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SUSTAINABLE DEVELOPMENT OF WATER RESOURCES, WATER SUPPLY AND ENVIRONMENTAL SANITATION

Restoration of a watershed, a case study at HuluGanga

W. K. Illangasinghe, K. Melvani and B. W. R. Balasuriya, Sri Lanka

The NWS&DB is the major organization supplying potable water. The major problem faced by theNWS&DB in reaching its long term goals was the deterioration of existing water sources and the difficulty in finding new water sources. Thus the restoration of the micro watershed at one of its intakes located at Huluganga was carried out; with the aim of establishing a demonstration model which will provide the basis for other such endeavuors within the NWS&DB and show the community involved that it is possible to establish vegetation that would serve their utility needs as well as ensure the health of the watershed perpetually. The project was launched in 2003 with the support of the UNDP, Global Environmental Facility(GEF) under their Small Grants Programme(SGP). The project was implemented by Neo Synthesis Research Centre(NSRC) a Non Government Organisation with many years of experience in restoring degraded land. Due to the unavailability of funds the project could not proceed to the monitoring and analyses stages. However it gave a good opportunity to learn about the ability to improve watersheds as well as the willingness of people within the watersheds in engaging in such activities in order to improve the natural waterways.

Background

The National Water Supply & Drainage Board (NWS&DB) is the main organization in Sri Lanka that supplies potable water. Under the strategic plan for the water sector, the NWS&DB is to supply 100% of the country's population with safe drinking water with the following objectives.

- Access to sufficient and safe drinking water to 85% of the population by 2010 and 100% by 2025
- Access to adequate sanitation facilities to 70% of the population by 2010 and 100% by 2025

The lack of vegetation cover on the mountain gullies of streams and rivers has decreased shade conditions and thus reduced the dry season water flow in our waterways. At present the natural forest cover in the country is less than 8%.

Objectives

- 1. To implement a watershed conservation programme in the micro-catchment of the Huluganga (River) above the intake point in order to increase water yield and quality in the long term.
- 2. Increase vegetation cover, precipitation and surface water accumulation within the watershed.
- 3. Increase forest cover thereby increasing the capacity of the watershed to sequester more carbon.

Description

Huluganga is a perennial river originating from the Knuckles mountain range above Madulakale and flows in to the Ma-

haweli River. The total extent of the Huluganga watershed is about 252km2 at its mouth. The upper catchment area of Huluganga above the intake point at 790MSL covers a land area of 22.3km2 and belongs to the Panvila Divisional Secretary Division. Three GN divisions, namely Watakele, Kelebokka and Kosgama are located within this area. Half the area is covered by natural forest in the Knuckles mountain range. Tea plantations, forest plantation, crop, scrubland, grassland and small villages cover the balance half.

At present, Huluganga is tapped at 790MSL to obtain water for the Kundasale Water Supply Scheme. The design capacity of the scheme is 13,000m3/day. A population of 56,000 is expected to be benefited by this scheme in the



year 2017. The average flow measured at the intake weir in 1989 was about 0.35m3/sec (30,800m3/day). The water was of very good quality in the dry period whereas in the rainy season water was a little turbid with a large runoff during short periods (Soil & Water 1991).

Watershed

Topography, land use and soil

The dominant soil groups in the project area are identified as Reddish brown latasols, immature brown loams and red yellow podsols.

Ground elevation varies from 790MSL to 1700MSL. The terrain is steeply dissected rolling hills and undulating terrain. 50% of the land is with slope between 300 to 600. The balance 50% is approximately equally divided between slopes of more than 600 and less than 300.

The steepest areas are covered with dense forest and a few tea plantations. The areas with moderate slope are mostly covered by tea plantations, forest plantations, home gardens, scrubland and grassland.

Rainfall, runoff and the water potential

The lowest rainfall is observed during January to March whereas the highest rainfall is observed during the North-East monsoon in the months of October and November. Flow measurements show that the discharge patterns are equivalent to the rainfall patterns. A drainage map of the area shows that there is a lot of small water paths leading to the main body of Huluganga.. Water quality measurements during past ten years show a dramatic increase in turbidity and conductivity.

People in the upper watershed

The plantation community occupies about 28% of the land area while the rest of the community lives in traditional villages and small townships. Growing of cash crops such as coffee, cardamom, pepper etc., in home gardens constitutes the main agricultural activities in the area. The main occupation of the villagers is working in the tea plantations.

The population can be classified as belonging to a low income group. Population pressure for fuel and fodder are two factors which have a direct influence on the surrounding



land and vegetation.

Present status of the watershed

The upper reaches of the watershed have a high distribution of streamlets. The land use of this area is purportedly denoted in the available maps as being under dense forest cover and tea plantations. However, in reality the lower canopy is heavily damaged due to unauthorized cardamom plantations. In addition, the 'forest' consists of monocultures of Eucalyptus and Pinus species that have an even planting pattern and are devoid of undergrowth and highly eroded. On the other hand, the natural forest is rich with a high species diversity, displays a canopied structure, a dense undergrowth and a thick layer of leaf litter and topsoil; however, the natural forest is limited to a very small land area. A few areas in the tea plantations have been subject to soil conservation practices but the majority of the land under tea suffers from soil erosion and the complete absence of vegetation in the gully areas. Another critical factor that affects water quality is the absence of adequate sanitation for the estate communities who live in the watershed. The contamination of the feeder streams is a serious problem which is exacerbated by the lack of awareness about proper sanitation. The problem is compounded by the unsustainable farming practices engaged in by the villagers who use agrochemicals for vegetable production in their home gardens. Illicit forest felling and the periodic outbreaks of fire contribute to the overall unhealthy status of the watershed.

Restoration methodology

The micro watershed of the existing intake of the Hulu Ganga was selected for the demonstration model. The intake level is 830MSL. The area covering the contour 840MSL was demarcated using the geodetic positioning system (gps). The demarcated land extent between the intake and 840MSL is 0.17km2 (17 hectares) and is, for the most part, under private ownership.



Hence, the decision was to garner the support of those land owners to participate in the restoration process. The Project also sought the assistance of the local administration, the Forest Department, the Department of Minor Export Crops and the management of the Alakolawatte Tea Estate who were the single largest land owner in the area.

Strategy adopted for restoration

The first step was the identification of the land owners. 20 land owners (9 Sinhala, 9 Tamils and 2 Muslims) were selected as beneficiaries of the Project including the Alakolawatte tea estate belonging to the State Plantations Corporation. The survey assessed the socio economic and ecological status of the lands in the micro watershed. The data gathered served as the basis for the mobilization of the community as a whole towards the Project.

Social mobilisation

Participatory planning and creating awareness are essential components of a project of this nature. At the inception a meeting was held with all the stake holders; Government organizations, land owners, NSRC and all the landowners of the area where the objectives and intended activities were described and discussed in order to clarify the problems and doubts that they had. A tentative work schedule was planned with the responsibilities spelled out.

Subsequently, monthly meetings were held to review the work done and to improve upon the original work plan. These meetings gave the stakeholders the opportunity to view their opinions and thoughts about the direction in which the Project progressed. In addition, these monthly meetings sought to educate farmers about aspects of organic agriculture and analog forestry like landscape designing etc.

The meeting held before the rainy season called for a consensus of opinion amongst farmers on the forthcoming planting activities. With the farmers' consensus the following soil and water conservation activities were planned to be started in succession.

- Map the areas designated for restoration and draw up a management plan that includes a time line for the activities planned.
- Carry out soil and water conservation activities
- Planting of Riparian Zone, Buffer zone, Gully and production area.
- After completion of individual plots riparian zone planting is planned to be conducted on a shramadana (collective endeavour) basis.

Awareness creation

- Exposing farmers to ecological farming, analog and conservation forestry.
- On the job training by NSRC staff
- Training on compost making, vermiculture, organic farming and pepper cultivation
- Sending farmers to other watershed restoration sites of NSRC; Monaragala, Mirahawatte

Restoration programme

Sustainable land management

1. Identifying and mapping land use of area. Some of the remnant natural forests in the area were surveyed in order to identify the architectural structure, ecological function and species (flora and fauna) with the participation of the officers of the Forest Department. This information would provide the basis for designing the landscape of those areas designed for restoration. In the buffer and riparian zones, the planting will be confined to the species found in the adjoining natural forest, thereby extending the range of the forest. The landscape design of the home gardens and the gullies that pass through them will, for the most part be planted using the technique of analog forestry where native species and other utility species that are analogous to the native species will be used. These utility species would then be able to provide for income generation, food, fuelwood, timber, medicine, fodder, fibre etc to the farmer.

Box 1. Analog forestry

- Analog Forestry is a system of land management that seeks to establish a tree dominated ecosystem analogous in architectural structure and ecological function to the original climax or sub climax vegetation community.
- It seeks to empower rural communities both socially and economically through the use of species that provide marketable products.

Source: Analog forestry manual

- 2. Participatory mapping of farmer gardens.
- The baseline maps of each individual home garden in the Project area showing their significant physical features and dominant vegetation were drawn. In addition, the problems in each farm garden and the area under the jurisdiction of Alakolawatte were identified with recommendations for their resolution in participation with the farmers/stakeholders.
- 3. Landscape design of farmer gardens.
 - The landscape design of each garden was divided into different sections comprising the areas designated for soil conservation activities like hedgerows and shade planting, the gully and canal areas, the production area, the buffer zone and the riparian zone. Each garden had these diverse facets for design and the plants required for each section were recorded separately. The plants required to execute the landscape design were to be propagated by the Project nursery or bought from external nurseries.
- 4. Establishment of nursery A central nursery was established to propagate native species of plants that would be used in buffer zone and riparian zone planting.
- 5. Planting during the rains The rains of the South West and North East monsoons were used to execute the planting of the micro watershed.

A total of 17,103 plants in 196 species was established during a one year period.

Soil Conservation

The first course of action was to engage in soil and water conservation activities in all selected gardens and hedgerows before planting. When the slope was steep drains were dug and shade trees were planted. 775 plants were planted in the one year period.

Water conservation and water management

Presently only five live feeder streams on the Alakola Estate side of the river feed the Hulu Ganga. Many others have dried up principally due to the lack of adequate gully vegetation and lack of shade. Hence the main focus of this project was to re-establish stream vegetation. The canals which exist in the farmers' gardens were also planted. Further, ponds were dug in some farmers' gardens that were gley lined and designed to have water slowly seep into the ground. The retention of water in the ponds gives the farmer the opportunity to grow annual crops in addition to the tree crops planted. 4,153 plants were planted in the one year period.

Production planting

The second phase of planting with the monsoonal rains where the plants allocated to the production area in the landscape design of farmer gardens were put down. The planting included several high value tree crops that would provide income to the farmer whilst providing other utility benefits like the provision of food, fuel wood, timber medicine, fodder etc. In the short term farmers were encouraged to engage in the cultivation of annual crops using organic methods of cultivation since it would reduce the risk of contamination of the water flowing into the intake and provide the farmer with a premium price on his produce. 8,251 plants were planted in the one year period.

Restoration of buffer zone

The borders of those gardens located adjacent to fragmented patches of natural forest were planted with species from the forest itself so that the range of the rapidly decreasing forest will be extended outwards. 801 plants were planted in the one year period.

Restoration of riparian zone

The riparian zone of the Hulu Ganga was up to the first 10 m. contour. Only the native species that were found in the riverene forests of the Hulu Ganga were planted. More than 3,123 plants in over 40 diverse species were used in the planting of the riparian zone.

Observations and other comments

The restoration activity was confined to only one year or two planting seasons. It was unfortunate that the Project could not continue due to unavailability of necessary funds where indicators like the establishment of shade, the development of top soil and the re-emergence of biodiversity due the re-creation of habitat would have been evident after two years Despite the restriction, the mobilization of farmers did produce positive results wherein a few farmers opted to adopt organic agriculture; further, the clean weeding of soil using a mammoty also ceased where hand weeding or the use of a scythe was adopted instead. This would, no doubt reduce soil erosion and thereby a reduction of silt entering the reservoir. In time, there would be seen a decrease in the turbidity levels of the water in the intake.

Discussion

While the ability to obtain potable water becomes more and more difficult due to the degradation of the intake watersheds, due importance must be paid to the restoration and conservation thereof. The protection of the watershed will no doubt ensure water quality but also increase water quantity due to the increase in surface water accumulation and reduced evaporation. While millions are spent on water treatment, it may be wise to allocate a fraction of the cost towards the long term sustainability of the water source. After all, water supply can only be carried out if there is good, potable water!

Reference

- Soil & Water Ltd. (1991) Water Supply & Sanitation District Report-Kandy District Kandy District Water Supply & Sanitation Project
- NWSDB (2002) Kandy District Water Supply Development Programme Project National Water Supply & Drainage Board
- IAFN (1997) Analog Forestry Manual International Analog Forestry Network. Falls Brook Centre: Canada,

Contact addresses

W. K. Illangasinghe Chief Engineer National Water Supply & Drainage Board Sri Lanka

K. Melvani Managing Director, Neo Synthesis Research Centre Sri Lanka

B.W.R.Balasuriya Deputy General Manager National Water Supply & Drainage Board Sri Lanka