Developing Effective Water-Management Institutions in River Basins: Case Study of Deduru Oya, Sri Lanka

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Introduction

This paper synthesizes the findings of a study conducted in the Deduru Oya river basin during 1999–2001 under the Asian Development Bank (ADB)-assisted Five-Country Regional Technical Study (ADB-RETA 5812). This section introduces the objectives, methodology and description of the Sri Lanka case study. The next two sections discuss the physical and socioeconomic characteristics of the basin and their implications for the performance of institutions. The fourth section offers an institutional analysis and discusses implications of institutional performance on water-resources management. The final sections propose institutional reforms required for integrated water resources management, discuss actions initiated by IWMI in this direction, and present some concluding remarks.

Sri Lanka Case Study and Its Objectives

Deduru Oya is a seasonally water-scarce river basin in which the agriculture sector is the major water user. There are no critically competing demands from other sectors such as industry, fishery, domestic use, or environment to pose a threat to the agriculture sector. However, the research indicates trends for future competition for water from other sectors, especially from domestic use, environment and industry. The major thrust of the institutions in the basin is to manage the present and future demands for water from different uses such as food production and ecosystem maintenance. In this context, this case study attempts to achieve two objectives.

The first objective is to contribute to international knowledge on poverty eradication, resource conservation, and environmental protection in developing countries. This goal will be promoted through increasing equity and productivity in water use, and by developing and strengthening policies and institutions for improved and sustainable management of water resources. The second set of objectives is specific to Sri Lanka and includes the following:

- Identify policies, support services, and institutional improvements that will lead to improved management of irrigation and other uses of water in the selected basin.
- Support efforts of national and basin-level stakeholders to implement institutional and policy improvements and reforms.

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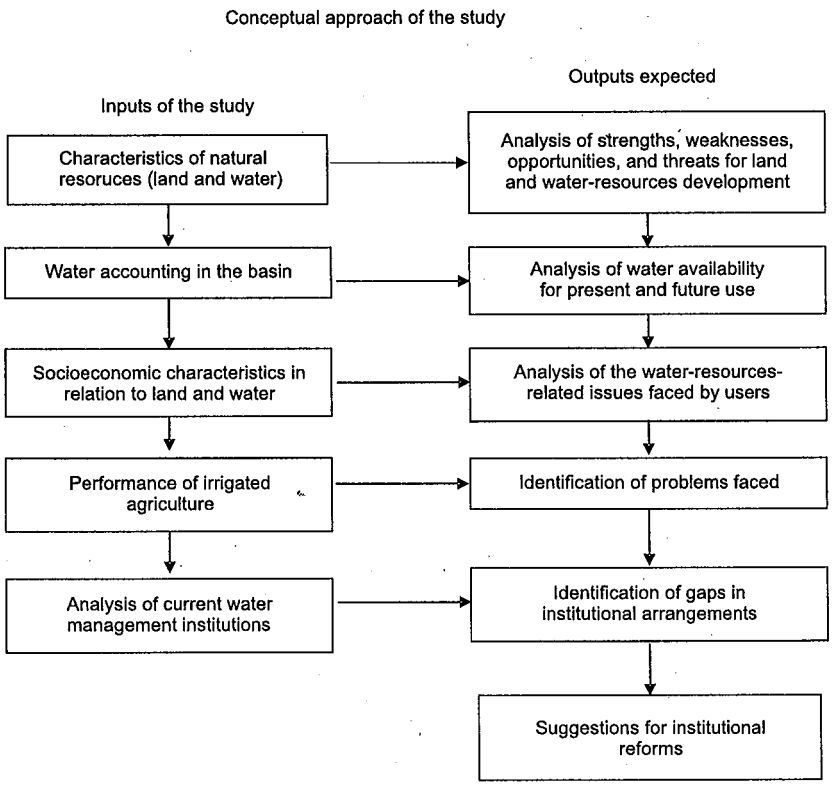
- Develop and validate a replicable methodology combining participatory and technical analyses, which can be used to plan improvements in river-basin management.

This work will also help implement the proposed new water-resources policies formulated by the Water Resources Secretariat (WRS) funded by the ADB.

Methodology

The main purpose of the case study is to help relevant stakeholders to identify the reforms and changes required in existing water-resources management institutions in the basin specifically, and in the country in general. To understand the current performance of existing institutions in managing natural-resources-based development in the basin, several studies were conducted during the first phase of the study. Challenges likely to emerge in the future for the existing institutions in carrying out resources-management functions were also identified through these specific studies. The contributions of each specific study in achieving overall objectives of the main study are shown in figure 1.

Figure 1. Framework adopted in the study.



Description of the Studies

In the context of this study, the main function of the institutions is to manage the human interventions within the natural environment in the basin. As a basis for evaluating the efficiency of the existing institutional mechanism, there is a need to better understand these human interventions and the way such interventions are managed by the existing institutions. The studies mentioned in figure 1 analyzed the institutions to obtain a comprehensive understanding. Examples of human interventions and the nature of the environments in which these interventions are implemented are given in table 1. The following section discusses significant findings and their relevance to the performance of institutions.

Table 1. Examples of human-intervention activities and the related environments.

Environment	Human interventions in the environment
Physical	Development of water resources for various uses, such as agriculture, industry and power generation, etc. Utilization of land for agriculture.
Biological	Utilization of forest resources for various activities, and for animal and human use.
Social	Population increase, social equity, distribution of resources, income generation and livelihood activities.

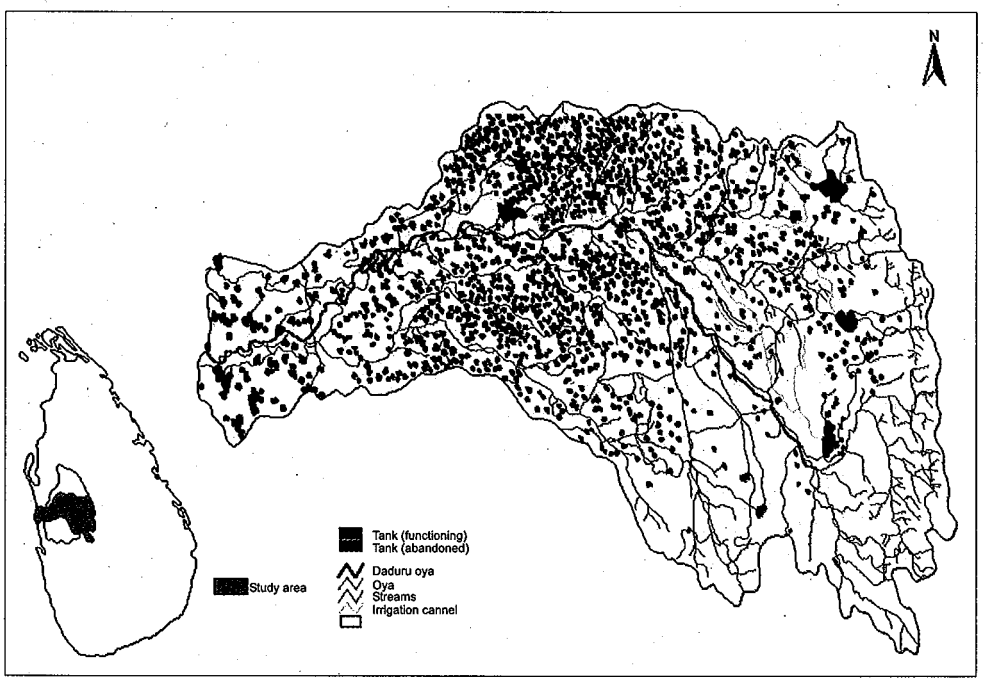
Physical Characteristics of the Basin

Significant Findings

The Deduru Oya basin area covers about 2,700 square kilometers. The Deduru Oya river with 14 tributaries is the main hydraulic feature of the basin. Rainfall is the only source of water and there are no trans-basin diversions into or out of the basin. The average annual rainfall in the basin is about 1,600 mm, ranging from 50 mm in a dry month to 280 mm in a wet month. Rainfall varies spatially, but there are no data from representative geographical locations to support spatial variations in rainfall. Generally, the tail-end and head-end areas of the basin receive comparatively more rain than the middle areas (figures 2 and 3).

The western side of the basin and areas towards the tail-end portion of the basin, with a deep weathered soil profile and sandy soils, are capable of retaining a substantial quantity of groundwater in the regolith. The north-central part of the basin has comparatively thin regolith soil and less groundwater. Salinity and hardness of groundwater are a problem, especially in the western part where the groundwater table is not deep. In the middle portion of the basin, water is contaminated with fluoride and iron. Depletion of groundwater is reported in many parts of the basin due to excessive sand mining of the river. Saltwater intrusion is a serious problem in the tail-end areas where the river has been deepened due to sand-mining activities.

Figure 2. Hydrography of the Deduru Oya basin.



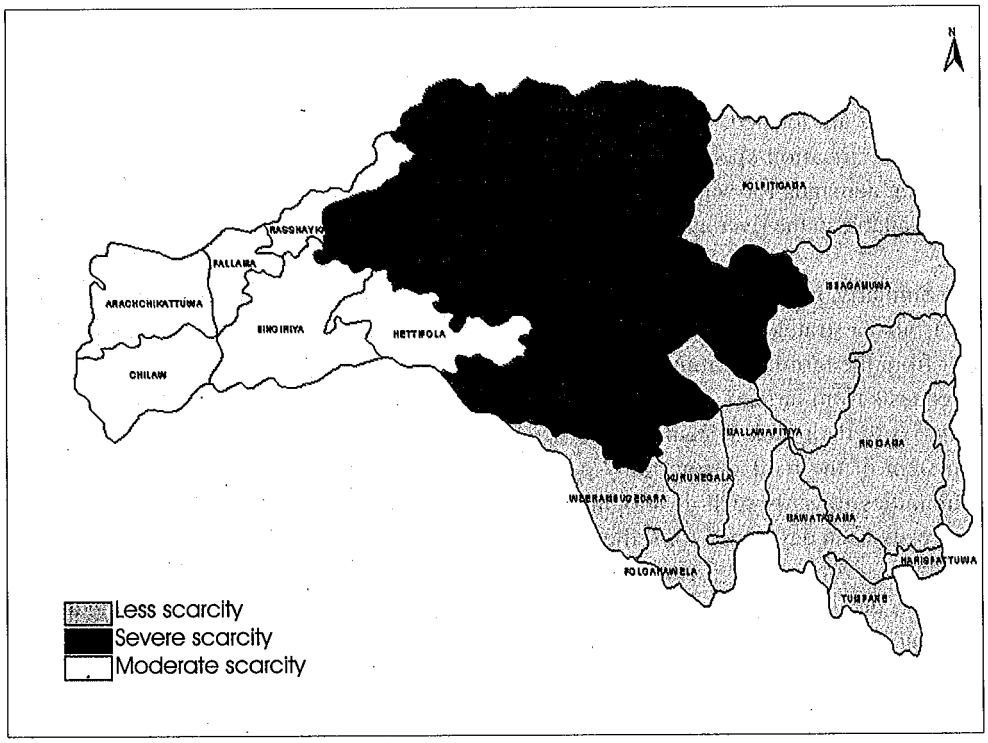
The total land area of the basin is about 262,250 hectares out of which 239,810 (91%) have already been developed and used for various economic activities such as residences and agriculture. The rest, 22,440 hectares, is undeveloped land; of this, except for about 1,500 hectares of barren land, the rest is categorized as forest, wetlands and water bodies. The largest area (36%) of developed lands in the basin is used for coconut cultivation while the second largest (19%) is used for paddy cultivation. The details of land use in the basin are shown in table 1 in the annex.

Water-resources development for irrigated agriculture started in the basin during the days of ancient kings. There is historical evidence for the existence of a large number of small and medium tank systems in the basin. Therefore, construction of tank systems of different scales can be considered to be the first step in irrigation development.

At present, there are four major reservoirs, depending on diversions from the main stream of Deduru Oya and two of its main tributaries, as well as several medium tanks and about 1,500 small tanks scattered through the basin. As a result of tapping almost all the potential surface-water resources for the development of these tank systems, there is little possibility for further development of tanks in the basin. Attempts have been made to increase the cropping intensity in the command areas of tanks through improvement, rehabilitation and water management.

Due to a shortage of surface water for irrigation development, the government and farmer communities have now shifted their focus to the development of groundwater resources and lift irrigation systems for agriculture. IWMI studies in the basin indicate that there are about 5,140 agricultural wells and 2,609 river lift pumping systems in the basin. An increasing trend for the use of these two water sources for lift-irrigation-based agriculture is observed in the basin at present. There are no restrictions by the government authorities on river lift irrigation or construction of agricultural wells for tapping groundwater resources. Figure 3 shows the spatial distribution of water scarcity in irrigation systems.

Figure 3. Spatial distribution of water scarcity in the Deduru Oya basin.



Demand for water by the industrial sector is low due to the slow tempo of industrial development in the basin. The small-scale industries in the basin use water from domestic wells or irrigation canals. Demand for water from the domestic sector is on the increase. However, only about 5 percent of the communities in the basin have access to piped water supplies. The National Water Supply and Drainage Board (the agency with a mandate to create infrastructure for domestic and industrial water use) has constructed about 2,000 tube wells in the basin for domestic use.

Pollution of water in some tributaries, such as the Maguru Oya, poses a major problem for augmenting domestic water supply schemes in some water-scarce areas of the basin. The main reason for water pollution in the basin is the discharge of solid waste and wastewater into natural drains and streams from the urban centers such as the Kurunegala town.

Basin-level water accounting studies conducted by IWMI reveal that about 300–400 million cubic meters (MCM) of water go out of the river basin within a relatively short period of time during the wet season. Table 2 in the annex gives details of water accounting. During the greater part of the year the river runs dry in the middle portion of the basin, below the Ridi Bendi Ela anicut. However, water is available in the tail-end part of the river for the greater part of the year because there is inflow into the tail of the river from some tributaries. Drainage water from irrigation systems located in the middle and upstream areas also flows into the tail portion of the river.

Implication of Hydrological Conditions for Institutional Performance

Managing relatively scarce water resources is the challenge faced by water-sector institutions. Water scarcity seriously affects the middle portion of the basin in which most of the small tank systems are located. Groundwater is also scarce in this part of the basin. This creates a demand for location-specific water-resources-management strategies in the future. With increasing demands for water by other sectors, such as industrial and domestic, allocation of water available in the river and its tributaries will be a difficult task for the institutions managing water.

Similarly, implementing irrigation-development programs that tap the excess water in the river is also a strategically challenging task for the institutions, as there are demands for this water from the farming communities in different locations along the river. For example, there are requests from farmers cultivating under small tank commands asking to divert water from tributaries to their tank systems. Construction of large reservoirs tapping excess water in the main stem of the river during rainy periods would create an unpleasant attitude in farming communities towards such developments. As most of the available land (91%) in the basin has already been developed for settlements, cultivation of coconut and other uses, construction of large reservoirs would seriously affect established settlements with permanent cultivation. Therefore, decision making for water-resources development in the face of competing demands under current socioeconomic conditions is a real challenge for the institutions.

Water management in major tank systems is reported to be satisfactory at present. However, with increasing demand for water by other sectors, the irrigation sector will have to compete for this demand. There will be pressure on institutions to improve the productivity of water resources. Under the circumstances, irrigation users will be required to use water more efficiently and increase productivity of water resources.

Managing limited groundwater resources is another task for the institutions. The full potential of this limited resource has not yet been realized in the basin due to various socioeconomic reasons. However, there are possible threats of deterioration and depletion of this scarce resource due to lack of institutional mechanisms to monitor and regulate groundwater development activities.

Deterioration of surface-water quality is reported from different parts of the basin. This is a serious situation since groundwater in many parts of the basin is not suitable for drinking due to salinity, alkalinity and other problems. If water quality continues to deteriorate at present rates, it will be very difficult to provide drinking water to the people in the basin. At present, there is no institutional mechanism directly responsible for monitoring and regulating water

pollution in the basin. This is a very important task that should be undertaken through water-resources-management institutions in the future. Similarly, river resources are being damaged through sand-mining, brick-making along riverbanks, and other undesirable development activities. These activities are carried out without proper monitoring. This is also an area for intervention to improve water-resources-management institutions.

Socioeconomic Conditions

The total population in the basin is about 1.4 million. The average population density in the basin is 378 persons per square kilometer. Comparatively high population densities are observed in the head end and the tail end of the basin, comprising urban and semi-urban centers. Sixty percent of families in the basin have 4–5 members in each family. Population growth rate in the basin ranges from 1 to 1.5 percent per year. Out of the total population, about 256,000 (39%) are within the 19–45 age group. Educational achievement is high for the populations living in and around towns and urban centers with better education facilities.

Nearly 90 percent of the population in the productive age group are involved in different types of livelihood activities. Only 10 percent are reported as unemployed. The majority of the employed people are involved in agriculture-related income-generating activities (43% in the Kurunegala district and 36% in the Puttlam district). The other income-generation activities of people in the basin are shown in table 3 in the annex. The significance of agriculture as a main income-generating activity is diminishing in many areas of the basin, in the view of community members. The changes in their income- generating activities as observed by the farmers are shown in table 2.

Table 2. Main income-generation sources of the sample householders.

Main income sources	Past 10 years (%)	Present (%)	Change
Agriculture	76	45	Significant
Wage labor	10	14	Moderately significant
Govt./Private-sector employment	11	27	Significant
Livestock	1	1	No change
Foreign employment	1	2	Significant
Self employment	6	17	Significant
Govt. welfare assistance	0	1	Significant

Source: Household survey in small tank systems.

Communities in the basin are multiple water users whose livelihood activities are dependent upon water availability in the basin. They include farmers under major, medium, minor, and lift irrigation systems, those who cultivate paddy and other crop varieties under rain-fed conditions, and cultivators of coconut and other permanent crops. In addition, there are people in the basin involved in livestock keeping and fishing in irrigation systems. Coconut and rice-based industries, brick- and tile-making, and other diverse small-scale industries are also found in the basin.

In addition to different water-use sectors, there are other groups whose livelihood is dependent upon river resources. They include people involved in sand-mining in the river and brick-making along the bank of the river. They too have a stake in the use and utilization of river resources. Their activities are carried out without being properly monitored and regulated in a responsible manner, so that they have already created serious ecological problems like soil erosion, groundwater depletion, and seawater intrusion into the basin.

The total command area under major irrigation systems is approximately 6,000 hectares and accounts for 13 percent of the irrigated area in the basin. Out of four major irrigation systems in the basin, farmers in three systems have no serious problems concerning irrigation water, and generally cultivate two crops a year in many instances. Out of the four major irrigation systems, two systems, Batalagoda and Kibulwana, have 100 percent cropping intensity in both seasons. Out of the two remaining systems, 10-15 percent of the command area in Ridi Bendi Ela is not cultivated with paddy in *yala* (dry season). However, non-paddy crops are cultivated now in the remaining portion of the command area that normally goes fallow in yala. Cultivation of the full command area of Hakwatuna oya major irrigation system is not possible in yala due to water scarcity. The average yield under major irrigation systems is about 3.4 t/ha in yala and 4.4 t/ha in *maha* (wet season). The gross income is about Rs 38,095/ha in yala and Rs 41,000/ha in maha (US$1.00 = Rs 95.00). Farmers in these schemes have a profit of Rs. 20,000 (US$ 210)/ha in yala and Rs. 21,000 (US$ 220/ha) in maha.

Paddy lands under small tank systems cover around 11,000 hectares (26% of the irrigated area under the basin). The number of families cultivating under small irrigation systems is about 36,700. This indicates that the average per capita holding per family is about 0.3 hectare. The cropping intensity under minor tank systems in maha is about 75–80 percent while it is very much less (below 50%) in yala. Agriculture under small tank systems faces problems such as land fragmentation, low yield and low cropping intensity. Due to the less-rewarding nature of paddy cultivation under small tanks, members of the younger generation in these tank villages are not willing to make farming their livelihood. They try to find employment outside the village.

During maha, farmers in the middle portion of the river basin practice shifting cultivation. Though this was a major livelihood activity of the farmers in the past, it is less rewarding due to the nonavailability of lands under long fallow periods suitable for shifting cultivation. In addition to cultivation of paddy under irrigated and rain-fed conditions, most farmers in the basin have some coconut trees, cultivated at least in their homesteads. Coconut cultivation is highly concentrated in the tail-end areas of the basin. While it is a major income source for farmers with large landholdings, it provides a supplementary income to marginal farmers cultivating under small tank systems in the basin. Household survey data in small tank communities in the basin show that the annual income of a household from coconut cultivation ranges from Rs 5,000 to 35,000. However, factors such as drought in yala, lack of programs for

soil and water conservation in coconut lands, land fragmentation, and sale of coconut lands for residential purposes have adversely affected coconut cultivation in the basin.

Livestock keeping is also an important livelihood activity of the people in the basin. Livestock includes mainly cattle, poultry and goats. Poultry keeping has become a major income-earning activity in water-scarce areas like Kobeigane in the middle portion of the basin. However, water scarcity in yala is still a problem for cattle-rearing in the middle portion of the basin.

Another major problem in many parts of the basin is the nonavailability of safe drinking water. Only 5 percent of households have access to piped water supplies. However, most of these schemes do not provide fully treated drinking water. Groundwater in the tail end and middle portions of the basin is contaminated and not suitable for drinking. People in water-scarce areas have serious problems with drinking water during drought periods when wells and streams run dry.

Poverty in the Basin

According to data from the government *Samurdhi* program for poverty alleviation, about 60 percent of families in the basin are below the poverty level and receive government assistance. Pockets of poverty are found mainly in the water-scarce middle portion of the basin. Farmers in these areas can cultivate only one crop a year and they cannot grow permanent crops like coconut due to water scarcity. Due to these reasons they cannot have a regular income throughout the year. The tail-end portion is comparatively rich due to the availability of groundwater for cultivation of other field crop (OFC) and the existence of large-scale coconut plantations. A similar poverty situation is observed in semi-urban areas close to the Kurunegala municipal area. These areas are characterized by smallholdings, unemployment and high population density.

Implication of Socioeconomic Conditions for Institutions

The major challenge for the institutions involved in community development in the basin is to address poverty-related issues in the poverty-stricken areas in the basin. There is a need to launch programs to help youths in the areas to find employment, and create opportunities for poor families to start income-generating activities (mainly nonagricultural ones) through special projects for poverty alleviation. National-level planning may be required in this case, as absorbing the growing population into the agriculture sector is no longer possible due to various reasons. Shortage of land and water resources is one main constraint for expansion of agriculture. Unwillingness on the part of youths to make agriculture their main employment is also a serious constraint. They view agriculture as less rewarding. Institutions managing resources in the basin need to pay special attention to address poverty issues, as poor groups tend to exploit natural resources intensively for their livelihood in the absence of alternative employment opportunities.

Institutional Analyses

A large number of sector-based institutions exist in the country for management of water and other natural resources. These institutions include not just organizations, but policies, rules and regulations. The organizations function at various levels such as national, provincial, district, and divisional, with branch offices. In some cases, power and authority vested in some organizations through ordinances, rules, and regulations have been delegated to provincial, district, or divisional levels for carrying out resources-management tasks. In some cases, authority and power lie with the central government authorities. The main organizations involved in water and other natural-resources management in the basin are presented in table 3.

Table 3. Basic information on organizations in the basin.

Name	Type of organization	Area of jurisdiction
Irrigation Department	National	Irrigation Engineer's (IE) Division
Irrigation Management Division	National	Irrigation Scheme
Department of Agrarian Services	National	Divisional Officers Division (Administrative Division)
National Water Supply and Drainage Board	National	District Level
Environmental Authority	National and Provincial	National and Provincial Levels
Water Resources Board	National	National
Cost Conservation Department	National	National
Pradeshiya Sabhas	Local Government Divisional Body	

In addition to the main agencies mentioned in table 3, there are a large number of organizations indirectly involved in the use, utilization and management of land, water and other natural resources for production. Some of these organizations include the Department of Agriculture, the Department of Animal Production and Health, Samurdhi Authority, Coconut Cultivation Board, Agriculture Development Authority, Forest Department, Cashew Corporation, and Minor Export Crop Development Department. In addition to these sectoral organizations functioning at different levels in the basin, there are three-tier coordination committee systems established to support planning, implementation and monitoring of agricultural-development programs. This committee system includes the Agrarian Development Committees at the grass-roots level, Divisional Agricultural Committees at the divisional level and District Agriculture Committees at the district level. Representatives of government organizations, nongovernmental organizations (NGOs), and community-based organizations in the respective areas attend monthly meetings of these committees.

There are large numbers of branch offices of the main line agencies in the basin area. For example, in nine Divisional Secretary (DS) divisions studied, there are nine DS offices, nine agrarian development centers, nine Pradeshiya Sabha offices, six branch offices of the Department of Animal Husbandry and Health, two offices of the Department of Irrigation and two project offices of the Irrigation Management Division.

International and local NGOs have very limited involvement in the development activities in the basin. A large number of community-based organizations (CBOs), such as Farmer Organizations, Milk Societies, Cooperative Societies, *Kapruka* Societies (coconut growers' associations), Samurdhi groups and Environmental Associations, operate in the basin area. For example, there are 1,225 CBOs in nine DS divisions from which data on institutions were collected.

There are nine major legal acts related to natural-resources management in which water-resources management has been a major component (table 4, annex).

Implications of Institutional Performance for Water-Resources Management

Absence of mechanisms to integrate activities of sector organizations in the basin is seen as the major institutional gap in the existing institutional framework. The existing organizations and legislation are adequate to manage development activities related to water resources. However, a system is required to manage the implications of water-resources development taking place in different location on the basin as a whole. The functions of current organizations are more concentrated on resources utilization and development rather than on managing the implications of development on the environment, its sustainability, and negative impacts on different stakeholders in different locations in the basin. Institutional mechanisms are also required in the present context for productivity of water in irrigated agriculture, which is the main water-use sector in the basin. These circumstances demand changes in institutions for use, utilization and management of water in a basin context.

Initiating IWRM

As discussed in the foregoing sections of this report, the Deduru Oya river basin presents us with a large number of water-resources management problems and institutional weaknesses associated with them. Most of these institutional weaknesses are not specific to the Deduru Oya basin alone but are manifestations of "sector-based development," a mode of development and management of water and other natural resources in the country up to recent times. Therefore, the main focus of the study during the action phase was on the identification of changes required in the existing institutions to address IWRM issues in the basin. Based on the findings of the study, the reforms required in the institutions are proposed in this section with appropriate methods for introducing such reforms. Also the report further discusses the activities initiated so far by IWMI and future actions to be implemented by the Water Resource Secretariat (WRS) for establishing IWRM in the basin.

Changes Proposed in Institutions

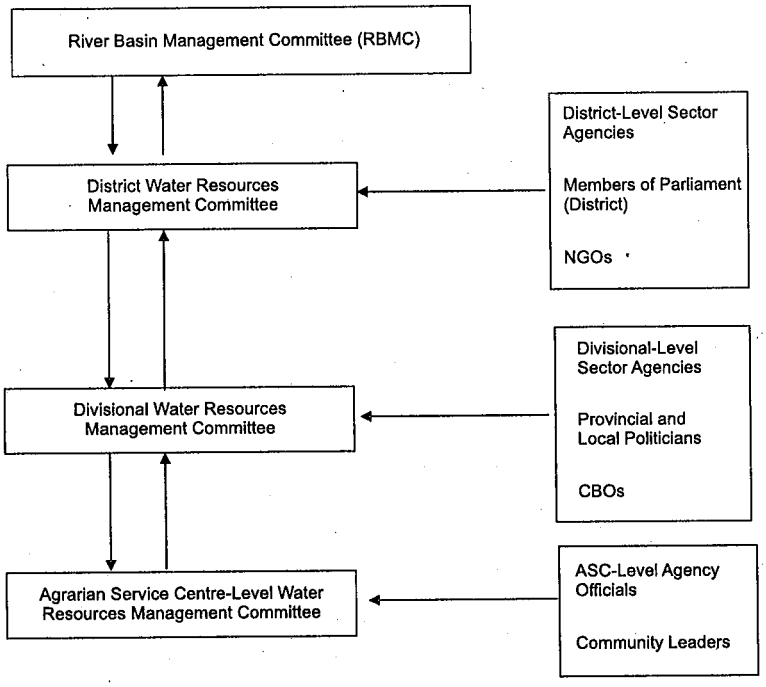
It is widely recognized that effective management of water resources requires basin-level organizations. However, experience with river-basin authorities suggests that they are difficult to sustain (Barrows 1998). This situation is seriously considered in the institutional reforms proposed in this paper. As an attempt in this direction, structural changes that bring vast changes in the existing institutional framework have been avoided to the maximum possible extent in the proposed institutional reforms. Instead, functional changes are proposed in the existing organizations to carry out IWRM activities effectively.

The major structural changes proposed by the WRS are the establishment of the National Water Resources Authority (NWRA), Water Resources Council (WRC), and Water Resources Tribunal (WRT) at the national level. These apex organizations would be responsible for water-resources planning, and for the management and implementation of regulatory measures. They would be independent from those agencies that are responsible for specific water-using sectors like irrigation and domestic water supply. The NWRA is responsible for clearly defined policy and regulatory functions regarding water resources and the WRC for coordination and advisory functions while the main tasks of WRT are to resolve appeals regarding the allocation of water and arbitrate in water-related disputes. The major structural change proposed for the river basin level is the establishment of a River Basin Management Organization (RBO), the institutional framework of which is shown in figure 4.

The RBO is the apex body at the basin level for water resources planning and management. An RBO can be established for one or several river basins and groundwater aquifers (or parts thereof) irrespective of whether they are provincial or interprovincial ones. It can be either a temporary body or a permanent establishment with a limited number of professionals in different disciplines such as hydrology, irrigation management, institutional development, and environmental science. In case the RBO is a temporary body that would withdraw after the establishment of IWRM there should be a central-provincial- or district-level body to take over the functions of the RBO once it is withdrawn. The major functions proposed for the RBO are as follows:

- Preparation of river basin plans—the RBO is expected to prepare a master plan for the river basin/s, under the guidance and assistance of the NWRA.
- Monitoring the activities of other agencies to ensure compliance with river-basin plans and national policy for IWRM.
- The RBO refers appeals regarding the allocation of water and water-related disputes to the WRT for resolving and arbitration.
- Communication with district- and lower-level coordinating bodies on monthly, quarterly or annual bases for effective IWRM in their jurisdictions.
- Maintaining data bases required for basin-management purposes.
- Working with the Central and Provincial Environmental Authorities for water-pollution control.

Figure 4. Proposed new organizational structure for the Deduru Oya basin.



The next level of the institutional framework for basin management is the District Water Resource Management Committee (DWMC) headed by the District Secretary of the relevant district. The proposed DWRC is not a new committee. It is the District Agricultural Committee (DAC) that will be strengthened to handle IWRM activities under the proposed institutional reforms. At present, the DAC comprises district-level officers of agencies involved in agricultural plan implementation and district-level representatives of CBOs like farmer organizations. Under the proposed reforms, the committee will include the district-level officials of the government, provincial and local government agencies involved in the development and management of land, water and other natural resources, representatives of NGOs, private-sector organizations and CBOs. It is necessary to make this committee a legal body with authority and power to plan, implement, and monitor IWRM activities and not just a coordinating meeting. In addition to its present roles and functions related to agricultural plan implementation, it would be responsible for IWRM in the district. The new roles and functions proposed for the DWMC are as follows:

- Responsible for planning, implementation and monitoring of IWRM activities at the district level. It will monitor the activities of other agencies working in the district to ensure compliance with river-basin plans and national policy for IWRM. The issues related to the depletion and deterioration of surface water and groundwater resources, and damages to river resources, will receive the attention of this committee. The NWRA and other relevant government agencies will delegate the power and authority required for implementing IWRM activities to the DWMC.

- Establish links with the RBO and provide feedback on IWRM activities in the district.
- Communicate with the Divisional Water Resources Management Committees that provide feedback on IWRM activities at Divisional Secretary level to the DWMC.

The level below the DWMC is the Divisional Water Resource Management Committee, headed by the Divisional Secretary of the respective DS division under the basin. As with the DWMC, this committee too is not a new one. It is the DS-level agricultural committee that will be strengthened to take up IWRM activities at the DS level. At present, this committee is represented by divisional-level officers of agencies involved in agricultural plan implementation. Under the proposed reforms, the committee structure will be widened to include the divisional-level officers of the national, provincial and local government agencies involved in the development and management of land, water and other natural resources, representatives of NGOs, private-sector organizations and CBOs. Its functions are similar to those of the DWMC. However, as far as field implementation and monitoring of IWRM activities are concerned, this is the most important and crucial level. This committee needs to be strengthened by devolving authority and power vested at national, provincial and district levels, by allocating resources and by developing knowledge and skills of the officers through appropriate training for effective IWRM. Separate units need to be established at this level for monitoring IWRM and other development activities and institutional development for IWRM.

The next level below the DS level is the Agrarian Development Center level. Development committees comprised mainly of farmer representatives and agency officers involved in agricultural development. These committees should establish links with the Divisional Secretary Level Water Management committee through representation. They can represent IWRM issues related to major, medium and minor irrigation systems in a DS division at the DS level. Officers, such as Divisional Officers (DOs) and Agriculture Production and Research Assistants, can play a leading role in the institutional development unit at DS level by providing training on IWRM to various CBOs.

The grass-roots level comprises organizations of resource users. The organizations such as farmer organizations, fisheries associations, and sand miners' organizations can have representatives on DS-level committees and be involved in planning, implementation, and monitoring of development activities within an IWRM framework. The Institutional Development unit to be established at DS level should work closely with these CBOs and strengthen them for IWRM.

Actions Initiated by IWMI to Establish IWRM in the Basin

The major role played by IWMI during the action phase was to create awareness among the key stakeholders about the water-resources problems in the basin as a whole, and how IWRM can contribute to resolving these problems. After a half-day workshop held with the key stakeholder agencies in the North Western Province to discuss the findings of the ADB-RETA diagnostic phase, agency officers proposed that awareness sessions be held at Agrarian-Center level, DS level and at district-level coordinating committees. Based on this request, awareness

meetings were held with Agrarian Development Committees and divisional-level agricultural committees at Ridiyagama, Ganewatte, Wariyapola, Nikaweratiya, Bingiriya and Chilaw DS divisions. An awareness session was held with the DAC at Puttlam. Though the officers were aware of the problems in their areas, they were less aware of the problems in the basin as a whole; hence, awareness creation was required to explain the relevance and importance of IWRM concepts and a river-basin organization as a means to find solutions to these problems.

During the awareness-creation sessions, institutional problems related to water-resources management were discussed in detail. The stakeholders proposed ways and means to overcome these institutional problems by strengthening the existing institutions rather than by creating new ones. It is on the suggestions of the stakeholders that strengthening of the DS level for planning, implementing, and monitoring of IWRM and other development activities is proposed here.

Another main activity during the action phase was to identify new roles and functions for the institutions that would take responsibility for IWRM activities. These new roles and functions were proposed by stakeholders to fill the existing gaps in the institutions.

Actions were pursued to carry out several studies based on the recommendations made by the stakeholders. They included a study on lift irrigation using groundwater and surface-water resources, a study on water quality, and another study to review legal provisions for the North Western Provincial (NWP) Council to set up a basin organization for Deduru Oya, which is an interprovincial basin. Out of these studies, the study on lift irrigation and the study to review legal provisions have been successfully completed. The study on lift irrigation revealed that a large number of agricultural wells and river lift systems are in operation in the basin even though they do not appear in the records of government organizations responsible for their management. As far as groundwater is concerned, there is no agency responsible for monitoring and regulating groundwater extraction in the basin and in the country as a whole. We recommend that the proposed RBOs should maintain the database on groundwater development and river lift irrigation systems and take regulatory measures concerning groundwater extraction. The database developed by IWMI would be a start for this activity.

The study that reviewed legal provisions came out with the finding that there are no legal impediments that would stand in the way of the NWP authorities proceeding to set up a river-basin organization for Deduru Oya. The study on water quality could not be initiated and remains to be undertaken when the Deduru Oya RBO is established.

Final National Workshop and Summary of Findings

Based on the findings of the diagnostic and action phases of the ADB-funded Regional Technical Assistance Study, the following recommendations were made for the Water Resources Secretariat for pilot testing of a river-basin organization and IWRM in the Deduru Oya basin:

- Reviewing IWMI reports and documents related to the Deduru Oya river-basin study. This will create greater awareness of socioeconomic-institutional- and water-resources-related problems in the basin as a whole.

- Taking these conditions into consideration, the Secretariat needs to initiate a river-basin organization for the Deduru Oya basin, with the consultation of provincial and central government authorities.
- Introducing necessary reforms in district- and division-level agricultural committees for undertaking IWRM activities in consultation with the authorities concerned.
- Initiating action through a river-basin organization and coordinating bodies at the district and divisional levels to regulate activities leading to degradation of water resources, such as sand mining, either through special projects or with the involvement of existing organizations.
- Initiating action to prepare a water-allocation plan and decide water rights, taking the prevailing political environment in the country into consideration.

Conclusions

The action initiated so far by IWMI was to facilitate the institutional-development process for the establishment of IWRM in the basin. IWMI believes that implementation of IWRM activities needs to be undertaken by the water-resources-management agencies in the country by introducing necessary changes in the existing institutional framework for sustainability. Institutional changes themselves may not be sufficient. The proposed institutions need to play a leading role in creating a favorable environment for the establishment of IWRM in the country. Awareness creation on IWRM concepts, knowledge, and skill development to undertake IWRM, commitment and attitudinal changes in the institutions and the members of civil society are also required. Above all, political will is of crucial importance for implementing IWRM concepts in the country. Therefore, the work we all have done so far is only the beginning. We have just embarked on a long journey to establish IWRM in the country.

Annex

Table 1. Land use in the Deduru Oya basin.

Land category	Usage	Extent (ha)	Land distribution (%)
Developed lands		239,810	91
	Build up lands	520	0.2
	Homesteads	35,050	13.4
	Tea lands	240	0.1
	Rubber Lands	4,680	1.8
	Coconut lands	95,560	36.4
	Mixed trees	1,950	0.7
	Paddy lands	48,655	18.6
	Sparsely used croplands (chena and highlands)	50,500	19.3
	Planted forests	2,655	1.0
Undeveloped lands		22,440	9
	Dense forest	4,225	1.6
	Open forest	1,155	0.4
	Scrub lands	4,035	1.5
	Grasslands	55	0.02
	Water bodies	11,410	4.4
	Barren lands	1,420	0.5
	Mangroves	90	0.03
	Marshes	50	0.02

Data received from land-use maps, Survey Department, 1989.

Table 2. Details on water accounting in the basin (data in MCM)

Component	1994 yala	94/95 maha	1995 yala	95 /96 maha	1996 yala	96/97 maha	1997 yala	97/98 maha	1998 yala
Climatic condition	Dry	Avg.	Wet	Dry	Avg.	Dry	Wet	Wet	Wet
Gross inflow	1,202	2,071	2005	1,578	1,745	1,558	2,172	3,031	2,010
Storage changes	259	-179	71	9	40	-40	-9	-150	150
Net inflow	1,407	1,891	2,076	1,587	1,785	1,518	2,163	2,880	2,160
Process depletion	615	985	1,019	842	840	968	967	1,109	969
Non-process depletion (beneficial)	245	305	386	205	401	205	392	319	392
Non-process depletion (non-beneficial)	243	196	255	192	485	116	350	135	299
Uncommitted outflow	358	406	416	349	85	230	454	1,318	500

Table 3. Employed persons by major employment groups, 1997.

Districts	Total	Agriculture		Mining & quarrying		Manu-facturing		Electric gas & water		Construc-tion		Trade and hotel		Transport		Other*	
	(000)	%		%		%		%		%		%		%		%	
Kurunegala	554	239	43.2	7	1.2	80	14.5	2	0.4	21	3.83	44	7.9	22	3.9	139	25.0
Putlam	210	76	36.4	5	2.2	43	20.4	-	0.02	14	6.77	25	11.9	10	4.7	37	17.6
All Island	5,608	2,032	36.2	92	1.6	920	16.4	31	0.5	312	5.56	696	12.4	268	4.8	1,257	22.4

*Other activities include individual services, real estate, insurance and miscellaneous.
Source: Department of Census and Statistics: District Profile of Labor Force 1997.

Table 4. Existing rules and regulations for water-resources development and management.

Enactment	Date	Key provisions	Agency/Agencies responsible for implementing legal provisions
The Irrigation Ordinance No.32	1946	The Irrigation Ordinance provides the regulations for the Divisional Secretaries to prepare plans for new minor irrigation schemes or introduce changes to existing schemes. The approval of the Minister is required to prepare plans for major irrigation schemes under the terms of this ordinance. The ordinance also provides for holding cultivation meetings in major irrigation schemes. There are provisions to take seasonal cultivation decisions at a special meeting of an Irrigation Management Division Project Committee (IMD PC) attended by the Divisional Secretary.	Minister of Irrigation, DS, IMD PC
The Crown Land Ordinance (The State Land Ordinance)	1947	The right to use, flow, management, and control of any public lake is vested in the state under this ordinance. It makes a distinction between public and private waters. Part IX of the ordinance provides for the regulation and control of public waters and streams through a system of permits. Water for irrigation is exempted from license requirements.	DS
The Electricity Act No.19 (as amended)	1950	This Act provides for licensing installations for the generation of electricity. These licenses confer all rights necessary for the purpose of electricity generation, including rights to use water.	Ministry of Irrigation and Power

Continued

Table 4. Continued.

Enactment	Date	Key provisions	Agency/Agencies responsible for implementing legal provisions
The Soil and Water Conservation Act	1951	This Act empowers the Minister of Agriculture to declare areas subjected to soil erosion as erodible areas. The Minister may make regulations applicable to these areas requiring the owners of land to take measures to afforest the banks or watercourses or to maintain a strip of land along the banks of watercourses free from cultivation.	The Minister of Agriculture
The Agrarian Service Act (as amendment and continuation of the Paddy Lands Act No.1 of 1958)	1979	Provides for tenure security in irrigated lands and sound management of agricultural activities and water in small tank systems through Agrarian Service Committees and Farmer Organizations.	Commissioner of Agrarian Services
The Mahaweli Authority of Sri Lanka Act, No. 23 (as amended)	1979	This Act empowers the Mahaweli Authority to use and develop the water resources of the Mahaweli river.	The Mahaweli Authority
The National Water Supply and Drainage Board Act No. 2 (as amended)	1974	This Act empowers the National Water Supply and Drainage Board (NWS&DB) to direct and use water to provide water supply for public, domestic and industrial purposes without other approval.	The NWS&DB
The National Environment Act (as amended)	1988	Provides for environmental pollution control, including the pollution of water and protection of sensitive habitats such as lagoons and lakes.	The National Environmental Authority (authority over some activities has been delegated to Provincial Environmental Authorities).
Participatory Irrigation Management Policy	1988	Provides direction for handing over of full responsibilities over O&M and resource mobilization below distributary canals to farmer organizations.	Irrigation Management Division and Irrigation Department

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