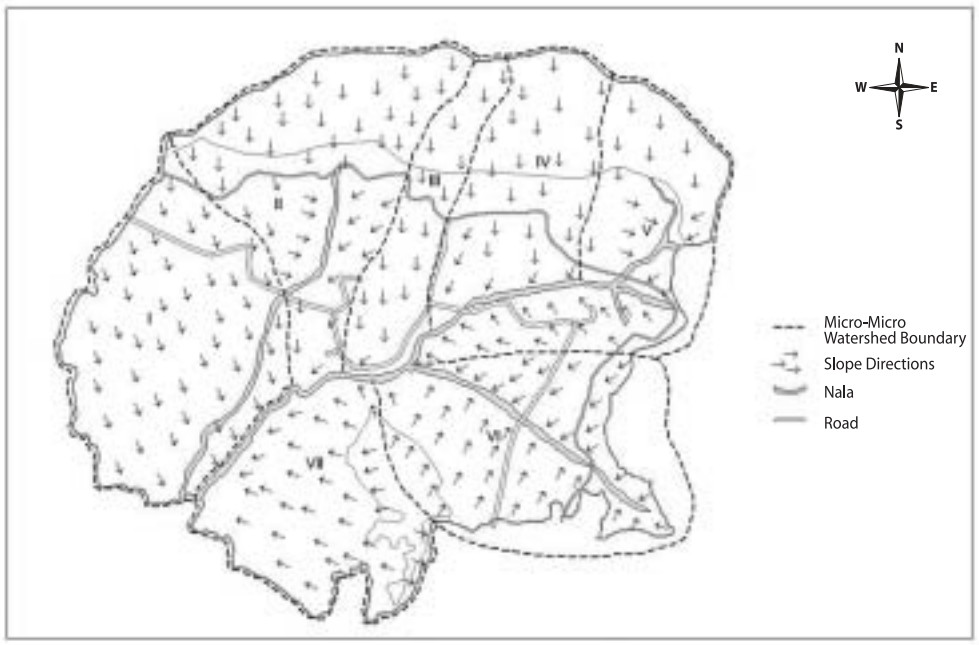


Figure 8. Slope map - Mini micro watershed zoining—Nakna watershed.



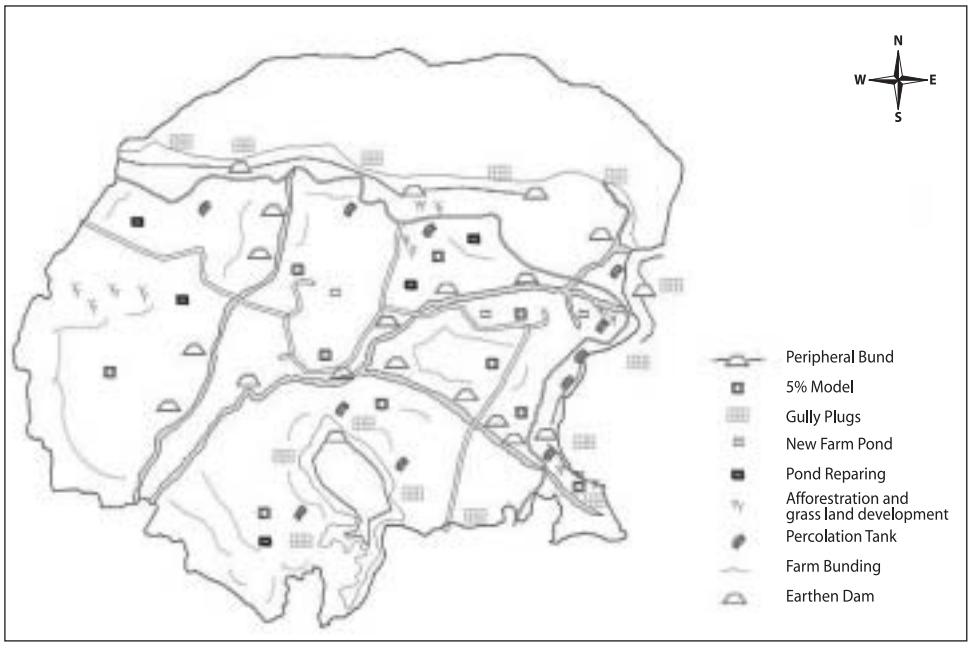
The land situation in the Nakna watershed is indicated in figure 7. The land situation plays a crucial role in designing the appropriate intervention measures. For example, the community has decided to have farm bunding along with percolation tanks and gully plugs in the upland area, while in the marginal/ medium land they wanted to have peripheral bunds to arrest soil erosion. As per the topo-sequential order, they have decided rely on the appropriate water harvesting structures.

Figure 8 is a slope map prepared to illustrate the runoff pattern and also to help design watershed interventions in a more precise manner. Dividing the watershed into mini and micro watersheds helps to understand the direction of the runoff flow making it easier to visualize and design appropriate water-related structures.

Figure 9 presents (see next page) the proposed intervention plan for the whole project life. Farm-bunding proposed in all upland fields is not indicated in the figure to keep the figure readable.

All these maps, prepared with the involvement of the community, have been extremely useful in designing a watershed development project, which is cost-effective and also meet most of the requirements of the community.

Figure 9. Proposed intervention plan—Nakna watershed.



5. Watershed Implementation Process

The watershed implementation process is an important phase of watershed development; if the process, especially the institution building process is not correctly implemented, then both the outcome of the project and its sustainability will be affected. Herein the watershed development process adopted in the Dundlu watershed is briefly described.

In Dundlu, the watershed development phase started in January 1, 2004, since then, a considerable amount of work has been carried out by the Project Management Team, comprising OP staff recruited mostly from the locals within watershed hamlets, and implemented through village institutions. The village institutions consist of a hamlet level committee, watershed committee and a core committee. The Project Management Team is guided by a Joint Committee consisting of CP, CRS, IWMI and OP, Sevabrato.

The special characteristics of this watershed development project are:

1. Preparation of a watershed development proposal detailing the activities envisaged, the resources required, the present status of activities and their expected benefits. Such a detailed proposal covering every hectare in the watershed make the implementation of the project much more simpler, easier to monitor and allow corrective steps to be taken in time.

2. Displaying on each hamlet notice board (wall), the sanctioned work, the cost estimated and expected contribution from the community. This transparency has a beneficial effect in creating the right kind of perception among communities about watershed development.

3. For each intervention, a user-group is identified and is involved from the very beginning of the project. Two examples can be presented in this regard: One is with regards to a pond construction for irrigation and fishing purposes. In this case, 24 farmers benefit

by the tank water; the tank is constructed on a private property; the land owner becomes a part of the user group; village institutions are also involved in the project; all these three groups form a user group; the benefit accrued from this tank will be shared in the respective proportions of 40 percent for village institutions (WSC); 30 percent for land-owner and 30 percent for those managing the system. In the case of irrigators, a fee must be paid for taking water from the tank. The fish grown in the pond will be caught and sold; the net benefit will be shared according to the ratios mentioned above. The user group will maintain and manage this tank; however, during pond construction, the hamlet level committee will involve itself in such a manner as to provide opportunities for the community to participate in the construction activities.

The second example is nursery raising; the plot on which the nursery is raised is given by a private land owner. The land is leased and a compound wall is constructed around the nursery plot. The nursery numbering 34,000 to 36,000 plants is raised within such a plot; Nursery plots are created in each of the villages within the watershed; each unit will provide a nursery to 24 ha, and in each ha there will be 2,000 plants, making a grand total of 48,000 plants. In return for these nursery plants, the recipients provide sabai grass that is grown in 1 ha of their land, which cost Rs 15,000, and which the WSC will use (the money) to develop handicrafts or sell the sabai grass. In addition, when the trees are grown and sold, 25 percent of the net profit will be given to the Watershed Committee.

The Watershed Committee, each year calls for a general body meeting of all the households, inform them of the work done, money received, money spent, and the proposed work plan and the allocated budget for the forthcoming year. In this meeting, all other service providing agencies such as panchayat, forest, and other stakeholders are invited. The process adopted and the transparency of dealings in implementing this project are appreciated by everyone.

4. Inspired by the progressive work being carried out by the Watershed Committee, a rich farmer in the watershed has come forward to provide one of his houses free of rent to the WSC for their use till they complete the implementation of the watershed project.

5. The synergy between Village Institutions and Panchayat is created through roping in an elected Panchayat member as a member of the Hamlet Committee, the Watershed Committee and the Core Committee.

6. They have already started to develop a monitoring mechanism to track down the livelihood changes that the Watershed development will bestow on the watershed community; they are developing a questionnaire based on the type of questions indicated in annexure 1.

6. Watershed Clustering and Up-scaling

It has now been accepted that the river basin should be the unit of analysis for managing the natural resource base, especially water. River basin in essence will consist of a number of watersheds, the management of which will have an impact on basin management and vice versa. Similarly, the alteration of flow paths in a particular watershed will not only affect the neighboring downstream watersheds but it will also have an impact on the whole basin. Both institutions and hydrological

variables, particularly the quantity and quality of flow are inter-related as one moves from watershed level to basin level. The basic problem encountered in watershed management is the complexity of the institutional arrangement needed to manage a large watershed, which consists of large number of small micro watersheds. Since watershed institutions are hierarchical and embedded within one another, the crafting of smooth and cooperating institutional arrangements with forward and backward linkages assumes greater significance. There are attempts to develop institutional mechanisms to manage the river basin in a top down approach. There are also attempts to develop institutions at a microlevel. However, there are not very many studies to connect these two approaches for the purpose of managing a large watershed with a number of clustered micro watersheds. This type of study would allow us to test a set of hypotheses on institutional arrangements from which to select the one that would be easy to implement and will be effective in managing up-scaled watersheds.

The bigger problem in managing clustered watersheds will come not from hydrological issues but from institutional issues due to the inclusion of extended administrative boundaries. If the institutional interface is not smooth and cooperative, managing the watershed becomes difficult; therefore, crafting institutions for collective and appropriate choice decision-making and devising institutional arrangements needed for effective management are the areas for action and adaptive research. As a result of the understanding and commitment to institutional issues, IWMI and CRS can play a crucial role in taking forward the clustered watershed approach to up-scaling.

7. Lessons Learned and Suggestions for Future Projects

The four pilot project studies undertaken by IWMI-CRS collaboration are under different stages of development. Two of the pilot studies are progressing well while the other two are not doing so well. In that which is progressing well, the following processes were adopted:

For setting the stage for participatory planning during the pre-watershed phase, the following activities were carried out in an intensive and systematic way.

- Awareness creation (meetings; street play; video presentation etc.)
- Rapport building through entry point activities
- Creating programs for women and the landless
- Creation of SHGs, and mobilizing community for watershed development works
- Formation of Village Institutions (Watershed Committee; Core Committee and the Hamlet Committee)
- Understanding the existing
    - indigenous knowledge use
    - ability of the community to make decisions
    - willingness to share the cost of watershed development
    - status of managing common property resource
    - equity among all (the poor, the women and the landless)
    - mechanism for conflict management

- Identifying livelihood coping mechanisms
- Identifying the core problems faced by the community through brain storming and prioritizing
- Hydrologic and socioeconomic data collection
- Preparation of watershed maps
- Preparation of a detailed watershed development proposal and its approval by the Village Institutions and CRS
- Developing skills and knowledge of PIAs to promote participatory planning
- Capacity building of Village Institutions for the purpose of taking up the implementation program
- Implementation and monitoring of the project

From the results of this study, it is seen that for efficient watershed development:

- It is necessary to bring all the communities within a watershed under one fold and make them feel that they all will get benefitted both in the short–term as well as in the long–term; this activity may need a flexible time period (not a fixed period as envisaged now) to create awareness, convince all the community to work together and show the benefit through entry point activities. In addition, the Project Management Team comprising OP staff should be recruited mostly from the locals within watershed hamlets and implemented through village institutions. They must speak the same language as the locals and must be well versed with their local customs and norms.
- A systematic procedure in creating hamlet and watershed committees should be followed using grassroot organization such as SHGs to select committee members giving representation to all. This broad-based representation in the committee will have a good impact in bringing the community together; great care should be taken in establishing smooth and cooperative institutions for collective choice decision making; it is also necessary to rope in the government and other institutions working within the watershed to be part and parcel of this activity.
- Socioeconomic, physical and hydrologic information bases need to be developed to the maximum extent possible by the stakeholders and presented in the easily readable forms of charts and maps to the watershed community to help make rational decisions.
- Preparation of a detailed watershed development proposal through intense community involvement detailing the activities envisaged, resources required, present status of that activity and expected benefits is necessary. Such a detailed proposal makes implementation of the project simpler, monitoring of the project easier and allow for corrective steps to be taken in time.
- Displaying on each hamlet notice board (wall), the sanctioned work, the cost estimated and expected contribution from the community has a marked effect on the community as regards the transparency of the implementation of the project.

- For each intervention such as nursery raising, pond construction, a user group is identified and is involved from the very beginning of the project; they maintain and manage the whole activity and share the benefits with the Watershed Committee.
- During the implementation phase, it is very essential that the community and others involved in the implementation be kept informed of the progress, made and the work that lie ahead, and what should be the contribution by the community. For this, an Annual General Body meeting on accounts and achievements of the project must be held.
- Capacity building of the village institutions is an important activity for sustaining the assets created and to reap the benefits. Presently, this component is not given that much importance either in allocation of funds or in the time allocated by the Project Management Committee (OP). This aspect needs to be given utmost importance while formulating the detailed watershed development proposal.
- Monitoring the livelihood changes of the communities during and after implementation is important.
- Institutional analysis becomes complex as watersheds are scaled up. It is time that we take up a few studies on clustering of watersheds with different institutional arrangement to learn lessons and to arrive at certain guidelines for scaling up of watersheds.

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Phansalkar, S.; Verma, S. 2004. Improved Water Control Strategy For Enhancing Tribal Livelihoods: IWMI-Tata Water Policy Program; Annual Partners' Meet.

Annexure

Information Needed for Monitoring Watershed Development Activities that have an impact on livelihood.

Schedue 1: Changes in Socioeconomic Status

1.1 History of family members;

Included in this section are: changes that have taken place within the family members, activities involved; schooling children; type of education (regular, non-formal, and others).

1.2: Health and livelihood status of the family:

- Adequacy of food (quantity, quality; and for how many months)
- Type of borrowing (bank, moneylender, neighbors and relatives)
- Member of SHG; activities involved; contribution of SHG activities to livelihood
- Adequacy of drinking water (quantity and quality); how long water is available in ponds, wells etc.
- Awareness, involvement in village celebration and other social activities
- General well-being (entertainment, thefts, and conflicts)
- Asset creation (household articles including watches, radio, T.V. jewels, utensils, clothes etc.)
- Agricultural assets (plough, sprayer, pump, hose pipes and others)
- Training undergone (specify types and number of days etc.)
- Your specific involvement in watershed-related activities

1.3: Housing Status

- Type of house
- Alterations, if any
- Additions
- Toilet facilities
- Lighting and electricity connection

1.4: Other Infrastructures

- New roads or improvements to existing ones
- Bus service

- Market facilities
- Cooking gas/ boutiques
- Doctors (PHC, veterinary etc.)

1.5: Gender Activities (questions to be directed to the head woman of the household)

- Are there changes in the gender activity in your household?
- If so, what are they? State one by one.
- Have they reduced your workload or increased?
- If you have gained time (time saved) what do you do with that extra time? (work additionally, take care of children and personal care. Work in the kitchen, garden or participate in village activities).

Schedule 2: Livelihood Activities:

2.1. Agricultural Activities:

2.1.1. Is it a normal rainfall year/ deficit year/ surplus year?

2.1.2.. Rank the deficit/ surplus as percent of normal (this information can be obtained from the rain gage installed in the watershed)

2.1.3. Rain-fed Cultivation (ha)

- Area cultivated in different types of lands (hillocks, tanr, baid, kanali, and bahal)
- Types of crops grown in the above types of lands
- Sources of moisture addition in the above types of lands(pits/trenches;bunds; 5 percent pits, ponds etc.)
- Number of family labor and hired labor used (Crop-wise and land-type-wise)
- Expenditure (crop-wise and land-type-wise)
- Yield and income (Crop-wise and land-type-wise)
- Fodder accumulated

2.2. Livestock

2.2.1. Types of animals owned (cows, buffaloes; goat/sheep; pig/duck/poultry)

2.2.2. Increase or decrease of animal population during the period under review

2.2.3. Amount spent on fodder, disease curing and others

2.2.4 Net income from livestock

2.3. Fisheries:

2.3.1. Are you a part of fishing activity in the village?

- provided land for fishing pond and getting an income;
- involved in fishing—in what capacity?
- involved in shrimp growing?
- number of days spent on fishing activity in a year;
- income accrued after expenditure due to fishing activity.

2.4 Nursery Raising:

2.4.1. Type of your involvement:

- giving land
- working in nursery as a laborer
- purchase of nursery
- number of days spent
- income earned

2.5. Kitchen Garden:

- extent of kitchen garden
- types of vegetables grown
- number of trees and types
- money spent
- vegetables/ fruits obtained and income

2.6. Other activities:

2.6.1. wage labor to others (within village)

- number of days
- money earned

2.6.2. Petty business (state the business)

- money invested
- money earned

2.6.3. Migration to outside place

- migration to where?
- -Number of days at a stretch and total number of days
- -Net income

2.6.4. Involving in improving your own land

- what are the activities involved (land leveling; farm bunding; pit construction; tree planting; erosion plugging etc.,) and number of days spent on each activity

Schedule 3: Perception of sample farmers on watershed development project (Open ended questions—the respondent has to answer the question)

3.1. What you think about the project? Is it good/ bad/ useless?

3.2. Why do you think the project is good/ bad/ useless?

3.3. In what ways has it helped you?

- to get more yield from your land
- to improve your livestock
- to get involved in other activities such as fishing, nursery raising, tree planting etc.
- to get more number of days of work
- to get more food
- to prevent migration from the village
- to build your capacity
- to make life more easier

3.4. Do you think that creating ponds has helped in increasing your drinking water supply/ domestic use/ livestock use/irrigation use/ fish production/ others?

3.5. Is the development benefit equitable? Did you get what others got? Or are there some who got maximum while others did not get much?

3.6. Any suggestions for improving the implementation process?

3.7. What other activities could have been included as component of watershed project?

3.8. What is the biggest benefit that this project has brought to your family; to village and to the whole watershed?

Postal Address:
P O Box 2075
Colombo
Sri Lanka

Location:
127, Sunil Mawatha
Pelawatta
Battaramulla
Sri Lanka

Telephone:
+94-11 2787404

Fax:
+94-11 2786854

E-mail:
iwmi@cgiar.org

Website:
http://www.iwmi.org

IWMI International Water Management Institute

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