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RESTORATION OF SMALL TANK CASCADES: ENVIRONMENTALLY SUSTAINABLE APPROACH TO DEVELOP IRRIGATION INFRASTRUCTURE IN DRY ZONE SRI LANKA*

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Abstract

Traditionally people of the dry zone of Sri Lanka depended on water from the small tank cascades for domestic and agricultural use. In course of time the tanks were dilapidated largely on account of foreign invasion and colonisation. Recently an attempt has been made to revive the traditional water resources under the Dry Zone Agricultural Development Project. This paper discusses the implementation of this project in Sri Lanka as a measure to enhance agricultural productivity and increase incomes of farmers in command and catchment areas of the small tanks in a sustainable way. In order to ensure long term environmental sustainability, the project followed the principles of the "integrated water resources management" approach and sought to improve the natural, social, human, financial and physical capitals of the farming communities. As an indirect service delivery initiative, the project formulated a strong partnership strategy incorporating all the stakeholders into the process and heavily trusted in community participation. The project succeeded in making a significant positive impact on farmers' lives at both the household and the community level, especially by improving their agricultural production.

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The Dry Zone Context and Problems of Dry Zone Agriculture in Sri Lanka

Sri Lanka's dry zone (DZ) extends over most of the north and the north central regions of the country and also part of the areas in the south and east. It covers almost 75 per cent of the total land area. Compared with most dry areas of the world, rainfall in the DZ of Sri Lanka is relatively high. The annual average rainfall ranges from 575 mm to 1400 mm. But it is distributed unevenly through the year. In terms of natural vegetation, moist deciduous forest is widespread in the DZ and also the dry evergreen forests occur where the annual rainfall is rather high.

Agriculture is the predominant means of the livelihood of the people in the DZ of Sri Lanka – 59 per cent of the households in the area depend on agriculture. Traditionally the dominant agricultural crop of Sri Lanka has been paddy. Crops like green gram, groundnut, ginger, maize, finger millet are also cultivated depending upon the availability of seasonal rains. The main fruit trees cultivated in the DZ areas are of mango, cashew nut, pomegranate and guava. Agriculture, the mainstay of the DZ economy is subjected to environmental shocks of occasional drought and unreliable rainfall. Water scarcity and several other inter-connected problems, like the poor state of the minor irrigation systems, inappropriate farming practices, unavailability of low cost agricultural technologies and inefficient support services contribute to low agricultural yields and consequent low income of the DZ farmers. Other factors that have further aggravated this situation include expensive production inputs often leading farmers to indebtedness, crop loss due to poor post-harvest practices and poor marketing of the crops. Hence, incidence of poverty is higher in the DZ than in the other areas. Nearly two fifths of the rural population in the DZ are estimated to live below the poverty line. Land use is dependent on geographical, environmental, social and economic factors.

Small Tank Cascades: A Sustainable Livelihood Model of Rural Dry Zone

Traditionally small tanks have been the main source of irrigation for agricultural pursuit in the DZ of Sri Lanka. They functioned as human-

made irrigation reservoirs. The tanks were created through construction of earthen dams across seasonal streams (Murray and Little 2000). The DZ agriculture of Sri Lanka was characterised by its irrigation system. The irrigation system in the DZ of Sri Lanka can be divided into major, medium and minor on the basis of the acreage served by the irrigation scheme. Major tanks are those that feed 400 ha. (hectare) or more (1 ha. = 2.47 acre). Medium tanks feed less than 400 ha., but more than 80 ha. of land. Minor tanks are those that feed up to 80 ha. of land (Sivayoganathan *et al*. 2003). Minor tanks provide water not only for irrigation but also for household use. They are more or less the centres of village life. Minor tanks, by regulating the local water table, are vital for ensuring the supply of drinking water to the village communities. They are owned by the local communities. These tanks are points for bathing and washing clothes. Their effect on the local community extends far beyond agricultural cultivation. Small tank system can be perceived as human adaptation to rainfall pattern, a water harvesting system that enables the uneven distribution of water for agricultural and household purposes. It suits the geological condition of the DZ, in so far as the condition of the soil prevents infiltration (Thennakoon 1986). Soil of this region has the attribute of holding up water in the form of tanks or reservoirs. Similarly, the narrow tracks of alluvial soil and some parts of the very clayey soil are also well suited for tank construction and water retention (Panabokke 2002).

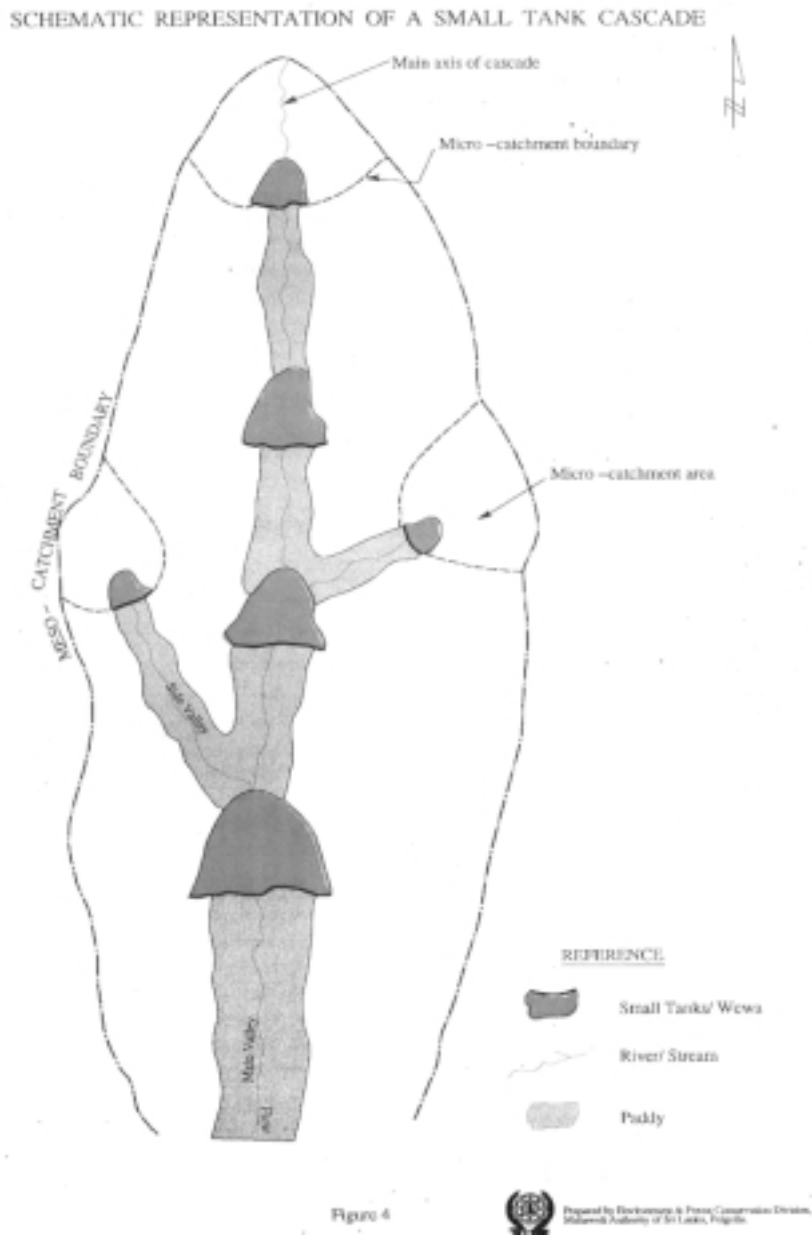
An important traditional form of community tanks is that of the cascade system. It is simply an interconnected cluster of small tanks or human made irrigation reservoirs adhering to natural, topographic, geological and meteorological factors of the region. A cascade system is a connected series of tanks organised within a micro-catchment of the DZ landscape, storing, conveying and utilising water from an ephemeral rivulet (Figure 01). It is a traditional land water management system which has obviously been developed on the basis of catchment ecosystems (Maddumabandara 1985).

A cascade tank is an integral part of its natural environment. It has the components of the tank bund, the tank bed (area covered by water),

the sluice, the spill and the catchment area. The sluice is used to control the water flow from the tank to agricultural land. The spill, where excess water overflows from the tank, is a technique used to avert the breaching of the bund due to overloading of the tank with water from heavy rain. In ancient times most of these tanks had a sophisticated mechanism to avoid sedimentation too. According to *Maha Vansa*, a book on the history of Sri Lanka: "Not even a single raindrop should be allowed to flow into the sea without having made use of it for the benefit of people" was a popular statutory statement made by King Parakramabahu the great, who ruled the country during 1153-1186 AD (Kravcík *et al.* 2007). This denotes the importance given to effective water management in the past. It also suggests the patronage of the irrigation systems received from rulers. According to the US library of congress, the early attempts at engineering the construction of these tanks showed the brilliant understanding which this ancient people had of hydraulic principles and trigonometry. The discovery of the principle of the valve tower (the sluice gate) or valve pit for regulating the escape of water is attributed to Sinhalese ingenuity more than 2000 years ago (Panabokke 2002).

Besides irrigation, the functions of the community tank were maintaining the ground water table, feeding downstream tanks, taking care of the consumption of villagers and village livestock, and catering to the need of indigenous industries such as pottery, brick making, sedge products and inland fishery. A village tank was an integral part of the typical traditional Sri Lankan DZ village system consisting of the temple, paddy fields, forest etc. and it synthesised the rural social fabric. Further, one could find religious beliefs and rituals centred on the community tank in the rural areas of the DZ. Tank also functioned as a source of confidence of the peasants in the ancient villages. Storage tanks enabled the farmers to commence farming early in the season provided that there was some rain just sufficient to prepare for growing paddy, the main food crop (Thennakoon 1986). Another important function of the community tank was creation and maintenance of the rich biodiversity (of both animals and plants) in the region. It is believed that over 40,000 tanks were in use in the past in the DZ areas of Sri Lanka, but were dilapidated as a consequence of various socio-economic factors and

Figure 01 – A Small Tank Cascade



Source: Panabokke 2002

constant political invasions. There are still about 12,500 small tanks scattered throughout the DZ and are reported to have the potential to irrigate about 100,000 ha. land (Gunasena 2000).

Dilapidation of Small Tank Cascades

Why was this time-tested sustainable irrigation system of community tanks dilapidated? This hydraulic civilisation began to decline by the end of the 12th century. The key factor responsible for the decline was reported to be foreign invasion of the DZ of Sri Lanka. Invaders pushed the indigenous people out of the DZ in the northern part of Sri Lanka towards the southern part. Also the new rulers had their own interests and did not provide the administrative support and patronage to the maintenance of the traditional irrigation schemes. Some scholars are of the view that the devastative political and economic strategies adopted by the western colonisers of Sri Lanka after the 15th century intensified the decline of village tanks. For instance, Maddumabandara (2009) points out that during the colonial period the demolition of traditional institutional structures undoubtedly had lasting adverse impacts on the hydraulic society. However, contrary to the aforesaid views, Fernando (2002) makes a scientific analysis. According to him, the fall of the ancient hydraulic civilisation of Sri Lanka in the 13th century was due to a sudden natural cataclysmic change of the course of the Mahaweli Ganga (river), and not foreign invasions as some historians would want us to believe. Evidence in support of this argument is drawn from the aerial photographs of the old and new courses of the river. The ancient Mahaweli river had *stupas* (dome-shaped shrines erected by Buddhists) on the sides of the river like a string of pearls, while the present river flows elsewhere with no *stupas* beside it. This change took place circa 1220 AD. The sudden change in the geological cataclysm, that sustained the ancient hydraulic civilisation, led to diseases and famine. This in turn resulted in the major portion of the population abandoning these areas and moving to the intermediate wet zones where the then rulers also established themselves at places like Dambadeniya, Kurunagala, Gampola, Kotte and Kandy (Fernando 2002).

However, Fernando also states that the decline of the system of the traditional tanks was severe during the British colonialism. During the early period of the British rule the colonial administration was pre-occupied with military and political consolidation, and thereafter with capitalist enterprises in plantation exploiting the riches of the island. The British replaced the main food crop of rice with cash crops (first coffee, and later tea and rubber). With no interest taken and no support extended to the farmers for irrigation of paddy fields, the tanks gradually fell into disuse, turning much of the countryside into malarial swampland. A modern historian calls this a "regrettable but understandable situation, given the fact that the higher bureaucracy itself had been so deeply involved in plantation agriculture" (Fernando 2002).

Dilapidation of the village tanks resulted in lack of water for irrigation which in turn led to instability of agriculture in the DZ. There has been no attempt, until the recent past, to reorganise the tank based civilisation for developing agriculture in the DZ areas. In spite of various water resource development programmes, and extensive and sustainable rainwater harvesting efforts, attention to the basic principle of the traditional tank system seems inadequate. According to Ariyabandu and Aheeyar (2004), only 10 per cent of the total direct rainfall water is used for domestic, industrial and irrigation purposes. Nearly 30 per cent of the rain water goes as run-off to the sea. Sri Lanka has more than 50 institutions and over 40 pieces of legislation dealing with water; but there is no single act that deals with water resources as a whole. This has not only created confusion and conflict in the allocation of water resources to different users but also contributed to water scarcity particularly during drought.

Sri Lanka does not have an environment policy pertaining to water resource management which is another sector that is necessary to bring about the aforesaid reorganisation of water sources. Furthermore, certain initiatives that were taken with the purpose of solving the whole issue of water have had serious adverse consequences on small tank cascade systems. For instance, unplanned agro wells for drawing up shallow water and also tube wells have interrupted ground water recharging. As a result,

most of the tanks dried up during even a short occasional drought season. Agro wells are constructed within the catchment areas of small tanks without considering the hydrological basis of the cascade system. The agro well development has to be undertaken carefully without exploiting the shallow ground water table of the cascade system as it could lead to disastrous economic and environmental consequences (Gunasena 2000). In addition, due to lack of proper maintenance measures, tanks have been getting filled with sedimentation of silt and clay that are carried by the run-off water from the upper lands. Above all, withdrawal of the new generation from the traditional labour intensive agriculture is another great challenge to sustain the tank irrigated agricultural system. Further, certain changes can be observed that adversely affect the limited number of small tank cascades that are presently in use. One such common change is the trend of deforestation and inhabitation of people in the upper areas of the tanks of the cascade which were not meant for human occupation in the past. Thus, various socio-economic and political factors contributed to the dilapidation of the traditional tank cascade system of irrigation in the DZ Sri Lanka.

Restoration of Small Tank Cascades

Restoration of tanks and irrigation systems became a key area of interest among development agencies in Sri Lanka during the post-independence era. The initiatives in this respect have been taken largely by non-state agencies including international donors during last three decades. In view of their agricultural, socio-economic and environmental benefits, the small tanks are considered to be highly relevant to the rural development programmes (Gunasena 2000). Besides, the national policy on agriculture and livestock also intends to promote increased use of tanks and minor irrigation systems together with the other water sources. These steps are based on the understanding that water can contribute to food security and economic growth, and thereby reduce poverty. It requires that in the use of water available at the lowest level, priority is given to domestic use and home food gardens (De Vries *et al.* 2005). It was in this background that the Dry Zone Agriculture Development Project (DZADP) was launched in Sri Lanka.

The DZADP was a joint venture of the European Commission (EC) and the Government of Sri Lanka (GOSL). The EC gave a financial grant of 5.132 million Euros. The project operations started effectively in March 2000 in two districts, namely Hambantota and Anuradhapura. A national steering committee (NSC) of the project, consisting of representatives from all line ministries and departments under their purview, was formed in 2000. The meetings of the NSC were chaired by the Secretary, Ministry of Agriculture. In each of the districts where the project was to be implemented, a district steering committee (DSC) was created. The district project teams worked closely with the DSC. The project activities were implemented in cooperation with the district/provincial government agencies as well as a number of selected partner NGOs (non-government organisations). The project expanded its intervention to two more DZ districts, Puttalam and Moneragala in 2002 and to another district, Mannar in June 2004. Over its full life span the project aimed to directly reach 16,000 small scale farming households, and through the lateral spread a total of 50,000 families in the five DZ districts.

The project in its operation consisted of four components. (i) *Institutional development and organisational strengthening* (ID-OS) aimed at capacity building of the project personnel of both the partners of the GOSL and the NGOs. It played a leading role in the implementation of the project in so far as the project personnel were enabled to become service providers for the local communities. ID-OS was also involved in the mobilisation of farmers' organisations (FOs) and the integration of the project partners with client groups of the district secretariat (DS) and the agrarian service centres (ASCs) at the district level. (ii) *Farming systems development* (FASYS) had the objective of seeing that the tank restoration would result in increase of production and productivity. It especially promoted sustainable agricultural methods and techniques, and crop diversification to reduce the dependence on paddy alone. The FASYS component took into account the needs of the local population and those of the environment. (iii) *Business development* (BUDEV) component had the main task of tackling the problems of marketing farm products, which involved optimising the present marketing channels and creating alternative ones including the

necessary linkages between producers and distributors. Furthermore, this component was engaged in promoting innovative methods of business and enterprise development, for example programmes of small scale processing and value addition at the village level. (iv) *Water resources management* (WRM), initially called irrigation management, was the component through which the project took into account the surrounding watersheds and, if possible, cascades, and planned to restore a number of minor tanks. It also provided training and capacity building of the communities for the operation and maintenance of their tanks. Alternative ways of water management, namely agro wells and rain water harvesting practices, were also explored.

Issues of gender and youth development, although not considered as a separate components in the project, were incorporated in all the activities of the project. Women and youth were identified as especially vulnerable groups. The gender sensitive approach of the project promoted equal role of women in the community and in village development. Young people were encouraged to take more active part in the development of their communities. Through appropriate new technologies, that would make agriculture a more remunerative enterprise, the youth were redirected into farming. Special roles, like that of farmer animator, were entrusted to them.

Integrated Water Resources Management

In order to ensure optimum results and long term environmental sustainability, the DZADP followed the principles of the integrated water resources management (IWRM) approach throughout its entire intervention, although similar projects were being implemented as isolated tank restoration programmes. Global Water Partnership (GWP) defines the IWRM as a process which promotes the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (Bandaragoda 2005). The IWRM approach can also be viewed as an attempt at a scientific rediscovery of indigenous water management practices of the great ancient era of hydraulic civilisation

in Sri Lanka. It endeavours to address water sector related intractable development challenges that result from short sighted narrow strategies. Today, as worldwide experiences have shown, the IWRM approach has moved beyond the field of agriculture to diverse areas such as transportation, energy, water related industries and enterprises of non-agricultural income generation.

According to Lenton and Mike (2009), the integrated water resource management approach seeks to achieve an optimum balance among three 'E's - efficiency, equity and environment. The first 'E' of economic efficiency consists in expanding the coverage of the scarce water resources as far as possible and to allocate water strategically to different economic sectors and uses. The second 'E' of social equity seeks to ensure equitable access to water, which means that the benefits from water use are received by all, women and men, rich and poor, across different social and economic groups both within and across countries. It would involve entitlement to, access to and control of water. The third 'E' of environmental sustainability is geared to protect the water resource bases and related aquatic ecosystems, which in turn helps address broader global environmental issues such as climate change, mitigation and adaptation, sustainable energy and sustainable food security.

From the perspective of collaborative resource management, the IWRM approach requires strong partnerships to be formed with all relevant agencies and community structures available in the area. Bandaragoda (2005) further observes that these stakeholders need to be actively engaged in planning, implementing and monitoring the IWRM activities. One institution alone may not be in a position to confront the whole gamut of issues linked to conservation and sustainable development of water resources (Bajimaya 2003). A collaborative approach is necessary. There is also the need of team work in order to achieve efficiency in irrigation (Keller *et al.*1996).

According to De Vries and others, there are four categories of entities that make decisions on investment in matters related to agricultural water: individual farm households, farmer groups and communities, micro

small and medium enterprises, and finally the respective governments. They point out that any investment made by the aforesaid stakeholders can aim to increase natural, social, human, financial and physical capitals of communities for sustainable and successful agriculture (De Vries *et al*. 2005). Bandaragoda (2005) has noted that the most effective stakeholder participation in the IWRM was seen in Sri Lanka among a few other Asian countries, namely China, Indonesia, Nepal and Philippines.

Knowing that programmes such as those of water management implemented in isolation are likely to be less successful, the DZADP entered into partnerships with all stakeholders of the project concerned in order to ensure a well coordinated intervention. The project signed memorandum of understanding (MOU) with the GOSL and the local NGOs of the private sector. At the same time, an agreement also was made between the project and the respective farmers' organisations pertaining to the small tank cascades selected for restoration. The DZADP paid enormous attention to strengthening community organisations, in order to make them effective structures to practise the IWRM approach. The project highly valued the potential of community based knowledge, skills, resources and institutions, as against the misunderstanding, neglect and disregard of indigenous and local communities seen in many similar initiatives. There was also legislative support to this mode of operation. According to the agrarian development act No.46 of 2000 of Sri Lanka (Ministry of Agriculture 2000), every component of any development project related to any irrigation system, tank and dam or water canal embankment should be subjected to the supervision of the farmer organisation of the area and all the maintenance activities should be done by the government department of agrarian development.

Being an indirect service delivery project, the DZADP prioritised human resource development for achieving sustainability of the intervention. This was done, in the first place, at the level of the partners through programmes for developing the necessary skills and right attitude of the staff of the support agencies. Expanding the scope and scale of the operations through enhanced institutional capacity was given priority over just providing the support agencies with financial resources and working materials to conduct

their routine work or project activities. Thus the project released financial grants not only for infrastructure development of institutions but also for human resource capacity building of partner agencies. Besides, the DZADP organised training of trainers (TOT) programmes on various topics, the IWRM in particular, for the benefit of the staff of the local agencies including the government.

The Process of Implementation

The DZADP was initially implemented as a multilayer process to restore twenty-two irrigation systems in the district of Anuradhapura, situated in the north central province of Sri Lanka. The process of implementation of the project had three phases. In the *first phase* the project adopted a vigorous selection process in order to identify the most suitable small tanks for renovation, which would optimise the functioning of the entire cascade system. According to the Agrarian Development Act (2003), the Department of Agrarian Development (DAD) of the GOSL has the sole authority to select the cascade systems or individual tanks for restoration. Accordingly the DAD provided preliminary investigation reports (PIR) for all the potential small cascade systems within the project localities in order to facilitate the selection of tanks and cascades. In the meantime, in order to align the process with the IWRM framework, the project hired the IWRM technical expertise and commissioned a study to assess the hydrological characteristics of small tanks (including surplus water) on three key indicators, namely hydrological potentiality, tank capacity ratio and cropping intensity. The next step of the first phase was to demarcate the meso and micro watersheds, cascades, water spread areas, command areas and local catchments on 1:50,000 maps, and then to carry out the cropping and social feasibility study. At the end of the first phase, the physical structure of each tank was ascertained in order to estimate the cost of restoration. Farmers were involved in the assessment and in collecting data on the cascade systems. In most instances participatory approach, such as participatory rural appraisal (PRA), was utilised for data collection and community mobilisation.

The *second phase* in the implementation of the project was of capacity building for both partner agencies and community organisations. The

DAD was invited to hold a series of awareness meetings with the prospective beneficiary communities and to officially inform the farmers that their respective cascade has been selected for renovation. It also provided a platform to discuss the issues that might not have been brought into the light yet and an occasion to know the farmers' attitude towards the project in general. In the meantime, the DZADP contracted to the local NGOs the task of conducting capacity building workshops for community organisations in matters, like organisational strengthening, financial management, participatory planning, record keeping and presentation skills. The DAD conducted a series of technical training programmes on tank construction, because the proposed renovations in the selected cascades were to be carried out through community participation. At the end of the training in construction, the DAD formulated a work ratification plan with the respective community organisations to ensure timely completion of the proposed construction. Upon completion of the work ratification plan, the DZADP signed an agreement with the community organisations to release the first instalment of the projected cost. The cost of the project was released in three instalments upon satisfactory progress of the construction. The last instalment of 5 per cent of the total cost was to be released only after the completion of the project.

During the *third and last phase*, a series of cross learning visits were organised for farmers to see the sites where the IWRM was successfully implemented. All community organisations were guided to make plans for the operation and maintenance of their cascades and the DZADP provided a grant matching the fund generated by the farmers towards maintenance. The total amount for maintenance was deposited in a separate savings account in a government bank. Farmers were also trained to draft the IWRM plans and villages were networked in order to ensure the development of the entire micro watershed area that spread beyond the limits of a cascade tank in many instances. With the help from the government departments concerned, the DZADP also assisted the farmers to demarcate new command areas and organise surveys for land distribution. The project also promoted crop diversification, assisted farmer groups in getting seeds and fertilizer, and provided them market information. Further, farmers were introduced to certain service providers, such as banks for agricultural loans and prospective buyers of agricultural products.

Impact of the Project

By the end of 2004, the DZADP had spent approximately 132,000 US Dollars in Anuradhapura district alone for renovation of 22 cascade systems. A remarkable feature of this programme was that the beneficiary communities managed to contribute over 30,000 US Dollars in kind, through labour in particular. As the result of the project intervention, 376 acres of land could be irrigated and brought under fresh cultivation. It amounted to 28 per cent expansion of the cultivable land over the pre-restoration situation. According the estimate made by the DAD, the new situation would create irrigation facilities for 250 additional families. Technical assessment has predicted that this intervention would have positive impact in a watershed area of over 3000 hectares.

Two years after the intervention, a sample survey was conducted to examine the changes. It revealed that 234 acres of land have been additionally made cultivable and the area covered by full water supply level has increased by 194 acres of land. Membership of community organisations has gone up by 295. During the capacity building phase greater attention was given to empower women and youth, who had been perceived to be marginalised from agriculture. The survey results showed that 152 out of the aforesaid 295 persons who joined community organisations were women. Community organisations have started to obtain various benefits out of the results of the project. They have changed their cropping patterns, as for example diversified cropping. For instance, farmers have started to cultivate vegetables and other commercial crops during the lean season. The positive impact of the project is indicated from the 29 per cent increase in the community organisations' funds in two years after the project. It has also been found that the farmers now have been better managing their organisations.

Benefits at the individual household level were also seen to have increased. Farmers pointed out that they had increase in their income, and some have started to modify or expand their houses. Women were happy

about the safe and convenient water facility. They further appreciated the change that more women have come into leadership positions compared to the earlier situation. The positive impact of the renovated tanks on village livestock has been pointed out by farmers when they said that they were confident of their livestock not being affected by the next drought. Farmers have also planned additional income sources such as inland fishery in these tanks. As of December 2006, four community organisations have initiated action for fish cultivation in their respective tanks.

Community organisations have begun to pay attention on improving the condition of the entire cascade system, instead of an individual tank. A few community organisations have started reforestation in the upper catchment areas of their cascade systems. The number of farmers who took to the practice of soil conservation methods has substantially increased – an increase of 51 per cent over the baseline data. This is a clear indication of their effort to take the IWRM approach forward. Farmers' interest to adopt organic farming practices was also encouraging. In order to have access to inter-village planning of cascade and watershed management, farmers have started to seek closer ties with the administrative and divisional secretariats of the GOSL. They have become highly conscious that positive impact could be bought about from the development initiatives in their cascade or watershed systems. They have prevailed upon the authorities that the farmer leaders should be informed about future renovations in their respective cascades. Survey results showed that 14 community organisations have raised 350,000 Sri Lankan rupees as maintenance and operational fund. Almost all of the community organisations have started to maintain the downstream and channels in order to minimise water wastage. It was noticed that slowly but steadily farmers were achieving their development, while incorporating the principles of the IWRM.

The DZADP trained the village level volunteer extension workers and the grassroots level government officers to follow up these initiatives with the support of the local NGO partners. The project was quite optimistic

about the strength of community organisations, that they would become effective conduits leading to village development. The cascade development approach of the DZADP was studied by certain peer agencies of both state and non-state sectors, and emerged as a replicable model. Most of the agencies admired the partnership model, community participation and the IWRM principles adopted at the very grassroots level. By the end of the implementation, the DZADP produced a comprehensive training module on the IWRM and a short video documentary as a training material.

Conclusion

The small tank cascade system in Sri Lanka is a time tested sustainable solution discovered by the agricultural communities to face drought, and thus it has become an integral part of their social system. It has managed to survive various challenges and shocks, and remains sustainable since its restoration after hundreds of years. The agricultural communities had been facing severe socio-economic issues, largely because of their dependence on the gradually dilapidated condition of the agricultural infrastructure of the irrigation systems. In this context the DZADP took a sensible decision to address the issue through the IWRM perspective and envisaged lasting impacts. The project viewed the IWRM as a collaborative resource management strategy and sought to improve the natural, social, human, financial and physical capitals of the farming communities through a coordinated approach. As an indirect service delivery initiative, the project formulated a strong partnership strategy incorporating all the respective and potential stakeholders into the process. The DZADP fully trusted in community participation and ownership. It also paid enormous attention to build human capital through a wide array of extension programmes, in order to obtain long term benefits and also to ensure sustainability.

As an agricultural development initiative, the DZADP managed to make a significant positive impact on farmers' lives at both the household and the community levels. What is most remarkable is that the project enabled farmers to broaden their view to the level of the cascade system, instead of

being limited just to an individual tank. The tremendous interest shown by farmers to incorporate the IWRM practices into their water management systems is also remarkable. Farmers' efforts to influence policy or decision makers to create a more enabling environment for them are not to be underestimated, although they needed considerable facilitation and guidance. In order to make the impacts lasting, relevant policy changes are to be brought about at the national level, and community participation in local governance mechanisms has to be simultaneously ensured.

Note

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