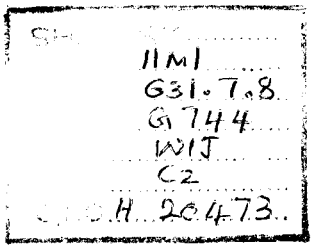
Shared Management of Watershed Resources: A Collaborative Effort by the Government, NGOs, Small Farmers, and Scientists

C. M. Wijayaratna



International Irrigation Management Institute

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Abstract

The Shared Control of Natural Resources (SCOR) is a participatory watershed management project aimed at developing and testing a holistic interdisciplinary approach to integrate environmental and conservation concerns with production goals. The conservation strategy being tested in the SCOR is different from traditional approaches. The SCOR hypothesizes that a package of measures—such as type of vegetation/crops, appropriate land and water saving and conservation practices, appropriate policies such as user rights to earn economic and other benefits from market-oriented conservation of natural resources—are more effective in protecting environmentally fragile lands in water basins and watersheds.

The SCOR design is built on the progress already made in Sri Lanka and elsewhere in participatory irrigation management and social forestry. It applies an organizational approach coupled with appropriate technologies for integrated land and water resources management on a watershed basis. The appropriateness of the approach is being tested and demonstrated in two pilot watersheds of Sri Lanka, chosen for their different social, agricultural, and environmental characteristics. In these pilot areas, appropriate *production and conservation techniques and technologies are being used to augment and sustain the resource base and its productivity through a participatory processes, novel modes of tenurial arrangements, and state-user partnerships.* After constraints to "shared management" activities are identified, the project assists in their removal. When the constraints are the results of policies, rules, regulations, or actions of a higher level, the project works at those levels to achieve its purpose.

The SCOR project has selected about 25 sub-watersheds ranging from 75 ha to 600 ha. for interventions. The paper briefly examines production and conservation efforts in two sub-watersheds.

In the Aninkanda Sub-watershed, ASWS, a local organization was formed and strengthened as an environmental NGO.

The NGO, Dothalugala Heritage, in collaboration with the government agencies, the organized private sector, scientists, SCOR, and catalysts.

In the sub-watershed, a participatory appraisal of the characteristics of resource uses and users as well as mapping of current resource use were done by groups comprising of resource users, NGO, Government agencies and SCOR project team. Subsequently, a participatory resource management "mini project" was formulated. Measures adopted by the Action-Research team in order to improve the **accuracy** and **acceptance** of the appraisal, planning and monitoring

as well as the efficiency in the implementation process included: participatory mapping using airphotos/toposheets; walk-through surveys; use of different sources of data and the use of GIS; use of mixed group of participants including resources users, local officers, scientists and catalysts; developing a "sense of ownership", belonging and commitment for action by users and partners etc. The NGO is assisted by the SCOR project team and government officials of line agencies which implement the SCOR activities.

Another participatory and "market-oriented" natural resources conservation effort is examined in detail in this paper. In this effort, the SCOR catalyzed a process of mobilizing resource users, NGOs, and government agencies to *develop a micro-hydroelectric power plant (MHPP) and to establish a participatory conservation program in the catchment.*

Illukpitiya villagers are the primary beneficiaries of the MHPP. The village is located in the Bovitiya Dola sub-watershed of the Nilwala watershed and consists of about 100 families. However, the terrain is steep only in the upper catchment of the Nilwala watershed and the river flows across a flat landscape for most parts of its length. Hence, micro-hydroelectric power generation is expected to be profitable only in the upper catchment.

In addition, the vast experience of an NGO—Organization for Resource Development and Environment, ORDE—in community-based resource management projects is being liberally infused into the SCOR implementation. In this effort, this NGO is enjoying the liberty of experimenting with new ventures which were not included in the SCOR. Buffer-zone management and conflict mitigation between human beings and wild life in the watershed could be cited as an example.

Shared Management of Watershed Resources: A Collaborative Effort by the Government, NGOs, Small Farmers, and Scientists[1]

C. M. Wijayaratna[2]

Introduction

The Concepts of Shared Management of Watersheds

This paper will briefly examine the conceptual framework and implementation strategies being adopted by a Participatory Action Research (PAR) project in bringing together the resource users (mainly poor/small farmers), government agencies, NGOs and scientists. The project, namely the Shared Control of Natural Resources (SCOR) funded by the United States Agency for International Development (USAID) is being implemented by the International Irrigation Management Institute (IIMI) in collaboration with the Government of Sri Lanka.

In Sri Lanka, as in many other developing countries, there is an urgent need for more intensive, but environmentally appropriate utilization of its natural resources base, particularly land and water resources, for profitable and sustainable agricultural and related industrial production. There is an increasing body of evidence from Sri Lanka and other countries in the region that farmers, even those with very smallholdings make production responses to the economic environment within which they carry out their farming activities. *These responses are influenced by the degree of control the users can exercise over their means of production, the availability of information on market conditions and opportunities, and the necessary support services.* For example, enhanced group action by the users and participatory management of irrigation have resulted in significant increases in water use efficiency and crop yields in many irrigation systems. Increasing the user's share of control over natural resources through group action and their active participation in making management decisions are, therefore, widely recognized to be vital prerequisites to improve management of these resources. Interventions aimed at improving natural resources management through local control are known to yield high rates of return. (IIMI-SCOR Proposal, 1993)

Moreover, the SCOR design team hypothesized that the natural resources base, particularly land and water, can be conserved and their productivity could be sustained if environmental and conservation concerns are incorporated into the production process of the users. The SCOR concepts and strategies were

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[1] Paper to be presented at the seminar on *NGOs, scientists and the poor: competitors, combatants or collaborators?* organized by the Crawford Fund for International Agricultural Research, 8-10 April 1997, Canberra, Australia.

[2] Project Leader, Shared Control of Natural Resources, SCOR Project, International Irrigation Management Institute, IIMI, Sri Lanka.

developed through a unique participatory project design process spearheaded by a core group of experts including senior government officials closely associated with the management of land and water resources of Sri Lanka. The design process included a review of past experiences in the management of natural resources in Sri Lanka and elsewhere, a series of consultations with a cross section of resource users, government officials at various levels, development banks and representatives of nongovernmental organizations (NGOs).

The SCOR design is built on the progress already made in Sri Lanka and elsewhere in participatory irrigation management and social forestry. It applies an organizational approach coupled with appropriate technologies for integrated land and water resources management on a watershed basis. The appropriateness of the approach is being tested and demonstrated in two pilot watersheds of Sri Lanka (namely Huruluwewa in the North Central Province and Nilwala in the Southern Province) chosen for their different social, agricultural and environmental characteristics. In these pilot areas, appropriate *production and conservation techniques and technologies are being used to augment and sustain the resource base and its productivity through a participatory processes, novel modes of tenurial arrangements, and state-user partnerships.*

SCOR Goal

The SCOR goal is to develop and test methodologies to increase sustainable productivity of natural resources—mainly land and water—in a watershed context. The SCOR strategy is to catalyze a process to motivate *partners* to use an integrated package of

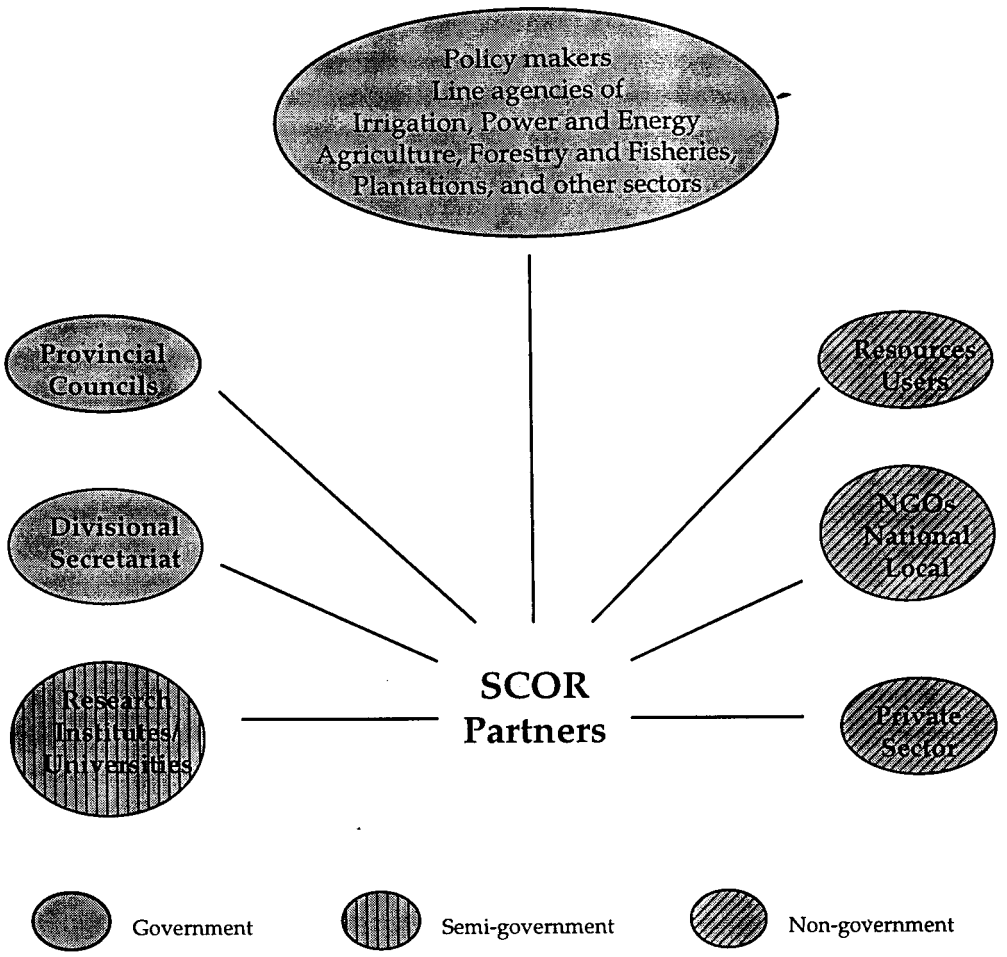
- technology
- organization
- resources
- policies

through collaborative initiatives. The SCOR partners are indicated in figure 1.

SCOR Objectives

- To develop conceptual and analytical frameworks to improve land and water resources management in watersheds. The focus will be on the integration of environmental concerns with production goals.

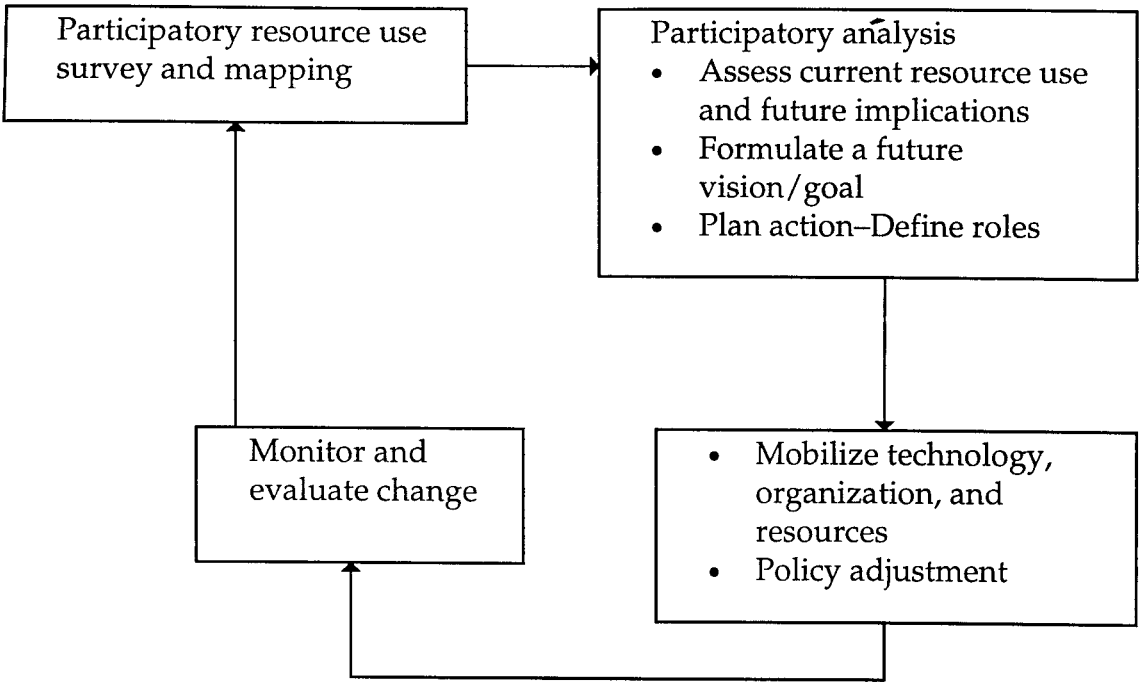
Figure 1. SCOR partners.



- To conduct action-research to develop, test, and disseminate strategies and methods to "reconcile social and environmental concerns with production goals in a watershed context, facilitating sustainable development."

The SCOR is a participatory watershed management project aimed at developing and testing a holistic interdisciplinary approach to integrate environmental and conservation concerns with production goals. The conservation strategy being tested in the SCOR is different from traditional approaches. The SCOR hypothesizes that a package of measures—such as type of vegetation/crops, appropriate land and water saving and conservation practices, user rights to earn economic and other benefits from the (participatory) conservation of natural resources—are more effective in protecting environmentally fragile lands in water basins and watersheds. The "package" is selected jointly by the professionals and users, and both conservation and production or other profitable uses of natural resources are incorporated into it. Figure 2 illustrates the SCOR action-research process.

Figure 2. *SCOR action-research process in watersheds.*



SCOR *activities* can be summarized as follows:

1. Integrated water management, focusing on water management in highlands and upstream-downstream linkages.
2. Soil and water conservation, specially in uplands. This includes precision irrigation practices and testing different crops and farming systems as well.
3. Integrated planning and coordination of activities related to land and water resources management.
4. Institutional/organization development.
5. Policy achievements including state user partnerships and shared control.
6. Developing, testing, and institutionalizing monitoring and evaluation systems,
7. Conducting special research studies related to topics 1–5 above.

SCOR Implementation

The strategy is designed to be user-oriented and participatory. This means that much of the emphasis and activity of the Project will be at the field level in the selected watersheds. The approach will be to increase the *share of control of the natural resources of the watershed by the users and to support them as they attempt to intensify, expand, or move into new economic activities. To achieve economies of scale, and*

to utilize group solidarity to promote responsible behavior, the project is based upon group action as a primary vehicle for project implementation.

As constraints to group activities are identified, the project assists in their removal. When the constraints are the result of policies, rules, regulations, or actions of a higher level, the project works at those levels to achieve its purposes. *Demand-driven changes* are likely to be more expeditiously addressed than recommendations for change from above. The project structure, including steering committees in each of the provinces and at the national level will facilitate the process of inducing change.

The project's participatory mode, starting with the design process, in which officials, resource user group representatives, and others from the national, provincial, district, and divisional levels, and NGOs played important roles through to implementation, has facilitated the identification of problems and constraints and their removal.

The project is being implemented primarily by the user groups with the help of catalysts, a multidisciplinary team of IIMI professionals (conservation farming specialist, agriculture/agro-forestry specialist, institutional development specialists, and enterprise development/marketing specialists) stationed on-site; the Watershed Resources Management Team (WRMT) chaired by the Divisional Secretary (i.e., chief government officer at divisional level) comprises IIMI professionals, concerned government officials (e.g., the Irrigation Department and the Departments of Agriculture, Forestry, and Agrarian Services), representatives of user organizations and NGOs. Representatives of organized private sector firms join the team as and when necessary. Provincial steering committees chaired by the provincial chief secretaries and the national steering committee chaired by the Secretary to the Ministry of Forestry and Irrigation and represented by the relevant government bodies, WRMT, etc., help recommend policy changes, provide guidance, help resolve conflicts, and monitor the progress of SCOR (figure 1). A rigorous monitoring and evaluation program and a special research study program are also included in the SCOR.

In all pilot sub-watersheds (25) the SCOR is being implemented in close collaboration with all the partners. Sections II and III will briefly examine two activities in the Nilwala watershed to illustrate the collaborative effort of the government, NGOs, scientists, and small farmers in the SCOR implementation.

Similar activities are being implemented by the SCOR Project in the dry zone watershed as well. In addition, in one of the sub-watersheds in the dry zone an environmental NGO is involved in testing the SCOR model without much IIMI inputs. This NGO namely Organization for Resource Development and Environment (ORDE) saw in IIMI ,through the SCOR Project, a common ground to ascertain whether the NGO has an opportunity to be involved and fulfill its obligation in sustainable development. Accordingly, the ORDE entered into an agreement with IIMI to proceed with the implementation of SCOR strategies as from October 1996. Through this effort several sub-watersheds are being transformed into an efficiently managed buffer-zone system where the

communities play a major role in the ultimate goal of optimizing and diversifying the land use and water use in a **sustainable** manner. This goal is designed to be achieved by the application of appropriate technology in market-oriented production diversification within a framework of self-governance. These interventions, which uphold the best of traditions in moral, material, and economic spheres in the region, are as follows :

- conservation farming and agro-/analogous forestry
- integrated water management
- self-governance framework in entrepreneurship and marketing
- buffer-zone management and conflict mitigation between human beings and wild life in the watershed
- moral development of the communities through spiritual development programs

ORDE's vast experience in community-based resource management (CBRM) projects is being liberally infused into the SCOR implementation. In this effort, this NGO is enjoying the liberty of experimenting with new ventures which were not included in the SCOR. Buffer-zone management and conflict mitigation between human beings and wild life in the watershed could be cited as an example.

II. NGO LEADERSHIP IN DEVELOPING ANINKANDA SUB-WATERSHED (ASWS)

This section will briefly examine the production and conservation efforts undertaken by an NGO, Dothalugala Heritage, in collaboration with the government agencies, the organized private sector, scientists, SCOR and catalysts.

In ASWS a local organization was formed and strengthened as an environmental NGO to implement the action plan produced to reach the future vision as mapped. The NGO named as the Dothalugala Heritage is assisted by the SCOR project team and government officials of line agencies which implement the SCOR activities.

Participatory Appraisal of Pre-project Resource Use[3]

The SCOR Project has selected about 25 sub-watersheds, from the 2 selected watersheds, for research interventions. The sub-watersheds for SCOR

[3] This section is adopted from, "Participatory Planning for Sustainable Natural Resources Management in Watersheds" Wijayaratna, C M, J M Samarakoon Banda, Gamini Batuwitage, IIMI-SCOR forthcoming.

implementation are contiguous areas of manageable size within the main watersheds, each having characteristic profiles of ecological, socioeconomic, and environmental features similar to those of the respective main watershed. The size of the selected sub-watersheds ranges from 75 ha to 600 ha. Action is being taken to demonstrate an "ideal" land use pattern with due emphasis on production and protection. This "contiguous area" or "model watershed" approach of implementation would illustrate the various production-conservation elements along with their intimate relationships that will have to be incorporated in watershed management to produce a sustainable land and water resources base.

As in other selected sub-watersheds in ASWS too, a participatory appraisal of the characteristics of resource uses and users as well as *current* resource use mapping were done by a "group" comprising IIMI-SCOR professionals/catalysts, relevant local officials (such as *Grama Niladhari* or the village-level government officer, colonization officers of the Land Commissioner's Department, agriculture instructor) and farmer/user representatives. The catalysts took the lead role in preparing the "map" and recording information. Other group members and the users helped the catalysts in the identification of landholdings, in consultations with users, and in providing information. The groups were guided and supported by senior IIMI-SCOR professionals, divisional secretaries, irrigation engineers, and technical officers, divisional officers and Agrarian Services, senior officials of the Departments of Forestry and Agriculture, etc. The general objectives of a typical participatory appraisal were to:

a) Prepare a map of the sub-watershed indicating individual *landholdings*, land use patterns, type and quality of vegetation, water use, drainage lines, irrigation methods, etc.
b) Develop a database, including basic data such as: type and membership of user organizations, ownership and tenurial patterns, cropping patterns, and intensities, slope category, apparent degree of soil erosion, conservation practices, production and productivity, and constraints to production and protection.
c) Help establish a baseline for the resource use pattern using (a) and (b).[4]

Steps used in the participatory appraisal were as follows :

i. Use of Existing Maps and Secondary Data

Topographic maps of 1:50,000 scale prepared in 1986 were available for ASWS. With these maps, sub-watershed hydrological boundaries have been demarcated. Availability of these maps and the higher literacy level of

[4] This is supplemented by other sources such as sample surveys, direct measurement of additional variables/indicators, etc.

participants, including farmers, had prompted SCOR researchers to design a mapping process which is more accurate than the "village mapping and transect surveys" normally used in PRAs. For example, to maintain accuracy, topographic maps of 1:50,000 scale were enlarged with land marks such as roads, streams, location of schools, temples, etc., for the use of small groups engaged in walking though every plot in an assigned smaller area to map the plots and collect basic data.

ii. Training and Familiarization

Special training sessions were conducted for SCOR catalysts who performed a leading role in the Participatory Appraisal. The catalysts were a "mixed" group with different knowledge and skills who had been working earlier as school teachers, agricultural instructors, social mobilizers, etc. They were trained on advantages and disadvantages of popular PRA techniques, SCOR concepts, basic farm management and participatory forestry aspects, social organizations, etc.

In addition, discussion sessions were held with NGO members (farmers and farmer leaders), and local officials participated in the Participatory Appraisal.

iii. Group Formation for Conducting Appraisal Exercise

As mentioned earlier, local officials, school children, farmer NGO representatives, SCOR catalysts and professionals were involved in the exercise. Each selected sub-watershed was divided into "zones" such as low land rice tracts, home garden area, tea cultivation area, etc. Each group comprising a few catalysts, about 2-3 local officials/professionals and a few farmer/NGO representatives has been assigned a "zone" and provided with a base map.

iv. Conducting Participatory Appraisal

The appraisal was conducted in each zone by walk-through of every plot and talking to the farmers. A questionnaire and a data format was used to collect basic data at plot level. Each plot as well as the land use pattern (seasonal and permanent crops, livestock, etc.) has been marked to scale, as much as possible.

At the end of this step, the zonal maps drawn by each team were "joined" together to prepare the sub-watershed or micro-watershed maps.

v. *Establishing a Benchmark Database in Relation to Pre-project Natural Resources Management*

Data and information collected during the Participatory Appraisal, the base maps, and secondary data were used to establish a benchmark in relation to pre-project Natural Resources Management.

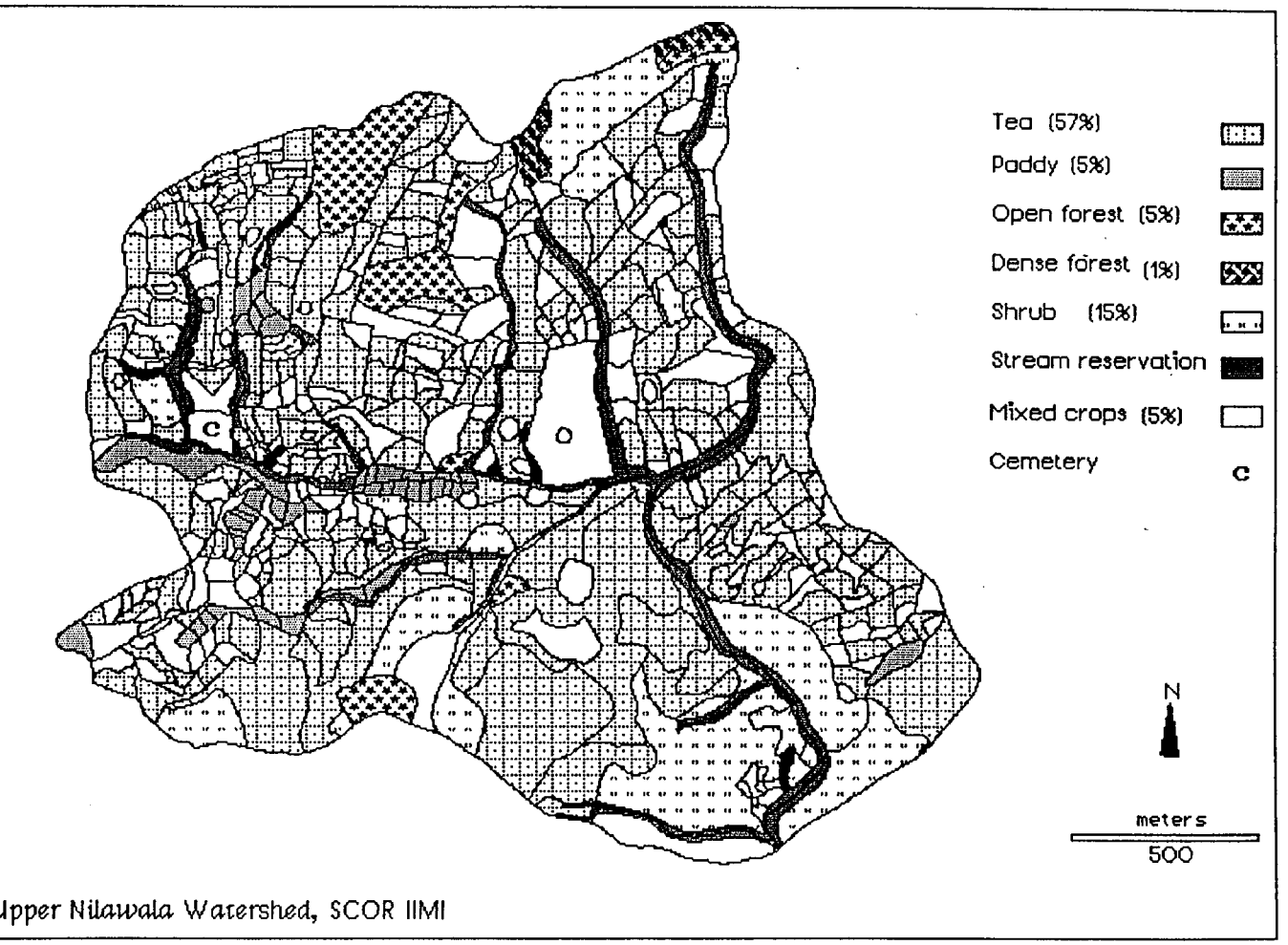
As indicated earlier, maps drawn to scale were enlarged with land marks such as roads, rivers, and locations of schools, temples, etc., for the use of small groups engaged in walking through every plot in an assigned smaller area to map the plots. Several GIS procedures were adopted to transform the PRA output to a GIS output. One of the outputs, namely the pre-project land use map of ASWS is shown in figure 3.

Some Important Characteristics of Participatory Appraisal

Several important characteristics of Participatory Appraisal could be highlighted as follows:

(a) Appraisal is undertaken by resource users/NGOs, local officers, and SCOR professionals including the Institutional Organizers.
(b) Information gathered from the secondary data and participatory mapping is used to stimulate dialogue on resource use.
(c) Interactions and dialogue focus on three major aspects: *description, analysis and prediction.* The current use of land and water resources in the sub-watershed is described. How such resource use patterns evolved is described to analyze process and trends. The future is predicted as the outcome with implications if the current use patterns continue.
For example, in ASWS participatory appraisal described the land use categories given in figure 3, *appraised* reasons for denudation of forest areas in the past and in the present, *analyzed* and *revealed* processes motivating users to encroach state lands for expansion of tea lands and *predicted* the possibility of future land slides from the hill top with exposed boulders, and continued dryness and absence of stream flows depriving the users of drinking water, forcing them to leave the area.
(d) A desirable and feasible future resource use is mapped based on the analysis as a shared vision.
(e) Action planning is undertaken collectively with activities included to actualize the future vision mapped.
(f) Information is extracted to prepare a "mini-project," with balanced disposal of activities to ensure equity, and investment in areas for *conservation-based production* to mobilize financial resources from local banks and other resources from local agencies. (Gamini Batuwitage, 1996) This process of planning of future resources use is briefly outlined in the next section.

Figure 3. Aninkanda model production and conservation area
Land use - January 1994



Upper Nilawala Watershed, SCOR IIMI

Planning of Natural Resources Management Interventions

After refining the map (indicating the pre-SCOR resources management pattern), the same group of NGOs and other resource users, local staff of line agencies, and SCOR professionals used the map and the corresponding database *for participatory planning of future use of natural resources* of that particular sub-watershed. The formulation of a participatory resources management "mini-project" is an output of the planning process. For the ASWS, the output or the planned future vision is shown in figure 4. The mini-project aims to change the present *land and water use pattern to a more profitable and diversified resource use combining production and conservation using appropriate technologies/techniques, novel shared control arrangements, and resource augmentation.* For example, characterization of the landscape of the ASWS by sub-area based on slope categories was useful in identifying specific problems and interventions. The following guidelines were used as indicative of land use recommended for the area.

Slope	Recommended practices
< 1	Area that should be protected from siltation and accumulation of chemicals, etc., that would affect crop yields
1 - 30	Seasonal/annual crops with conservation
31 - 45	Well-managed tea or other crops ensuring conservation
46 - 60	Agro-forestry and tree cover (commercial enterprises)
> 60	Forest cover[5]

This means that the villagers in such pilot sub-watersheds have "action plans" that guide them along a path to the planned future from the current status of resource use.

The ASWS achievement at the end of 1996 or the GIS output updating baseline map, guided by the information on future vision added to the spatial database, is given in figure 5.

[5] The agricultural strategy designed for the country requires that lands of slope greater than 60 percent in this area should be put under forest cover.

Figure 4. Aninkanda model production and conservation area
Planned future land use

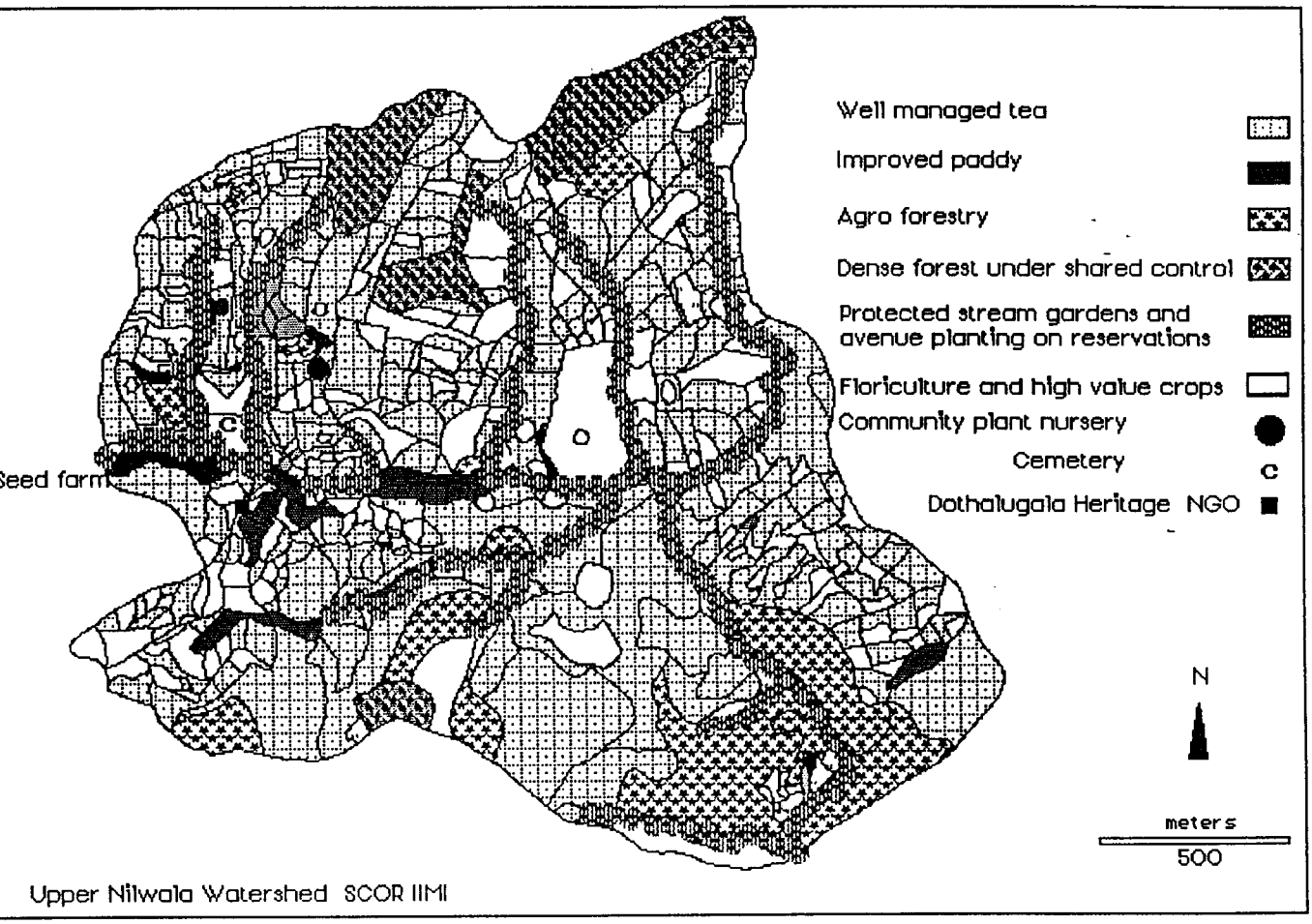
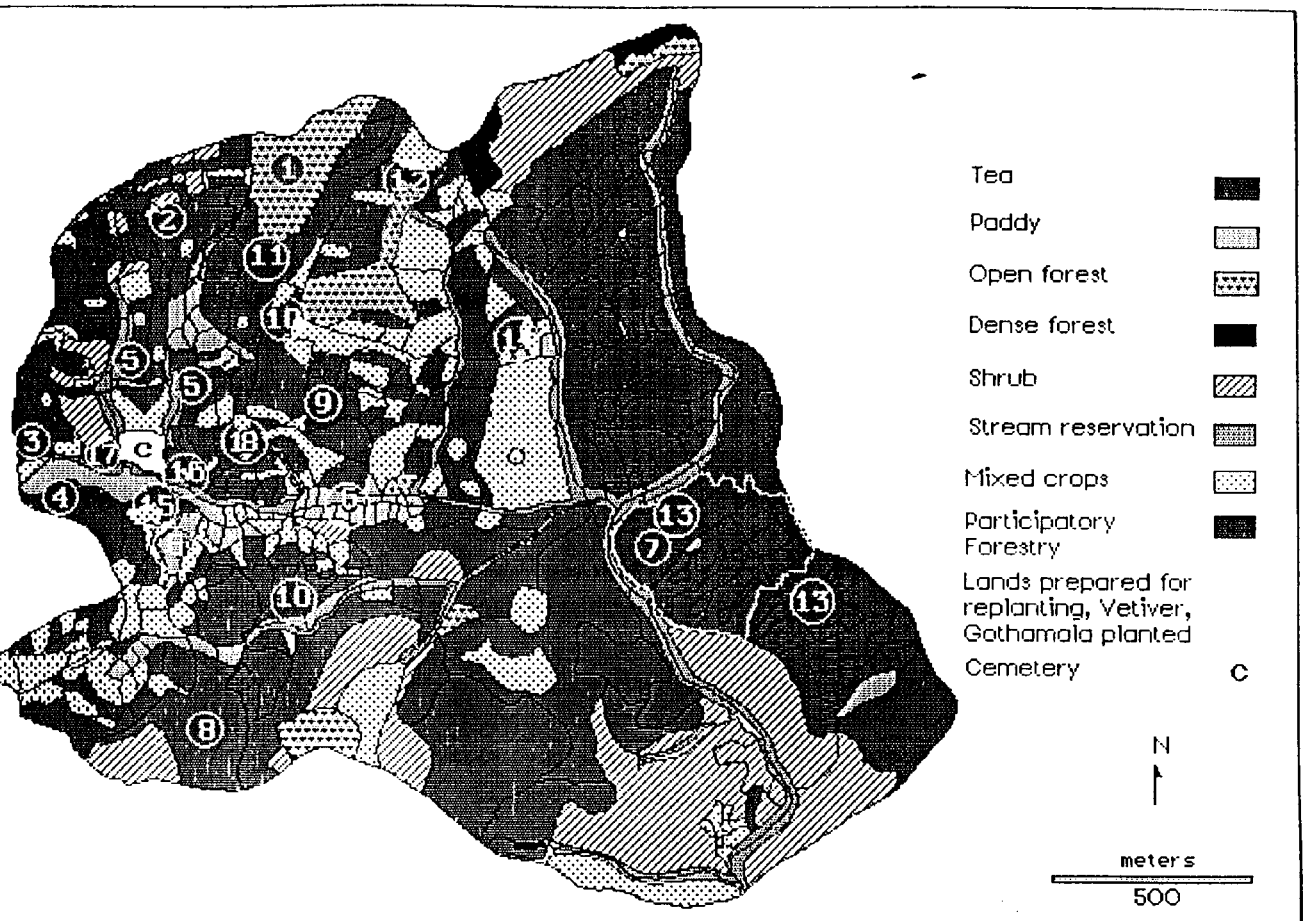


Figure 5. Aninkanda model production and conservation area
Land use - December 1996



7 ha. of enrichment planting completed (10,000 plants)
Tea lands planted with 6278 trees (Timber & fruit)
Floriculture group
Consolidated paddy tract
Stream reservations enriched by planting 2730 plants
Paddy tracts improved by new technologies and good seed materials
3520 plants planted in road reservations.
Goat farm established in Marginal tea lands (30 goats)
Tea Small Holder Society area of activities
. 80 ha. of tea lands improved
. Homestead enriched with 4352 plants

12. Govt. wellfare beneficiaries received 125 Rambutan plants to plant model area
13. Two Anthuriyam groups comprised of 18 farm families (400 Anthuriyam plants) established.
14. Started a nursery (2000 plants) to plant in model area.
15. Dothalugala heritage NGO started conservation activities
16. Service oranization formed and registered
17. Medicinal plants and avenue planting completed
18. Training on resource use planning completed

The planed future envisioned by the resource users and the NGO as jointly worked out with the SCOR team and government agencies had the following elements :

1. Transform poorly managed tea lands to well-managed tea lands.
2. Transform open forest areas to dense forest cover.
3. Maintain good ground cover and protect the stream reservations.
4. Transform unproductive rice lands to productive rice lands.
5. Improve homesteads with production and protection techniques.

It is hoped that such a strategy, in addition to farm profits, would help moisture conservation in uplands and maintain a dry weather flow for the downstream.

Several major output indicators were used to update monitoring data through participatory approaches. Some indicators pertaining to the implementation of the action plans in ASWS are listed below :

1. Number of plants raised in community-managed nurseries.
2. Number of forest trees planted in degraded forest lands as enrichment planting.
3. Number of trees planted on poorly managed tea lands.
4. Number of conservation practices adopted on tea lands.
5. Number of plants planted on stream reservations.
6. New plants and practices on unproductive rice lands.
7. New plants and practices on homesteads.
8. Extent under adoption of production and conservation practices.
9. Number of farm households engaged in production and conservation practices.

The change marked on maps indicates an increasing trend of resource use as direct output of interventions. The maps offer a visual presentation of the changes taking place with the spatial distribution producing useful information to steer interventions. The presentation of monitoring information in maps periodically records the process for validation of events in participatory evaluation. (Gamini Batuwitage, 1996)

III. A COLLABORATIVE EFFORT BY NGOs, THE GOVERNMENT, SCIENTISTS AND RESOURCES USERS IN MICRO-HYDROELECTRIC POWER GENERATION: INTEGRATING ENVIRONMENTAL CONCERNS WITH PRODUCTION AND WELFARE GOALS

This section examines a participatory and "market-oriented" natural resources conservation effort. In this effort, the SCOR catalyzed a process of mobilizing

resource users, NGOs, and government agencies to *develop a micro-hydroelectric power plant, MHPP, and to establish a participatory conservation program in the catchment.*

Illukpitiya villagers are the primary beneficiaries of the MHPP. The village is located in the Bovitiya Dola Sub-Watershed, BDSWS of the Nilwala watershed/basin and consists of about 100 families.[6]

The Participatory Development Process of MHPP

In 1994, the SCOR facilitated a participatory appraisal of natural resource use in the BDSWS. As in ASWS, in BDSWS too, participatory appraisal of the characteristics of resource uses and users as well as mapping of *current* resource use were done by groups comprising resource users/farmers, NGOs, local officials of government agencies such as the Tea Small Holdings Authority, the Departments of Agriculture, Forestry and Agrarian Services, IIMI-SCOR professionals, and catalysts (figure 6). The SCOR catalysts took the lead role in preparing the resource use maps and recording information.

Subsequently, a participatory planning exercise was conducted and a resource management plan was formulated for the sub-watershed. This was aimed at changing the land and water use pattern to a more diversified resource use combining production (including hydroelectric power generation) and conservation, using appropriate technologies and novel shared control arrangements. The planned future land use is illustrated in figure 7.

During the planning sessions themselves, the villagers expressed deep interest and concern in harnessing the Bovitiya Dola waterfall for generating electricity for both domestic consumption and small industries. Moreover, the need for protecting the catchment to ensure the sustainability of the hydroelectric power plant too was emphasized. It was noted that the village was located 2.5 km away from the main grid transmission and that the estimated cost of supply was about Rs 3-4 million (US$70,000). Even the future possibility of grid connection remained weak. An average family spent about Rs 150 (approximately US$3) per month for energy use, the main sources being kerosene and car batteries.

[6] The terrain is steep only in the upper catchment of the Nilwala watershed and the river flows across a flat landscape for most part of its length. Hence, micro-hydroelectric power generation is expected to be profitable only in the upper catchment.

Figure 6. Bovitiya Dola micro watershed production and protection project area - Land use April_1994

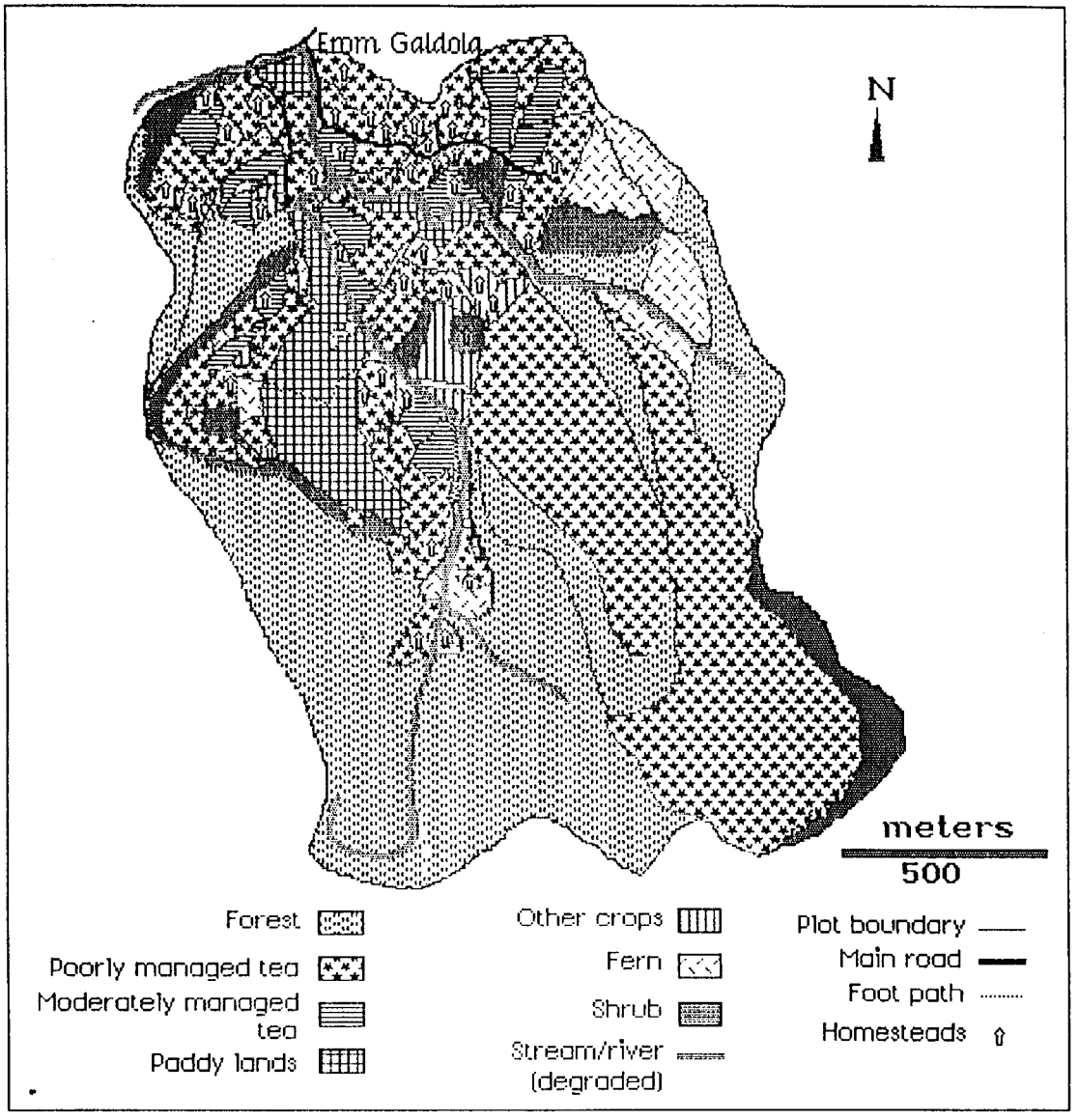
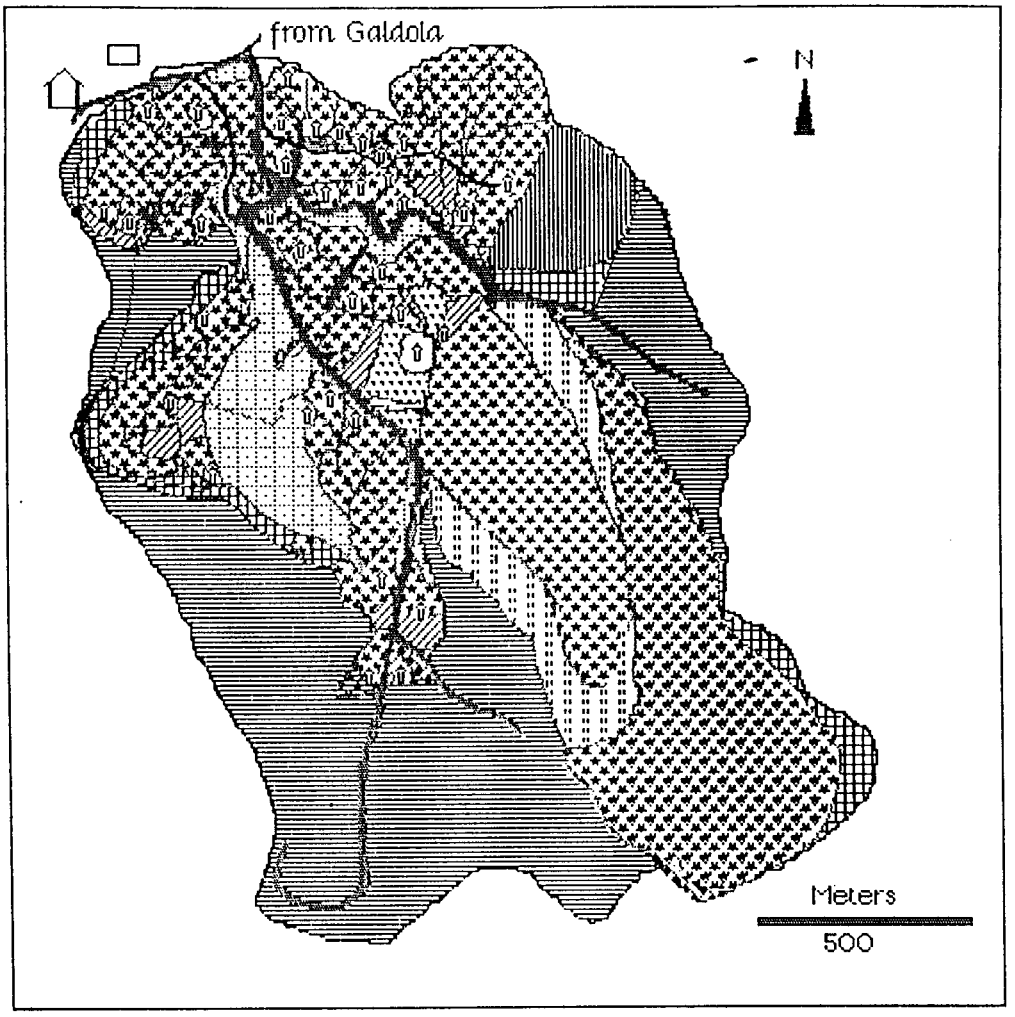


Figure 7. Bovitiya Dola micro watershed production and protection area Planned change of land use



Well managed forest
Well managed tea
Well managed paddy
Agroforestry (coconut, pepper, etc.)
Well managed cinamon
Well managed reforested area with fruit trees
Well managed Cocoa plantation

Agroforestry (pineaple, mahogani, grass, etc.)
Stream/river (degraded)
Plot boundary
Main road
Foot path
Well managed homesteads (everybody use electricity)
Micro-hydro power station
Battery charging centre (community centre)

Because of its remote location and difficult accessibility, villagers did not have much contact with government departments and projects. Even though the villagers were aware of micro-hydroelectric power generation, they did not have the technical know-how, financial resources, etc. There was no government agency directly responsible for micro-hydroelectric power generation.

Formation of User Organization

As decided during the planning sessions, the villagers were organized into a cohesive group to develop and use the waterfall/stream as the source of electricity *without having adverse effects on the existing minor irrigation deliveries.* The IIMI/SCOR catalyst facilitated this process. The organization, among other things, decided and designed action-plans for the following:

i. take collective measures to conserve and maintain the catchment;
ii. construct the hydroelectric power plant and supply electricity *directly* to 48 families;
iii. establish a "battery-charging center" and supply electricity **indirectly** to another 22 families;
iv. invite the NGO, Intermediate Technology Development Group (ITDG) to provide mainly the technical assistance;
v. share a considerable portion of capital costs of construction in the form of (limited) capital and offer voluntary and organized labor;
vi. plan and take over the responsibility of post-construction operation and maintenance of the hydroelectric power plant;
vi. undertake necessary post-project rehabilitation.

A Rights Issue

Rice farmers whose fields were located further downstream had two irrigation lines installed at the point where the weir was constructed. They feared the construction of the weir and the diversion of part of the Bovitiya Dola through the forebay tank would reduce the flow of irrigation water to their fields. As a compromise, the members of the micro-hydroelectric power group, at a negotiation process, agreed to assign priority for irrigation and *fixed two irrigation lines, six inches* below the existing levels.

To maintain equity and also to optimize the limited power generated, the organization *decided to limit the supply to only 100 W per household.*

Resources for the Construction of the Micro-Hydroelectric Power Plant

Members were requested to contribute Rs 1,500 (US$28) each in cash and supply their share of construction material and labor equitably for construction. The organization borrowed Rs 11,000 (US$204) at a 2 percent annual interest rate from their apex farmer organization.[7] This organization expects to recover the loan within 2 years of the completion of the power plant.

The proposal for hydroelectric power development was submitted to the Watershed Resources Management Team, WRMT. The forest department official (who had participated in the design of catchment development efforts) commended the users for their motivation on conserving the forest. The representative of the Department of Agrarian Services agreed to the project as it was clear that irrigation water rights had been protected. The WRMT discussed the possibility of linking the proposal with the Matara Integrated Rural Development Project (MIRDP)[8] mainly to obtain funding for electro-mechanical equipment. This proposal was well within MIRDP's scope and the director of that program, who was also a member of the WRMT, agreed to provide the balance funding.

In addition to the consultancy services, the ITDG also volunteered to supply a battery charger free.

Hydrological Considerations and the Design of Power Plant

The IIMI watershed management coordinator, an engineer, joined the ITDG in providing technical assistance. He assisted the organization in the hydrological analysis.

The discharge of the stream was computed based on the stream flow during the dry months of the year and studying the variations during the rest of the months. The "design flow" of the stream was 35 let. Several elders in the area reported that they experienced continuous flow (implying the perennial nature of the stream) before the destruction of forest in the catchment.

The location of the diversion weir, inlet canals, forebay tank, penstock, and power house were decided collectively by the users, the ITDG and the IIMI Watershed Management Coordinator. A low-level spillway incorporated with a regulating device was also provided in the diversion weir to protect the banks from collapsing. The team decided to provide silt exclusion devices at the diversion weir and at the forebay tank to protect turbine vanes from impacts of silt particles. Complying to the requirements laid down by the Central Environmental Authority of Sri Lanka and the Forest Department, the user

7 This apex organization, namely the Horagala Service Farmer Organization was formed as a result of SCOR intervention.

8 MIRDP is a Government Development Program.

organization decided to build a stone-terraced leader drain to discharge outflow of the turbine back to the same stream to minimize damage to the environment.

Economic Analysis of the Project

Cost Analysis

Cost of the Micro-Hydroelectric Power Generation Plant : Capital costs, Labor costs, Material costs, and Operation and maintenance costs.
Cost of the Battery Charging Center : Capital costs, and Operation and maintenance costs of the battery charger
External Costs : Reforestation and "enrichment planting", and Tea land conservation.
Direct Benefits : Cost savings accrued by the introduction of electricity in place of kerosene, Cost saving through reduced car battery utilisation for operating radios and TVs and savings of the battery recharging costs, and Cost saving by reducing torch cell utilization.
External Benefits : Tea yield improvement due to soil conservation practices (this was not included in the analysis), Value of the trees planted, Returns to reforestation, Returns to the enrichment planting of degraded forest, and Returns from stream reservation conservation.

Financial Analysis

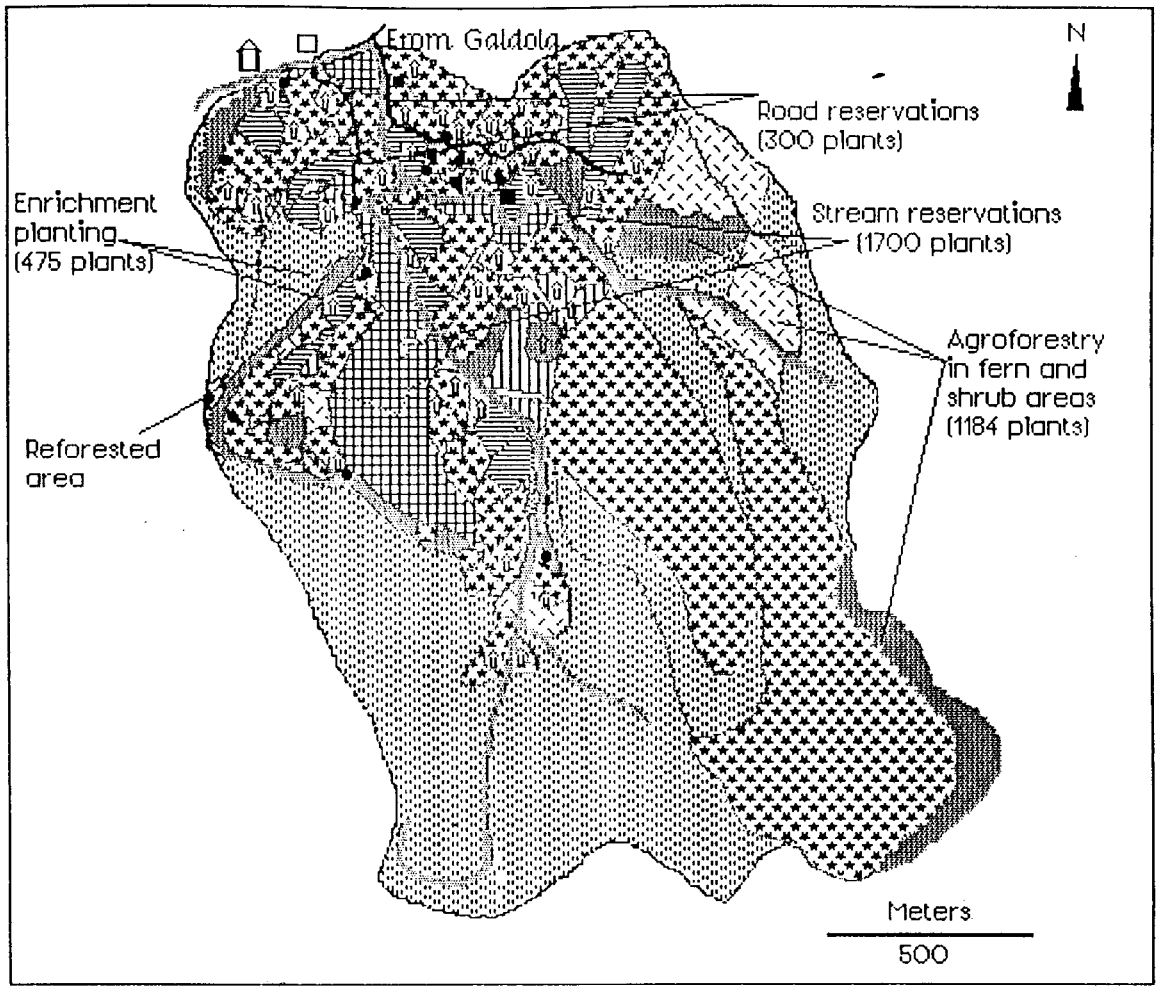
Financial analysis is of the project was carried out taking into consideration only direct costs and benefits of the project. In the process of discounting a discount rate of 6 percent was used. It was assumed that the beneficiaries would not use batteries after receiving electricity.

The B/C ratio and Internal (Financial) Rate of Return were estimated to be 1.08 and 7 percent, respectively.

Economic Analysis

The economic analysis considered all direct and secondary (including conservation benefits) and true economic price of kerosene and labor, etc. The economic analysis has been carried out under different assumptions (e.g., changing the value of opportunity cost of labor and the consumption of electricity). Depending on assumptions, the B/C ratio and Economic Rate of Return varied from 1.3 to 2.5 (B/C) and 10 to 21 (ERR). The members of the Electricity Consumers' Society have been actively involved in achieving the targets set by their production-conservation plan. Catchment management is in progress, as scheduled and the changes in land use as of September 1996 are shown in figure 8.

Figure 8. Bovitiya Dola micro watershed production and protection project area Land use - September 1996



Homesteads
Micro-hydro power plant
Battery charging centre
Banana plots (425 plants)
Tea nurseries (10,000 plants)
Forestry nursery 4500 plants

Forest
Paddy with Management improvements
Moderately managed tea
Poorly managed tea
Other crops
Fern
Shrub
Stream/river (degraded)
Plot boundary
Main Road
Foot Path

REFERENCES

Shared Control of Natural Resources (SCOR) Project, Technical Proposal. IIMI. 1993. (Unpublished).

Batuwitage, Gamini P. 1996. GIS for Collaborative Planning and Monitoring of Watershed Resources for Sustainable Productivity - A Case from Sri Lanka. (Unpublished).

Wijayaratna, C M, J M Samarakoon Banda and Gamini P Batuwitage. 1997. Participatory Planning for Sustainable Natural Resources Management in Watersheds. (Forthcoming).