ALLOCATION OF WATER AMONG DIFFERENT WATER-USE SECTORS IN SRI LANKA: LESSONS OF EXPERIENCE

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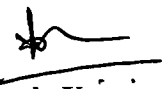
Foreword

As freshwater is becoming a scarce resource, competition has already developed. Besides the well-known disputes and conflicts over limited water supply at international level, there is an increasing competition over water within the irrigation sector and between different water-use sectors (drinking water, hydro-power, industries etc) within Sri Lanka has often reported. The challenge that we face now is not primarily a technical one; rather it is political, institutional and social. The major challenge is developing an appropriate policy and institutional framework for effective management, allocation and protection of the water resource. The policy and institutional arrangements are more specifically vital during water scarcities.

The national policy of water resources management and institutional arrangement has been the subject of water sector though it is not being properly placed on the agenda yet. The process adopted in the formulation of the national water policy had undergone severe criticism and agitation by various groups and political parties, which created a vacuum in the country's water policy arena to date.

Abstraction of water from irrigation schemes for drinking and other purposes has been on an increasing trend and emerged as a political and social sensitive matter. Conflicts have been reported in many places causing loss of livelihoods, constrained to improve well-being of the people and delays in development activities. Lack of coherent policy to share the water is the main reason for the situation.

I wish to congratulate the authors of this report for undertaking this valuable piece of research, which provides much insight to the experiences of water allocation systems practised in the country in selected locations. The findings discussed in the report in the background of social, economic and political perspectives are very important lessons to manage the water resource of Sri Lanka on a more equitable and sustainable basis.



Kamala Uyanwatta
Chairman of the Board of Governors, HARTI

15th November, 2008

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Aheeyar is responsible for chapters 1, 2, 4 and 6, while Nanayakkara and Sidath Bandara wrote chapter 3 and 5 respectively. Chapter 7 was written jointly by the authors. However, all the chapters were read and discussed by all three authors in preparing final version of the report.

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November, 2008

Executive Summary

Background

The presence of ample water resources in Sri Lanka nonetheless, high variability in temporal and spatial water availability complicates the water supply situation. Precipitation is mainly confined to about five to six months in a year and varies from less than 1,000 mm to more than 5,500 mm per annum. Nearly 80 percent of the annual flow of the dry zone rivers occurs in the four month period from October to January. Increasing population, urbanization, climate change, pollution of water resources, the process of economic growth, and change of life style complemented with some other factors are expected to further intensify the problem of water scarcity in the coming years. Farm irrigation accounts for over 85 percent of the tapped water resources and the corresponding figures for people (drinking and sanitation) and industry are 6 percent and 5 percent respectively.

In the circumstances, the problem of water allocation among the sectors has emerged as a growing problem in Sri Lanka, warranting immediate policy intervention for the sustainable and most feasible utilization of the tapped water resources. The water allocation problems (surface and groundwater) in the past were addressed via both *ad-hoc* and systematic procedures by the relevant stakeholders. However, it has been reported that allocation mechanisms have resulted in many problems of co-ordination and conflicts. The documentation on the implications of past interventions in the socio-economic conditions of the affected communities and the lessons of experiences are useful for the formulation of a sustainable water policy to avoid the envisaged future water crises.

The findings of this report are based on three case studies conducted on water allocation at Thuruwila (between agriculture and drinking water needs), Kalthota (between agriculture and hydro power generation) and Krindi Oya Irrigation and Settlement project area (between agriculture and livestock water needs) and the review of literature on water allocation policies in selected countries.

Lessons from Water Policies of Selected Countries

Many countries including neighbouring India have legally enacted water policies to address the issues of water resources planning, development and management. More specifically water allocation priorities during the periods of water scarcities and arrangement for adjudication of water disputes and the established institutional arrangements to solve the water conflicts are well in placed based on the national water policies of the respective countries. The Chilean experience shows how the allocation of water through markets in tradable water rights has increased the insecurity of the collective, indigenous systems. Water rights are clearly established for allocation in Australia which establishes the priority of domestic and livestock uses over industrial purposes. Currently, in Sri Lanka there is no policy on water allocation from major water bodies or streams for diverse purposes. The Government decides on allocation for various purposes on a case by case basis or when a dispute occurs. There are no accepted principles on allocation resulting in *ad-hoc* decision making. A serious limitation in Sri Lanka is the absence of an institutional arrangement for conflict resolution. Present scenario provides clear advantages to the powerfully vested interests at the expense of the rural farmer whose rights have not been secured through a clearly enunciated water policy.

Water Allocation between Agriculture and Drinking Water Needs

The study at Thuruwila was conducted to ascertain the experiences gained in the water sharing arrangement made between the Thuruwila irrigation scheme and the Anuradhapura drinking water

users. Sample population selected from Thuruwila comprises mainly the smallholder subsistence farmers involved in paddy cultivation in both seasons. Majority of the sample respondents of Anuradhapura do not own agricultural land and they are mostly involved in white-collar jobs.

Majority of the Thuruwila farmers objected to the diversion of water from Thuruwila tank to cater to the drinking water demand of the Anuradhapura town area, at the initial stage of the project, but later they have changed their stance. Lack of proper information from authentic sources about the project, has led to this initial resistance. Some "interested parties" have attempted to exploit the under-informed farmers to achieve some of their vested interests. The verdict in the fundamental rights case filed against the project by the civil society legally ensured the rights and privileges of all parties concerned. The Supreme Court was very concerned about the poor quality of drinking water, the related health issues and the inundation of land in Thuruwila area. Mutually agreed solutions given by the Supreme Court is a win-win situation for all the stakeholders including the drinking water users, the farmers, NWSDB and ID. The clear message to the project is the need of transparency in project implementation in order to avoid the public mistrust about the project.

The drinking water project has generated considerable advantages for the beneficiaries in improving the economic and social welfare, especially among women and children. The majority of the farmers do not see any negative impact of the project on agriculture production and productivity.

The first priority accorded in water allocation for both Thuruwila and Anuradhapura during water scarcities is drinking, followed by sanitation. Water for agriculture is the third priority in Thuruwila. In Anuradhapura, it is the fourth priority as water for ecology has gained third place.

Water Allocation between Agriculture and Hydropower Generation

Farming paddy at subsistence level in both seasons is the primary source of income for the people in Kalthota. Irrigated farming is boosted by a high input of water to undertake water intensive paddy cultivation, but some limitations of water supply have been imposed after the construction of the Samanalawewa reservoir. The water duty of the Kalthota Irrigation Scheme (KIS) is in the range of 10-13 ac.ft, which is more than double the average consumption of most of the well performing irrigation schemes. Habitual use of water due to farmers' traditional attitudes, higher percolation losses in the fields, poor condition of irrigation infrastructure, extended period of continuous water issues for land preparation and other problems in water management have contributed to the higher water duty. A competition for water between agriculture and hydropower generation persists in KIS (located in upper part of Walawe river basin) after the construction of the Samanalawewa reservoir for hydropower generation.

Under the water sharing arrangements between the ID and the CEB, Kalthota farmers are entitled to get 40 Mm^3 of water per year for paddy cultivation in addition to the water from dam leakages. Although Samanalawewa power plant expected to generate on average 300 GWh electricity annually, the generated power in the past ranged between 220 -235 GWh per annum. The under-utilization of the power plant for lack of water is especially evident during dry seasons. In economic terms, the ratio between the value of economic return of one cubic meters of water used for paddy cultivation and hydro power generation is 2.77 in year 2007. In other words, the reduction of the amount of water used for the cultivation has an added advantage of producing hydropower by 2.77 times. The CEB made efforts in the past with little success to promote the System of Rice Intensification (SRI) and the 'Nawa kekulam' methods of cultivation to reduce the water usage for paddy cultivation. They also provided tractors to the tenant farmers in the area to expedite the land preparation in an attempt to cut short the continuous water issue period, since land preparation in KIS took about 21-28 days.

In 1997, the CEB proposed and put in place a compensation scheme for the farmers in lieu of their irrigation right of *yala*. However, it was rejected by the farmers after two seasons due to

socio-cultural reasons, problems of managing the one off compensation money at household level, lack of income for tenant farmers and insufficient income for small land owners because of the pausing of opportunities to hire out their labour.

Water sharing arrangements in KIS have a positive impact as their water share is assured even during dry seasons and the farmers are slowly adopting the rotational water issue system. Nevertheless, water duty is still over 10 ac.ft. About 75 percent of the farmers do not want to get back into the compensation programme. Therefore, a strict water management programme is needed for the area in order to change the attitudes of the farmers and improve the system efficiently. All the beneficiaries have opted for the drinking water need as their first priority in the allocation of water during water scarcities, while by water for sanitation is another priority.

Water Allocation between Agriculture and Livestock

Water and land scarcity for livestock rearing have been problems since the inception of the Kirindi Oya Irrigation and Settlement Project (KOISP). But this pursuit was one of the important components of the integrated farming system practised by the 'old system' farmers. Income earned from livestock enterprise accounts for 35-60 percent of the total household income for 50 percent of the sample livestock farmers.

Farmers in the 'old system' area of KOISP suffered water shortages not only due to destruction of traditional irrigation tanks and ponds, but also the priority allocation of almost 70 percent of Lunugamwehera reservoir water to 'new system' areas. Livestock enterprise was not recognized by the project appraisal and the basic thrust of the KOISP was for irrigated agriculture. The project converted the forest scrub lands traditionally used for livestock rearing into crop land disregarding the basic needs of the animals. This is a clear example of non-recognition of the multiple use of land and water resources at the basin level.

This land use pattern and the reduced fallow period resultant in the increased cropping intensity in the area aggravated the problem of food and water for livestock pursuits and the livestock production and productivity dropped. Difficulties encountered in rearing livestock under the traditional free range system increased the cost of production and reduce the income. Conflict between the livestock farmers and crop growers has been a common phenomenon in sharing land and water resources. However, authorities have hardly made any attempt to address the problems confronting the livestock farmers possibly through introduction of hybrid animals and intensive methods of rearing, which needs less space for animal rearing. These issues are expected to further aggravate with the ongoing augmentation of Lunugamwehera reservoir through Menik Ganga diversion at Weheragala. The augmentation project anticipates to increase the cropping intensity and grazing lands would be hard to find. Although the present project has recognized some of the multiple uses of water in the basin such as ecological needs, downstream drinking water requirements and importance of maintaining an up-stream small tank system but again overlooked the livestock enterprise in the area.

The process adopted in sharing of water in Krindi Oya basin is a failed attempt, which has caused inequality in water sharing between different types of water users. The rights of rearing livestock prevalent under the traditional management system have been denied by the authorities and the problems of the livestock farmers yet remain to be addressed. The first water allocation priority of livestock farmers in the area during water scarcities is drinking followed by sanitation, livestock rearing, agricultural activities, ecological needs and industrial requirements.

Policy Implications

Lack of a comprehensive water resources management policy and the non-existence of an implementing authority to ensure the equitable access to water to fulfill the basic needs of all stakeholders are being identified as one of the major drawbacks in addressing the problem of

growing competition for water between different sectors. It is vital to set up an apex body for inter-sectoral coordination and decision making in the water sector. Lack of integrated and multi-objective planning of available water resources seriously affects the fair and equitable access to water for different users and leads to crises and conflicts in the allocation of water. Re-allocation of existing water shares is socially, culturally, economically and politically very sensitive. Therefore, transparency in project implementation is vital in order to avoid the public distrust about the project. Lack of integrated and multi-objective planning of available water resource seriously affects fair and equitable access to water by different users and lead to conflict and other side effects of the allocation of water.

The water scarcity is expected to worsen in irrigated agriculture, because of the abstraction of water for drinking purpose. It has been substantially reduced in the past by the improvement of irrigation infrastructure, adoption of water saving management practises such as rotational water issues and implementing cropping calendars and the change of the attitudes of farmers from habitual water usage. Provision of safe water has significantly improved the social and economic well-being of the beneficiary community.

The first water allocation priority during water scarce dry periods is provision of potable water, followed by sanitary requirements in all case study areas. However, conflicts are experienced in many places in drinking water supply projects including Thuruwila, when the extracted water is made available to the areas outside the original source of water overlooking the users in the area covered by the source.

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Abbreviations

ADB	-	Asian Development Bank
AGTWS	-	Anuradhapura Group Town Water Supply Scheme
GDP	-	Gross Domestic Product
GOSL	-	Government of Sri Lanka
HARTI	-	Hector Kobbekaduwa Agrarian Research and Training Institute
ID	-	Irrigation Department
KIS	-	Kalthota Irrigation Scheme
KOISP	-	Kirindi Oya Irrigation and Settlement Project
MASL	-	Mahaweli Authority of Sri Lanka
MCM	-	Million Cubic Meter
NCP	-	North Central Province
NWSDB	-	National Water Supply and Drainage Board
OFC	-	Other Field Crops
O&M	-	Operation and Maintenance
tmcft	-	Thousand million cubic feet

Glossary

Acre Feet: The amount of water required to cover one acre one foot deep. Also abbreviated as ac-ft.

Attam: A traditional system of unpaid reciprocal labour exchange

Aquifer: A water bearing stratum of permeable rock, sand or gravel.

Basin: Area drained by a river and its tributaries.

Beneficial Use of Water: The use of water for any beneficial purpose. Such uses include domestic use, irrigation, recreation, fish and wildlife, fire protection, navigation, power, industrial use, etc. The benefit varies from one location to another and by custom. What constitutes beneficial use is often defined by a statute or court decisions.

Catchment area: Area of land surface producing run off, drainage area of a stream, river or lake (also see 'river basin' and 'watershed').

Chena: Chena is variously defined as shifting cultivation, slash and burn cultivation, dry farming or swidden cultivation.

Dam: A structure of earth, rock or concrete constructed across a valley for impounding water or creating a reservoir.

Discharge: The amount of water flowing past a location in a stream/river in a certain duration usually expressed in litres per second or gallons per minute.

Estuarine Waters: Deepwater tidal habitats and tidal wetlands that are usually enclosed by land but have access to the ocean and are at least occasionally diluted by freshwater run-off from the land (such as bays, mouths of rivers, salt marshes, lagoons.

Estuary: This zone is along a coastline where freshwater system(s) and river(s) meet and mix with a salty ocean (such as a bay, mouth of a river, salt marsh, lagoon).

Flood: A flood is an overflow or inundation that comes from a river or other body of water and causes or threatens damage. It can be relatively high stream flow overtopping the natural or artificial banks in any reach of a stream. It is also a relatively high flow as measured by either gage height or discharge quantity.

Flow: The rate of water discharged from a source given in volume with respect to time.

Groundwater: Water under ground, such as in wells, springs and aquifers.

Groundwater available for annual abstraction: It is the recharge less the long term annual average rate of flow required to achieve ecological quality objectives for associated surface water. The maximum availability is the recharge amount.

Groundwater recharge: Replenishment of groundwater supply in the zone of saturation, or addition of water to the groundwater storage by natural processes or artificial methods for subsequent withdrawal for beneficial use or to check saltwater intrusion in coastal areas.

Irrigation: The controlled application of water for cultivation purposes through man-made systems to supply water requirements not satisfied by rainfall.

Integrated Water Resources Management (IWRM): IWRM is a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital eco-systems.

Maha: It is the wet season or major cultivation season in Sri Lanka extending from October to January and receives monsoonal rains from north-east monsoonal wind.

Yala: Yala is the minor or dry season in Sri Lanka which receives south-east monsoonal rains. Rainfall mainly prevails during the months from March to June.

Natural flow: The rate of water movement passing a specified point on a natural stream. The flow comes from a drainage area where there has been no stream diversion caused by storage, import, export return flow, or change in consumptive use caused by man-controlled modifications to land use. Natural flow rarely occurs in a developed country.

Outflow: Annual natural outflow of surface and ground waters

Purana Village: Traditional villages are locally called as Purana villages

Recharge: Refers to water entering an underground aquifer through faults, fractures, or direct absorption from precipitation and infiltration from streams

Regulated water source: A river system with flows controlled through the use of major storages, such as weirs, locks and dams. Also known as supplemented water sources.

Reservoir: A lake where water is collected and stored until it is needed.

Riparian Water Right: The legal right held by an owner of land continuous to or bordering on a natural stream or lake, to take water from the source for use on the contiguous land.

Riparian zone: A stream and all the vegetation on its banks.

River: A natural stream of water with a considerable volume.

River basin: The area drained by a river and its tributaries.

Run-off: Surface water originating from rainfall entering rivers, freshwater lakes, or reservoirs.

Stream: A general term for a body of flowing water. In hydrology, the term is generally applied to the water flowing in a natural channel as distinct from a canal. More generally, it is applied to the water flowing in any channel, natural or artificial.

Stream flow: The discharge that occurs in a natural channel. Although the term discharge can be applied to the flow of a canal, the word stream flow uniquely describes the discharge in a surface stream course. The term "stream flow" is more general than run-off, as stream flow may be applied to discharge though it is affected or not by diversion or regulation.

Surface Water: Water flowing or held in streams, rivers and other wetlands in the landscape.

Tributary: A stream that contributes its water to another stream or body of water.

Unregulated Water Use: A water source, such as a river system, where no major storages such as dams or weirs, have been built to assist in the supply or extraction of water.

Water Right: A legally protected right, granted by law or tradition, to take possession of water occurring in a water supply and to divert the water and use it.

Watershed: The area of a land that contributes surface run-off to a given point in a drainage system.

Water use (all uses): Use of water for agriculture, industry, energy production and households, including in-stream uses such as fishing, recreation, transportation and waste disposal.

Water use and demand: Water use can be distinguished into three different types. Withdrawals or abstractions where water is taken from a surface or groundwater source, and after use returned to natural water body, consumptive water use or water consumption that starts with a withdrawal or an abstraction but in this case without any return flow. Non-consumptive water use where there is *in-situ* use of a water body (e.g. for navigation, fish, recreation, effluent disposal and hydroelectric power generation). Water demand is defined as the quantity of water requested by users to satisfy their needs.

Chapter 1

Introduction

1.1 Background

Around the world, water is becoming a critical resource for human existence. Even in countries where there is no apparent water shortage, surging populations continue to create an increasing demand for water. The demand comes from all water use sectors, such as agriculture, domestic water supply, industry and environmental conservation. The outcome is a growing competition for water among all water use groups. The competition could be among various farmer groups within a single irrigation system, among the different irrigation systems, or between the irrigation and other water use sectors. Allocation of water to various groups by some common authority is an essential feature in any attempt to equitably distribute scarce resources and resolve conflicts arising from this rapidly increasing competition for water.

Water is likely to be one of the most critical resource issues for the development of Sri Lanka in the 21st century. The demand of water for food production, human needs (drinking, sanitation, commercial and industrial requirements) and to sustain environmental values has been growing in many parts of the country. Competition for limited water supplies and conflicts in sharing water among the different water-users has emerged and is growing. Therefore, a balanced and sustainable approach to development and management of water is mandatory, if the adverse impacts of the impending water crisis are to be avoided.

Sri Lanka being a tropical country receives 108,000 MCM volumes of water per annum from rainfall, based on 75 percent probability. Out of this total volume, about 64,000 MCM of water escapes to the atmosphere as evaporation and evapo-transpiration. Therefore, the total annual replenishable water in Sri Lanka amounts to 44,000 MCM, which includes 40,000 MCM surface runoff flow into 103 rivers and 4,000 MCM goes to recharge the groundwater. Further, the current per capita water availability (at year 2006) amounts to 2200 m^3 and the per capita water availability by year 2025 will be 1,900 m^3 with the stabilized population of 23 million (De Silva, 2004). Therefore, even in year 2025 Sri Lanka will have an annual per capita water availability exceeding the UN limit for per capita water adequacy of 1,600 m^3 per year.

Despite the satisfactory average water availability situation in Sri Lanka, a high variability in temporal and spatial water availability complicates the water supply situation. Precipitation is mainly confined to about five to six months in a year and varies from less than 1,000 mm to more than 5,500 mm per annum. Of the total annual replenishable 44,000 MCM, of water about 22,000 MCM (50 percent of total available water) is available in 15 river basins located in the wet zone, which covers only about 25 percent of the total land area. Mahaweli basin consists of 11,000 MCM of water. The three dry zone river basins of Walawe, Gal Oya and Deduru Oya accounts for 5,000 MCM, while the dry zone covers about 75 percent of land extent. Therefore, it is interesting to note that the balanced 84 river basins (out of 103 total numbers of river basins) contribute only 6,000 MCM (De Silva, 2004). Moreover, in the dry zone rivers, nearly 80 percent of the annual flow occurs in the four month period from October to January (*ibid*).

1.2 Major Causes Leading to Water Scarcity

The demand for water is expected to increase further for various reasons. Important among these are the following.

1. Population growth
2. Urbanization
3. Climate change and pollution of water resources
4. Economic development and change of life style

1.2.1 Population Growth

The first official population census conducted by the British in 1871, recorded a total population of 2.8 million. The total population in 1981 census was 15.01 million and it increased to 18.73 million by 2001. The rate of population growth at present ranges between 1.1–1.2 percent per annum. Population has not spread out but mainly concentrated within the wet zone and the urban centres in the coast. The country's mean population density in 1981 was 230 persons/km^{2}and increased up to 299 persons/km^2 in 2002. The current population density (2008) is 319 persons/km^2.

In the past, water was mainly used for agriculture and other human needs. Food demand for growing population has been soaring along with other human water needs. Agriculture intensification has increased after independence to keep pace with the growing food demand. The gross irrigated extent has increased from 0.3 million hectares in 1960 to about 0.71 million hectares by the end of year 2006. Further expansion of irrigated agriculture is expected to feed the growing population under the proposed and on going irrigation development projects such as Moragahakanda, Wheragala, and Kaluganga.

Production of food grains (paddy) has increased from around 2.4 million tonnes in 1984 to about 3.3 million tonnes in the year 2006. The increasing population demands further rises in food production. The drinking water needs of people and livestock have also to be met. As a result, water which is already a scarce resource, will become even scarcer in future.

1.2.2 Urbanization

Urbanization is taking place everywhere with the growth and expansion of the economy. The largest concentration in urban population, however, has been witnessed around a few large centres. The people living in cities increased from 11 percent in 1871 to 15 percent in 1946 and 21.5 percent in 1981. It has been projected that, the percentage of urban population would increase from 24 percent in 2000 to 42 percent in 2030 (Population Division, 2002).

The NWSDB estimates forecast that the urban population will increase to 8.3 million and 11.9 million by the year 2015 and 2025, which is 45 percent and 65 percent of the country's total population in the respective years (Fernando, 2004) (see table 1.1 below). The projected urbanization and the change of population density would result in a stiffer competition for water, land and other resources in the urban areas.

Table 1.1: Population Forecast (in million)

Year	Urban Population	Rural Population	% of Urban Population
2001	3.2	15.2	17
2004	4.7	14.2	24
2005	5.4	13.8	28
2010	6.9	13.3	34
2015	9.6	11.7	45
2025	15.5	8.3	65

Source: Fernando, 2004

The Department of National Physical Planning has prepared a National Physical Planning Policy and Plan as per provision in the Town and Country Planning Ordinance No.13 of 1946 as amended by Act No. 49 of 2000. The policy and plan have been approved by the National Physical Planning Council chaired by the President. The policy discourages the urban expansion in central environmentally fragile areas and coastal fragile areas and protected areas (forests,

archeological reserves, river and stream reservations etc). The plan advocates the needs of concentrated development effort for areas where urbanization may be encouraged and where opportunities are abundant to lure younger generations (Veranjan Kurukulasuriya, 2008, personal communication). The plan proposes the development of five Metropolitan areas namely, Western Metropolitan area, Hambantota Metropolitan area, North Central Metropolitan area, Eastern Metropolitan area and Jaffna Metropolitan area.

Table 1.2: Projected Population for Metro Cities and District Capitals

City Type	City Name	District Population (2001)	Urban Population (2001)	Target Population	Metro City Total
Metro City	Colombo	2,234,146	1,221,761	3,000,000	
District Capital	Gampaha	2,066,096	301,689	1,000,000	
District Capital	Kalutara	1,060,800	112,715	1,000,000	
Western Metro Region					**5,000,000**
Metro City	Anuradhapura	746,466	56,632	1,000,000	
Metro City	Dambulla	[a]	[a]	1,000,000	
Metro City	Polonnaruwa	359,197	[c]	1,000,000	
Metro City	Trincomalee	383,000[b]	[c]	1,000,000	
North Central Metro Region					**4,000,000**
Metro City	Ampara	589,344	112,422	750,000	
Metro City	Batticaloa	544,000[b]	[c]	500,000	
Eastern Metro Region					**1,250,000**
Metro City	Hambantota	525,370	21,671	1,000,000	1,000,000
Metro City	Jaffna	596,000[b]	[c]	1,000,000	1,000,000
District Capital	Badulla	774,555	52,474	75,000	
District Capital	Galle	990,539	110,654	300,000	
District Capital	Kandy	1,272,463	156,923	150,000	
District Capital	Kegalle	779,774	17,430	50,000	
District Capital	Kilinochchi	143,000[b]	[c]	50,000	
District Capital	Kurunegala	1,452,369	34,719	250,000	
District Capital	Mannar	97,000[b]	[c]	200,000	
District Capital	Matale	442,427	36,352	100,000	
District Capital	Matara	761,236	64,539	100,000	
District Capital	Moneragala	396,173	[c]	100,000	
District Capital	Mulativu	144,000[b]	[c]	50,000	
District Capital	Nuwara Eliya	700,083	43,050	50,000	
District Capital	Puttalam	705,342	65,072	100,000	
District Capital	Ratnapura	1,008,164	58,371	75,000	
District Capital	Vavuniya	142,000[b]	[c]	100,000	
Total		**18,913,544**[b]		**14,000,000**	**12,250,000**

Notes: a - Dambulla is part of Matale District
b - Estimated 2001 population
c - Urban population data not available
Source: Department of Physical Planning (2006)

The proposed national physical plan aims to utilize the finite land resource efficiency to promote sustainable pattern of development. Over 25 percent of the country's population is concentrated within one kilometer of the coast, which constitutes only 5 percent of the land area (National Physical Planning Department, 2006). The National Physical Plan proposes three metro regions

which include an interconnected network of metro cities, district cities, towns and villages surrounded by rural areas and open space.

The Western Metro Region includes Colombo as a metro city supported by the district cities of Gampaha and Kalutara. The metro cities of Anuradhapura, Dambulla, Polonnaruwa and Trincomalee will work together to form the North Central Metro Region. Batticaloa and Ampara will be the focus of the Eastern Metro Region, while Hambantota and Moneragala is the focus of the Hambantota Metro Region. A network of well planned metro cities will have a population of at least 1 million and provide urban services of higher standard, amenities and facilities for the needs of their wider hinterlands. The metro cities will provide a high-quality urban environment to live in. The proposed development plan alters the current water use pattern and demand for water among the different sectors in the metro cities

1.2.3 Climate Change and Pollution of Water Resources

Sri Lanka as a small island has been identified by UNFCCC and IPCC as a nation under serious threats from climate change impacts, such as the sea level rise and severe floods and droughts (UNFCCC, 1992; IPCC, 2001). The global average surface temperature has increased from 1860s to 2000 by about 0.61 °C in the range of 0.4 to 0.8 °C. Fernando and Chandrapala (1992) observed that, ambient temperature has recorded increases in all meteorological stations in Sri Lanka during 1961-1990. The rate of increase of mean air temperature in Sri Lanka in the reference period is in the order of 0.016 °C per annum or 1.6 °C per 100 years (Chandrapala, 1996a). The maximum rate of increase of night-time annual mean minimum air temperature is reported to be about 0.02 °C per year at Nuwara Eliya (Basnayake, 2007). The temperature change figures indicate that the rate of temperature increase in Sri Lanka is much higher than the global average.

According to UNFCC (2000), "Global warming is expected to lead to a rise in sea level, higher temperature, more frequent and prolonged droughts, high intensity rainfall and increased thunder activity in Sri Lanka. These anticipated changes represent a significant threat to the coastal areas, the different sectors of the national economy and human health". The increase of ambient temperature leads to an increase in the atmospheric water demand and subsequently increases the potential evapo-transpiration. Therefore, crop water requirements also have to increase to compensate for the increase in atmospheric water demand which will substantially affect irrigation water withdrawals.

An analysis of district-wise average annual rainfall during the period 1931-60 and 1961-90 shows that, the average annual rainfall received in the districts belonging to the upper and middle water sheds has dropped substantially causing considerable impacts on the downstream water users in the dry zone areas (Jayathilake et-al, 2005). Average annual rainfall in Sri Lanka came down by about 144 mm, about 7 percent, during the period from 1961-1990 compared with that for the 1931-1960 period (Chandrapala, 1996b). Although Sri Lanka has experienced droughts once in a decade or so since 1930s, droughts have tripled after the year 2000 indicating the increase in the drought frequency (Ariyabandu, 2005). It has been predicted that, the rainfall expected from the North-east monsoon will be reduced in the future by about 26-34 percent, especially in the dry zone districts of Anuradhapura, Trincomalee, Batticoloa, Jaffna, Mannar and Vavuniya. Conversely it has been estimated that, the rainfall from south-west monsoon in the wet zone areas will increase by around 38 percent. In Colombo, Galle and Nuwara Eliya, the rainfall is predicted to increase by 43-57 percent (De Silva, 2006). With the change of future rainfall pattern, wet areas become wetter and dry areas become drier. The increased intensity of rainfall will not be much useful for crop cultivation, as it will be mainly in the form of high intensity erosive rains due to enhanced convection. In the circumstances the increased rainfall in wet zone areas is likely to create serious water management problems such as floods and landslides.

Sri Lanka has a long coastline of about 1660km. Sea level rise triggered by climate change is expected to pollute fresh water resources through increased sea water intrusions into low-lying areas and inundation. Excessive sand mining of rivers and depletion of groundwater in coastal aquifers through excess pumping also have caused salt water intrusions in many areas. Tsunami disaster of 2004 has damaged about 40,000 dug wells and the long term sustainability of these wells in the coastal sand aquifers has been questioned (Illangathilake et-al, 2006).

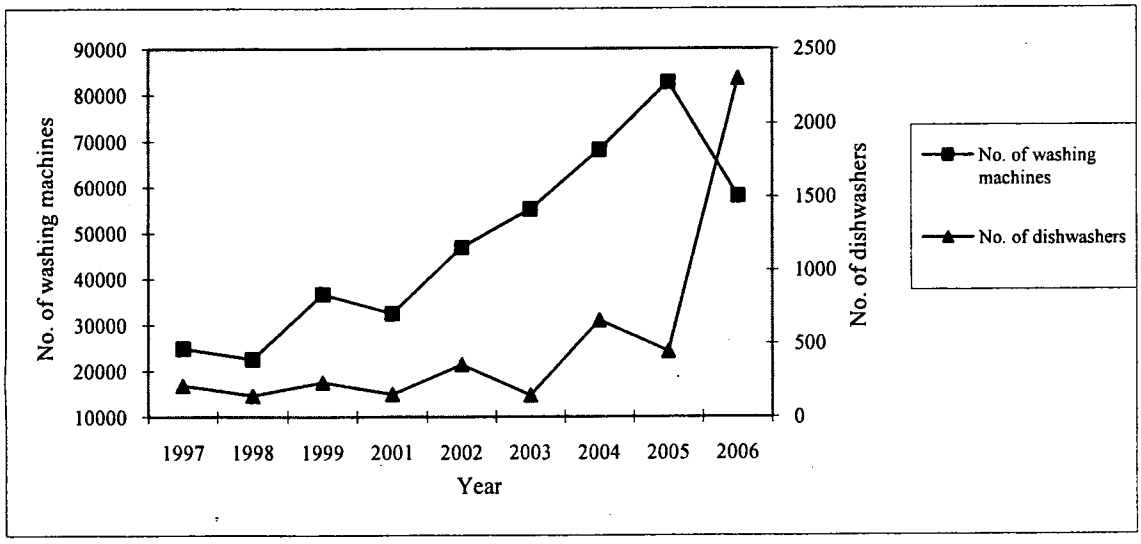
Fresh water resources in Sri Lanka are polluted by the extensive use of fertilizers, herbicides and insecticides in agriculture, grease and toxic chemicals from urban run-off; sediments from mines and construction sites and dumping of solid waste in open spaces. The use of fertilizers in Sri Lanka is the highest in the South Asian region, though it is much lower than in many developed countries (World Bank, 1992). According to the records maintained by the Registrar of Pesticides, the import of pesticides (insecticides + herbicides+ fungicides) had increased from 4,000 metric tones to 6,000 metric tones during the period from 2000 to 2006, which is a 40% increase (Vidanapathirana and Rambukwella, 2008). Pollution of water resources is likely to accelerate with increased urbanization, industrialization, intensive agriculture and other development programmes.

1.2.4 Economic Development and Change of Lifestyle

Water is essential for sustainable development of the country. The economic development of Sri Lanka has registered an upward trend and the per capita income is also on the increase following the strides made towards development. The per capita GDP in 2002 was 858 US$ and it rose to 1025 US$ in 2004 and 1,617 US$ in 2007. Therefore, more people have reached a higher standard of living which in turn has made an upward swing in the per capita water demand. If the current economic growth continues, there would be major changes in lifestyles of the people, necessitating higher water requirements.

According to Biswas (1996), water demand in England is expected to increase by 25 percent, by the year 2020, although the population is projected to remain stabilized. This is primarily because of lifestyle changes in terms of increasing use of washing machines and dishwashers. The trend in the import of washing machines and dishwashers to the country during the last couple of decades is shown in figure 1.1. Increased income level and change of lifestyles demand quality water for drinking and other domestic needs. The local water demand is estimated to increase by 8-10 percent per annum (George, 2005).

Figure 1.1: Imports of Washing Machines and Dishwashers to Sri Lanka



1.3 Statement of the Research Problem

The farming sector needs over 85 percent of the tapped water resources for irrigation and people's needs amount to 6 percent (drinking and sanitation water) with another 5 percent for the industries. In the meantime, the water sector has to respond to the needs of an emerging knowledge based society, which call for improved health, sanitation and a cleaner environment as in the developed world. The government has committed itself to provide access to adequate and affordable safe drinking water and good sanitation for all citizens by the year 2025. In addition, industrialization is being promoted by the government to be globally competitive, while giving priority to fulfill the water needs of wildlife, inland and brackish fisheries, and the bio-diversity of wet lands. Maintenance of a minimum flow for ecological purposes and enhancing the aesthetic beauty of the environment is of primary importance, from a tourism perspective. Although hydropower does not directly consume water, its generation frequently conflicts with other users in allocation. The situation has witnessed the competitiveness for water among different sectors.

According to World Bank (2000), 25 percent of people in Sri Lanka are deprived of safe drinking water. National Water Supply and Drainage Board (NWSDB) of Sri Lanka has estimated that about 90 percent of pipe borne drinking water supply schemes outside of Colombo do not have adequate supplies. Communities especially in rural towns, typically receive domestic water supply for only a few hours a day and new household connections are restricted mainly because of the lack of availability of "raw" water. Water conflicts within agricultural sector have emerged due to the reported water scarcities in several places of the country in the recent past, especially in Anuradhapura and Polonnaruwa districts.

Drinking water scarcity in the dry season 2002 in the Anuradhapura urban areas led to requests for additional water from Kala Oya and water was delivered under the police security to prevent the water from being tapped in between the two points and also neutralize the tense situation (*Lankadeepa* newspaper, 19.08.2002). The water stored in reservoirs in Kantalai, Nuwarawewa, Muruthawela and a few other locations have been used to meet the domestic water supply needs of the major towns such as Trincomalee, Anuradhapura, Weeraketiya etc. The absence of a proper policy/institutional mechanism in the groundwater extraction has caused immense problems in many places related to the quantity and the loss of water in household wells as a result of over-exploitation by a handful of major bulk users of groundwater.

Water sharing among the sectors is a complex issue. In case of irrigated water-users of the country, the depriving of water will result in the loss of livelihood of many smallholder farmers. The needs for drinking, sanitation and irrigation cannot be suspended and alternative sources are difficult to find or economically, technically and environmentally not feasible.

Therefore, the problem of water allocation among the sectors has turned out to be a growing problem in Sri Lanka which warrants immediate policy intervention for the sustainable and most feasible utilization of the tapped water resources. The water allocation problems that emerged (surface and groundwater) in the past were solved adopting both *ad hoc* and systematic procedures by the relevant stakeholders. However, it has been reported that allocation mechanisms have resulted in many problems of co-ordination and conflicts (Wickramage, 2001). No comprehensive studies have been undertaken on the mechanisms adopted in the allocation of water resources among different sectors to solve the problem of competing demands. The documentation of the implications of past interventions on social and economic conditions of the affected communities and lessons of experiences gained are useful for the formulation of a sustainable water policy to avoid envisaged future water crises.

1.4 Objectives of the Study

The major objective of the study is to analyze the past experiences and lessons learned about the water allocation mechanisms adopted among the different sectors in various parts of the country. The specific objectives of the study are,

1. To study the process and methodology adopted to solve competing water demand among different sectors.
2. To examine the social and economic consequences of current water allocation mechanisms practised in the selected areas.
3. To prioritize the allocation of water to competing sectors (water supply, irrigation, industrial, power and environment) during (the periods of) water scarcity.
4. To draw the lessons from current water allocation mechanisms in Sri Lanka and selected countries for future water policy formulation.

Chapter 2

Methodology and Data

2.1 Selection of Study Sites

Study sites were selected from the areas where water allocation mechanisms had been institutionalized to address the problem of competition of water between the agriculture and various other sectors. Different locations were selected to study the different water allocation mechanisms adopted in the past.

I. Anuradhapura Group Town Water Supply (AGTWS) Scheme:
This scheme was selected to study the experience of water sharing arrangements made between the Thuruwila irrigation scheme (Agriculture) and the drinking water supply scheme of Anuradhapura (AGTWS).

II. Walawe River Basin:
Kalthota irrigation scheme and the recently constructed Samanalawewa hydropower project in the Walawe river basin were selected to study the lessons of water sharing arrangements made between irrigated agriculture and hydropower generation.

III. Kirindi Oya River Basin:
Kirindi Oya river basin was selected to study the water sharing arrangements of the Kirindi Oya irrigation and settlement project (KOISP) developed in the Kirindi Oya basin with special focus on conflicts of water and land use between the agriculture and the livestock sectors.

2.2 Description of Study Sites

2.2.1 Anuradhapura Group Town Water Supply Scheme

Anuradhapura is located in the North Central dry zone and classified under DL_1 agro-ecological zone. Average annual rainfall in the area is 1,269 mm. Anuradhapura is a faster growing city earmarked as one of the proposed metro cities and also a major agricultural area of the country. The demand for water at Anuradhapura is therefore very high in keeping with the development activities taking place in the area. The drier environment, low quality of groundwater and the increasing number of temporary and permanent army camps in the area with the on going civil war in the neighbouring districts (North and East) have drastically increased the demand for water.

Anuradhapura drinking water supply scheme first got underway in 1956 and was upgraded in 1972. The scheme has a capacity to release a restricted supply of water for 8-12 hours per day for a population of 56,000 (46 percent of total population). Although the augmentation of the water supply to Anuradhapura was a priority since early 1990s, it was delayed due to the inability of securing reliable and cost effective raw water sources (Jayaweera, u.d.).

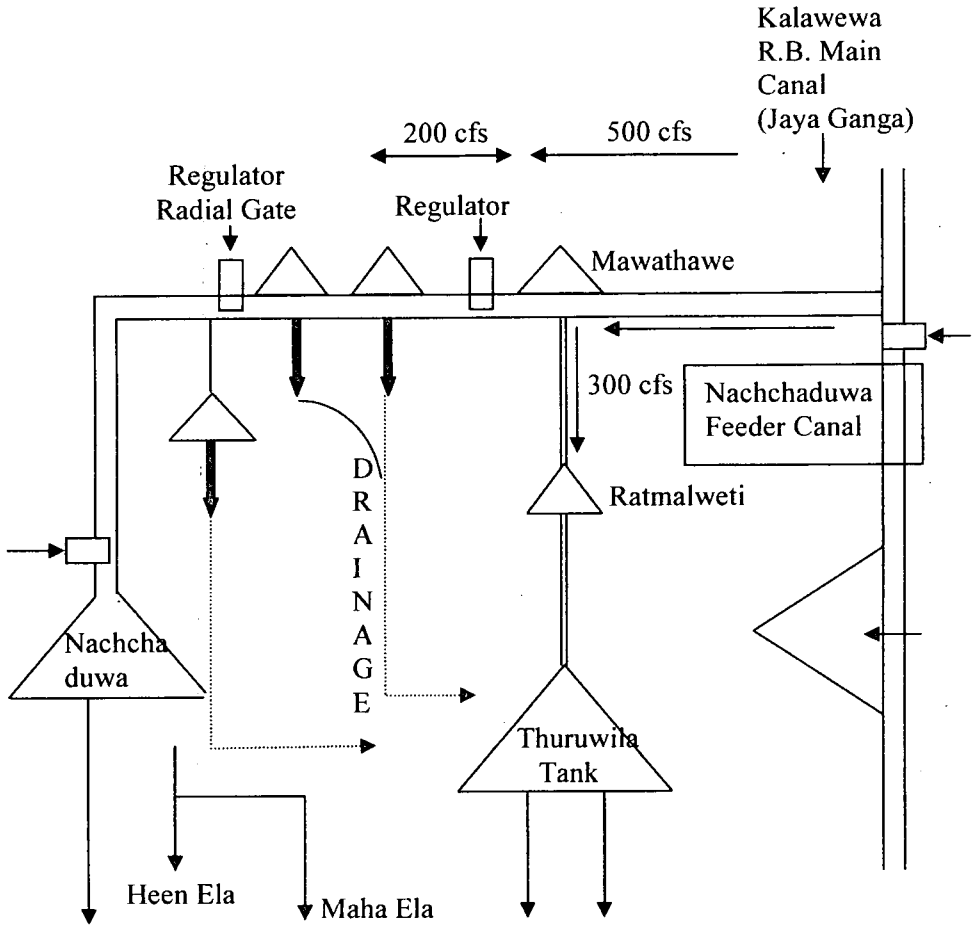
Anuradhapura Group Town Water Supply Scheme (AGTWS) was implemented during the period 2002-2005 as an augmentation to the existing drinking water supply scheme. Thuruwila irrigation tank was selected for the storage of the quota of water received from the Mahaweli project. Agreement to share the water resource was reached between key agencies namely Mahaweli Authority of Sri Lanka (MASL), Irrigation Department (ID) and National Water Supply and Drainage Board (NWSDB).

Thuruwila Project Area

Thuruwila village is located in the southern ward of the Anuradhapura municipality area. It is an ancient village with a beautiful ecological environment similar to that of the wet zone area which is rather uncommon in most the dry zone villages. Thuruwila tank is one of the medium-sized, ancient tanks located in the Thuruwila village and it is operated and maintained by the ID. Before the inception of the drinking water supply project, the tank received water from its own catchment spread in an area of about 38 km^2. The quality of tank water is relatively high. The annual catchment yield is 1,253 ac ft. The tank capacity is 5,190 ac ft. The water yield was sufficient to cultivate the rice crop in both seasons in most of the years. The irrigation command area under the tank is 463 ac, benefiting 350 farmer families.

One component of the water supply project is diverting the Mahaweli water from Nachchaduwa feeder canal to the Thuruwila tank. Schematic diagram of the diversion is shown in figure 2.1.

Figure 2.1: Schematic Diagram of Water Diversion to Thuruwila



Source: Adopted form the project documents maintained by the Irrigation Department

The diversion required improvement and maintenance of the following irrigation infrastructures.

i. Improvements to Nachchaduwa feeder canal to allow additional flow of up to 300 cusec from Amunukola upto Mawathawewa.
ii. Construction of a new canal from Nachchaduwa feeder canal to Thuruwila tank.
iii. Augmentation of Thuruwila tank including head works and lifting the spill by 2 feet.
iv. Improvements to the canal network under the Thuruwila tank.
v. Maintenance of 08 minor tanks directly or indirectly fed by two feeder canals.

2.2.2 Walawe River Basin

The Walawe River Basin is the case for the study of sharing water between the agriculture and the hydropower sectors. The Walawe River which originates from the central hills is one of the important rivers flowing towards the drier parts of the country along a length of 132 km. The Walawe river falls to the sea at Ambalantota. The irrigation project (Kalthota Irrigation Scheme) and the hydropower generation project (Samanalawewa reservoir) are both located in the upper reach of the Walawe Basin.

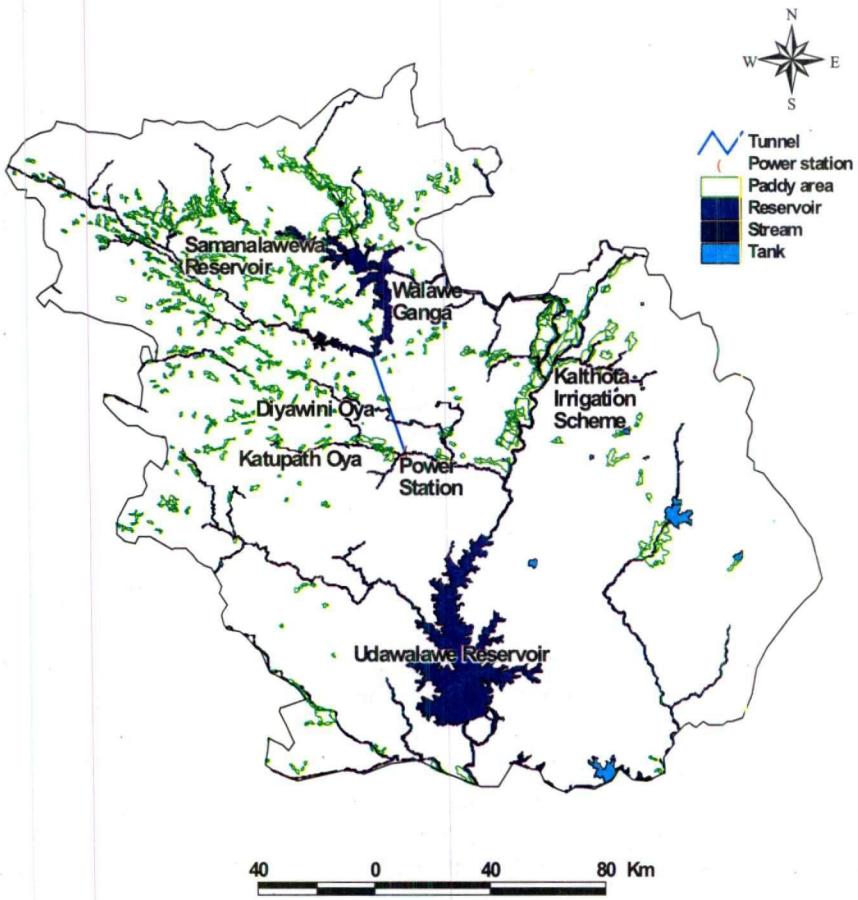
Kalthota Irrigation Scheme (KIS)

Kalthota is located in the Ratnapura district. The Ratnapura district is predominantly a wet zone area, but the Kalthota Irrigation Scheme (KIS) and the settlement areas fall into the low country dry zone (DL1) agro-ecological region.

KIS is an ancient river diversion scheme of the Walawe river renovated in 1892 by the British and expanded in 1956 by the ID to promote agriculture and settle the people from densely populated areas in the district.

The irrigation scheme provides water for about 920 ha mainly to cultivate paddy in both seasons. Over 1,600 farmer families have been settled in the scheme (Imbulana, 2006). The farmers enjoy unrestricted access to water except during a few dry seasons until the impoundment of the Samanalawewa reservoir.

Figure 2.2: Map of the Kalthota Project Area



Samanalawewa Hydropower Project

Samanalawewa reservoir was constructed in 1992 across the upstream of the Walawe river, mainly for power generation. The reservoir has a capacity of 278 MCM and 463.5 m above sea level at its full supply level. A hydropower generation complex of 120 MW capacity was constructed to generate power using the water sent along 5.4 km length of canal. The construction of the reservoir and the hydropower complex obstructs the free flow of water to the KIS. However, considering the historical right the Kalthota farmers enjoy, to use the water, the authorities have agreed to share the water without affecting farmers' farming pursuits in both seasons. Nevertheless, KIS farmers have lost their unlimited sole authority on irrigation water after the project which follows the cropping calendar and rotational irrigation issue as determined at pre-seasonal meeting.

2.2.3 Kirindi Oya Basin

Kirindi Oya river basin is located in the South Eastern dry zone of Sri Lanka. Most of the areas in the Kirindi Oya basin are characterized by arid condition with low rainfall, high ambient temperature, low relative humidity and thorny and shrub vegetation. The average annual rainfall is 1,000 mm and minimum average temperature varies from 26 ^{0}C to 28 ^{0}C. Evapo-transpiration values vary from 110 mm in November to 184 mm in August with an average annual value of 1,765 mm.

Scarcity of water is the most critical problem affecting the livelihood and the overall development of the area. People in the area have been used to an integrated farming system of paddy, subsidiary field crop growing, shifting cultivation, inland fishery, livestock farming and home gardening. Historical evidence shows that, people of Kirindi Oya have depended on Kirindi Oya and the network of hundreds of small tanks in the area for their farming system (Ananda et-al, 1998).

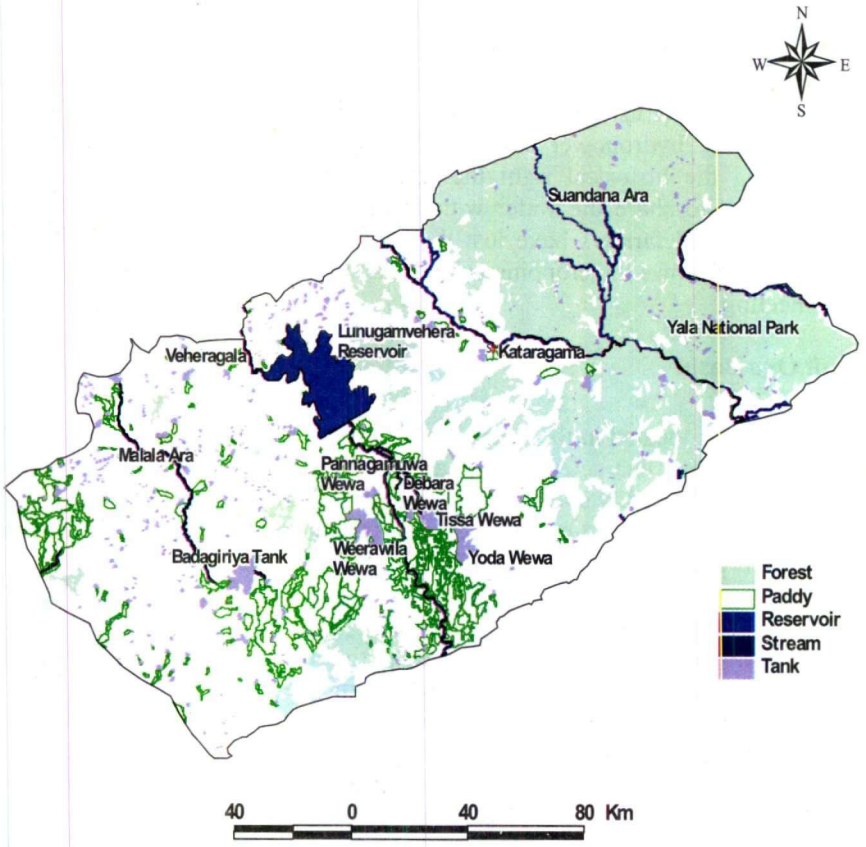
The Kirindi Oya Irrigation and Settlement Project

The augmentation of water resource in Kirindi Oya basin was one of the high priorities of the government in 1980s to address the problem of water deficit in the area and to provide irrigation for more new lands. The Kirindi Oya Irrigation and Settlement Project (KOISP) area consists of the "old area" i.e. the fields cultivated under the old tanks namely Debarawewa, Tissa wewa, Yoda wewa, Weerawila wewa and Pannegamuwa wewa and the "new area" brought into cultivation under the Lunugamvehera reservoir. The old area is fed by Ellagala reservoir anicut system constructed at Kirindi Oya during the 19th century.

KOISP focused more attention on the advancement of the agricultural sector in the area mainly through improvement of the irrigation system in 4,840 ha in the existing "old" area, the increase of the cropping intensity in the new area from 20 percent to 170 percent and in the old area from 140 percent to 170 percent (IRMF, 1995). New area consists of 5,340 ha of land fed through right bank and left bank canals. Although the planned cropping intensity in the old area is attainable, it is not so in the new area for want of water. In addition, 2,900 ha of land in the new area yet remain to be developed due to shortage of water.

In order to overcome the problem of water deficit in Kirindi Oya, diversion of Menik Ganga through a trans basin canal from the newly constructed Weheragala reservoir across the Menik Ganga basin is now in progress. This diversion project does not intend to open new lands for irrigated agriculture, but expected to increase the cropping intensity in the new area of the KOISP.

Figure 2.3: Map of the KOISP Area



2.3 Sampling Design

In Anuradhapura and Thuruwila, sample households were selected from domestic water-users and irrigation farmers respectively. The beneficiaries of the AGTWS scheme residing along the Airport road who received water supply connection under Thuruwila water diversion before 2005 were used as sample population. Forty seven sample beneficiaries were chosen using the linear systematic sampling method.

Sample irrigated farmers were selected from D1 channel, FC5, FC6 and FC7. About 43 farmers were selected out of 64 using stratified random sampling techniques and considering the head and the tail difference of channels. The sample size therefore represents 67 percent of the population of the selected channels.

KIS was selected to study the water sharing arrangement between the hydropower generation plant and the irrigated farmers. Farmers in D2 and D3 canals under KIS were selected for the detailed survey. About 46 farmers were selected randomly from field canals (FC) No.8, 3, 15, 16, 19, 21, 25, 26 and 27 under D2 and FC 9 and 12 under D3 canals. The sample size represents 32 percent of the population of the selected canals.

The KOISP area is the third area selected to study the impacts of the irrigation project on livestock farmers. Traditional livestock farmers living in the area were selected for the survey. Sampling frame was prepared using the membership list maintained by "Ruhunupura Cattle Owners' Association". The sample size of the study was 42, which covers 30 percent of the total population.

2.3.1 Data Collection Methods

Data for this research report was primarily obtained through sample questionnaire surveys in three selected locations in Sri Lanka. The data collection process followed three inter-related steps. First, available literature on process and methodology adopted to establish current water allocation mechanisms in the selected area and selected countries was reviewed by the research team. Second, the key issues identified in process and methodology of past experiences of water allocation were listed and a checklist was prepared for focus group discussions and key informant interviews, which were undertaken at various times during August – October, 2007.

In the third step, the information obtained from the first and the second steps was used to develop specific research questions with special focus on the consequences of current water allocation arrangements in the selected locations.

Chapter 3

Water Allocation Policies and Disputes in Selected Countries

Conflicts between nation states have been caused or exacerbated by various challenges for sharing of international river waters. Within sovereign nation states, competitive claims of sub national governing entities such as states and provinces have given rise to disputes among them for sharing of water resources. Policy prescriptions for international river systems have some relevance for inter-state (inter-provincial) water disputes within countries. As a country's water resources are not evenly distributed according to political boundaries, water disputes have many characteristics that extend beyond state or provincial borders. As Sri Lanka is a sovereign nation state, it may be useful to examine a few instances of dispute resolution in the case of intra-national waters. For a better understanding of the water allocation issues, six illustrative cases, synopses of selected catchments management initiatives, three from India, one each from Australia, Chile and US are presented below.

3.1 Water Allocation in India

In the Constitution of India, water is a state subject and is included as entry 17 in list 2 (listing for state legislation). It reads as follows:

> Water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power subject to the provisions of entry 56 of list 1. (Bakshi, 2005: 368)

The role of the Federal Government is stipulated in entry 56 of list 1 as follows:

> Regulation and development of inter-state rivers and river valleys to the extent to which such regulation and development under the control of the Union is declared by Parliament by law to be expedient in the public interest. (Bakshi, 2005: 364)

Article 262 of the Constitution explicitly grants Parliament, the right to make laws for the adjudication of any dispute or complaint with respect to the use, distribution or control of the waters of, or in inter-state river or river valley. Further, it gives Parliament primacy over the Supreme Court by excluding such disputes from being referred to the Supreme Court.

> The Inter-States Water Disputes Act No. 33 of 1956 is a piece of legislation enacted by Parliament under article 262 of the Constitution. Section 11 of the Act excludes the jurisdiction of the Supreme Court in respect of a water dispute referred to the Tribunal. But the Supreme Court can direct the Central Government to fulfill its statutory obligations under Section 4 of the Act, which is mandatory. See *T N Cauvery Sangam* v *Union of India*, AIR 1990 SC 1316: (1990) 3 SCC440 where the state of Tamil Nadu supported the writ petition filed for the purpose by a registered society. (Bakshi, 2005: 229)

The National Water Policy of 1987 advocates a holistic and integrated river basin oriented approach to water development, the promotion of conjunctive use of surface and groundwater, water conserving food patterns, irrigation and production technologies and recognition of water as an economic good. It recognizes the basis of planning to be a hydrological unit, such as a basin or a sub-basin, groundwater exploitation should be regulated with reference to recharge possibilities. The 1987 policy was replaced in 2002 with a greater reorientation towards resource policy issues. The officially declared current policy is the national water policy 2002 which underscores *inter alia,* areas such as environment, ecology, sustainability, equity, social justice, conservation, participation, role of women (Iyer, 2003:68).

In India, there is a national water policy and most of the states have their own state water policies. The policies, apart from other aspects, define the prioritization of water allocation amongst different water using sectors. For example, section 5 of the National Water Policy 2002 states as follows:

> *"In the planning and operation of systems, water allocation priorities should be broadly as follows: 1. Drinking water, 2. Irrigation 3. Hydropower, 4. Ecology 5. Agro-industries and non-agricultural industries, 6. Navigation and other uses. However, the priorities could be modified or added if warranted by the area/ region specific considerations".* (Government of India, Ministry of Water Resources, National Water Policy, 2002)

However, the rationale for such a prioritization as well as the manner in which the actual amount of allocation to different sectors is decided and made available is not clear.

We briefly discuss the following three cases with respect to water disputes in India.

A. Cauvery water dispute
B. Krishna – Gadavari dispute
C. Ravi Beas dispute

3.1.1 Cauvery Water Dispute

Sharing the Cauvery river water has been a major bone of contention between the upstream farmers of Karnataka and downstream farmers of Tamil Nadu for well over a century. River Cauvery, 800 km long with a drainage basin around 81,000 square km covers an area much bigger than the whole of Sri Lanka. The Cauvery river system comprises the Cauvery itself and a number of tributaries such as the Hemavati, Kabini, Bhavani, Amaravati and others. It flows through the states of Karnatake, Kerala, Tamil Nadu and Pondicherry before discharging into the Bay of Bengal (Figure 1). The core of the dispute relates to the sharing of waters that are already being fully utilized as the demand for irrigation far exceeded the irrigation potential of the river. The two main contending parties are Karnataka (Old Mysore) and Tamil Nadu (Old Madras Presidency). The dispute goes back to an agreement between the two states in 1892. During the period 1831 to 1881, irrigation projects were continued in both states. A master plan for improving tanks and irrigation works was approved by the Secretary of State in 1872. Madras state objected to the proposals for expansion of irrigation by Mysore state. Following a conference held in 1890, an agreement was made in 1892.

Between 1900 and 1910, the state of Mysore developed the Krishna Raja Sagar (Kannannbadi dam project) and the state of Madras the Cauvery-Mettur project. On the basis of a number of discussions held during the period 1910 to 1924, an agreement was reached in 1924 which provided that it should be open for reconsideration at the expiry of 50 years. Under the agreement, Mysore agreed to limit new irrigation to 110,000 acres, and Madras to 301,000 acres. However, the agreement did not include extreme variations due to hydrological events and how the flow should be shared in such an eventuality.

Discussions during the 1960s and 1970s between Karnataka and Tamil Nadu did not produce any agreement. Although 26 ministerial meetings were held between 1968 and 1990, no attempt was made to generate technical options to the sharing of Cauvery waters. The issue became highly politicized with governments in two states run by different political parties.

At the request of the Government of Tamil Nadu, a tribunal was constituted in 1990 under the ISWD Act. Tamil Nadu wanted the Tribunal to restrain Karnataka from using any more waters of Cauvery and to maintain a status quo as of May 1972. In January 1991, the Tribunal gave an interim award to the effect that Karnataka should ensure an annual release of 205 thousand

million cubic feet (tmccf3) of Cauvery water to Tamil Nadu. This interim order caused dismay in Karnataka and led to tragic violence.

The main argument of Karnataka is that at the expiry of the 50 year period in 1974 the Agreement of 1924 is deemed to have expired. Hence, present water allocation is not determined by any claims based on the 1924 agreement. Karnataka contends that the 1924 agreement was made at a time when it was under Maharaja's administration and hence did not possess the freedom to present its interests. Karnataka also contends that the upstream farmers have as much right to irrigate its crops as do farmers in downstream areas. It is further argued that the claim on Cauvery waters by Tamil Nadu ignores the unequal distribution of rainfall in two states. Karnataka is solely dependent on the South-East monsoon (June-September) for its river flow. Tamil Nadu, on the other hand, additionally benefits from the North-East monsoon (October-December). Hence Karnataka being forced to share waters from the single monsoon is manifestly unfair.

It is also argued that when an upstream state faces water scarcity, a downstream state cannot make a claim on that water. Consequently, Karnataka can release waters to Tamil Nadu only if the quantum of water is adequate to meet its needs. Hence, Karnataka finds it difficult to release waters to Tamil Nadu when their farmers face acute water stress and argue that under a 1926 treaty between the two regions, Tamil Nadu receives 60 percent of the river water for irrigation. Karnataka farmers contend that their state contributes 70% of Cauvery water, but receives only 20% for its own use.

Figure 3.1: Cauvery River

By taming the Cauvery River with massive stone dams, Tamil Nadu farmers have turned a flood prone area into one of the best watered regions in India. Tamil Nadu argues that historically the downstream farmers have grown three crops a year and that the Agreement of 1924 is crucial to the development of key projects in both states and hence its core principles are unalterable now. Further, the prescriptive right of the farmers irrigating their rice cultivation in the Cauvery delta should be recognized and protected. Tamil Nadu contends that a river flowing through two states is a common property and not a private property of the upstream state. While Tamil Nadu recognizes the position that emanates from the area of the basin, and the contribution to river flow, such considerations need to be applied to distribution of waters beyond those needed to meet the prescriptive rights of downstream farmers.[1]

In 1990, the Union Government set up a tribunal for Cauvery River under Interstate Water Disputes Act of 1956 and an interim judgment was made in 1991. The final Cauvery award, made on 5 February 2007 makes allocations of Cauvery waters to the four parties to the dispute, recommended proportionate adjustments in years of low rainfall and proposes the establishment of a Cauvery Management Board for monitoring implementation. Proceeding on the basis of an annual availability of 740 thousand million cubit feet (tmcft) in the Cauvery on "50 percent dependability" basis, the following allocations were made:

Tamil Nadu	419	(billion ft^3)
Karnataka	270	"
Kerala	30	"
Pondicherry	07	"
	726	"

This leaves 14 tmcft, out of which 10 is meant for environmental protection, and four representing the inevitable escapades into the sea. For years of low rainfall, the award envisages a proportionate adjustment of the allocations. In Karnataka, the award is considered unfair and has met with deep resentment. It is a judicial verdict which is final and binding. What needs to be done is to arrive at an understanding on how water will be shared in distress years. Thus, distress sharing will be a practical matter to be worked out by the Cauvery Management Board set up by the Tribunal award. Moreover, the award has been critiqued on its failure to consider the groundwater availability in the Cauvery basin, while the allocations have been made as the basis of surface water availability. The lower riparian Tamil Nadu has significant availability of groundwater while the upper riparian, Karnataka has very little of it. Yet, the root of the conflict is the excessive draft on Cauvery waters by the farmers in both states. It is apt to quote Ramaswamy R Iyer who queries whether the contending states need all that water. He counters that what lies at the heart of this conflict is the better management of water in all the states (Iyer, 2007: 643).

3.1.2 Krishna-Godavari water dispute

The River Krishna originates in Mahabaleswar in Maharashtra in the west and enters the Bay of Bengal in Andhra Pradesh, on the east coast, traversing a distance of 1400 km across the Deccan plateau. It flows through the state of Karnataka (Figure 2). Godavari river which runs to the north of the Krishna river originates in the state of Maharashtra and flows through the states of Karnataka and Andhra Pradesh before joining the Bay of Bengal. Canals from the Godawari river connect with those from the Krishna river. The contending parties in the Krishna-Godavari conflict are the states of Maharashtra, Karnataka, Andhra Pradesh, Madya Pradesh and Orissa.

[1] The arguments for and against each state is summarized from University of Bradford, Water and Identity: Making Sense of the Cauvery River Water dispute.

(Karnataka and Andhra Pradesh are the lower riparian states on the river Krishna). While the interstate river Godavari's catchment area spreads over these five states, the main river flows through the three states, Maharashtra, Andhra Pradesh and Madhya Pradesh. Both Godavari and Krishna rivers are interstate rivers.

In accordance with India's First Five Year Plan, the Planning Commission requested the states of Bombay, Hyderabad, Madras and Mysore to propose feasible projects for irrigation and hydroelectricity on the rivers Krishna and Godavari. An interstate conference paved the way for an agreement in 1951 to utilize the Krishna and Godavari waters. Andhra Pradesh was established in 1953 and the states were re-demarcated on a linguistic basis. Separate tribunals were constituted for the Krishna and Godavari in 1969. A conflict with regard to the sharing of the basin waters arose with the competitive claims of the riparian states for the utilization of the waters of the Godavari basin. The Godavari Tribunal constituted by the Central Government in 1969 adjudicated the dispute. In terms of the award of the Tribunal, waters available in the sub basins have been allocated among the respective states. The remaining yield from the free catchment available in different sub-basins, as will be flowing into the river Godavari, is left for utilization by Andhra Pradesh.

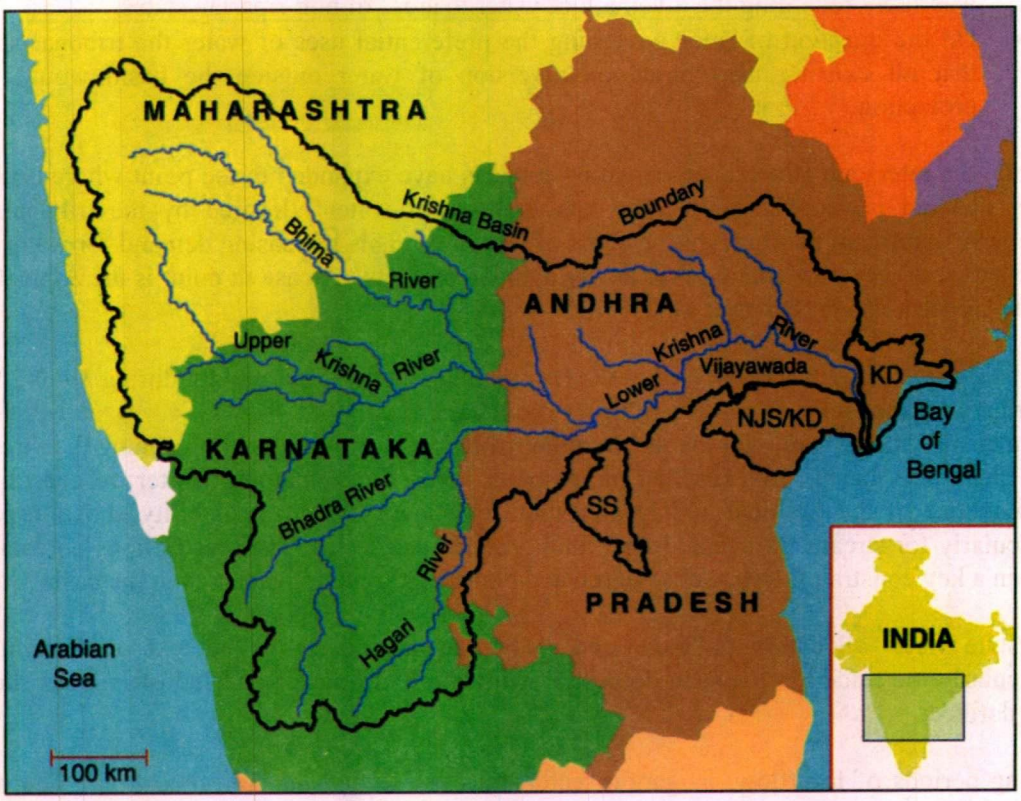
Originally proposed by Andhra Pradesh the Polavaram project was a state venture for extending irrigation facilities to the upland areas in East Godavari, Visakhapatnam, West Godavari and Krishna districts and for other benefits like making water available for industrial purposes at Visakhapatnam and generation of hydropower.

On account of diversion of Godavari water into the Krishna, Maharashtra and Karnataka had been agitating for the utilization of more water of the Krishna river. A 1978 agreement entered into between the States of Karnataka and Andhra Pradesh stipulated the diversion of 2265 Mm^3 (80 TMC), at 75% dependability, of Godavari waters from Polavaram Project into Krishna river above Prakasam Barrage at Vijawawada. Thereby, it displaced the discharges from Nagarjunasagar project for Krishna delta, which enabled the use of the above quantity for projects upstream of Nagarjunasagar. The states also agreed that the quantity of 2265 Mm^3 (80 TMC) thus made available will be shared in the proportion of Andhra Pradesh 1274 Mm^3 (45 TMC); Karnataka and Maharashtra together 991 Mm^3 (35 TMC).

A disagreement arose between Maharashtra and Andhra Pradesh regarding the building of barrages on the Godavari. Andhra Pradesh alleged that its western neighbour sought to convert into virtual desert by building a barrage across the river only a few kilometers from the state's boundary. It has plans to build a dam of its own on the Godavari, the Sripadasagar Project, shortly after the mighty river enters the Nizamabad district from Maharashtra's Nanded district.

The Godavari Tribunal gave its final award in 1979, but meanwhile the contending states negotiated among themselves, and reached agreement on all disputed issues. Hence the Tribunal was merely required to endorse this agreement in its award. Unlike in the case of other tribunals, there was no quantification of flows, or quantitative division of these flows. Dividing the area into sub-basins, the states allocated flows from these sub-basins to individual states. The agreement was not subject to review, becoming in effect, perpetually valid (Richards and Singh, 1966: 13).

Figure 3.2 : Krishna River Basin



Notes : Command areas outside the basin boundary

NJS : Nagarjuna Sagar
KD : Krishna Delta
SS : Srisailam
Source : Biggs, Trent W., e-al, 2007.

Water is extracted from the Krishna Basin for agriculture, industrial and domestic uses and demand in all areas is growing. After independence, the pace of irrigation development in the Krishna basin intensified. As the aggrieved lower riparian state, Andhra Pradesh accuses both Karnataka and Maharashtra of constructing unauthorised projects on Krishna, Godavari, Bhima and Tungabhadra rivers to the detriment of Andhra Pradesh. It has brought these illegal constructions to the notice of the Union Government. These issues have been filed before the Krishna Water Disputes Tribunal created by the Indian Government for redress so far as Krishna river water was concerned.

The award of the Krishna Tribunal was made in 1976 on the basis of the principle of "equitable apportionment" for the actual allocation of the water. The actual allocations for each state were as follows; Maharashtra 28%, Karnataka 34% and Andhra Pradesh 38%. (Gaur et. al, 2007:585).

- With regard to the extent to which existing uses should be protected as opposed to future or contemplated uses the tribunal concluded that projects that were in operation or under consideration as in September 1960 should be preferred to contemplate uses and should be protected. The tribunal also judged that except by special consent of the parties, a project committed after 1960 should not be entitled to any priority over contemplated uses.
- On the question of the diversion to another watershed the tribunal concluded that diversion of Krishna waters to another waterline was legal when the water was diverted to

areas outside the river basin but within the political boundaries of the riparian states. It was silent regarding the diversion of water to areas of non-riparian states.

- On the question of rules governing the preferential uses of water the tribunal specified that all existing uses based on diversion of water outside the basin would receive protection.

Despite the interstate allocations, irrigation projects have expanded to the point where basin-wide water demand is roughly double the total volume of water allocated by the tribunal. This generates significant conflicts during years of low flow. This increasing demand for water creates interstate conflicts, particularly over newly planned projects. A case in point is the Alamatti Dam on the Upper Krishna (Biggs et al, 2007:27).

Discharge from the Krishna river into the Bay of Bengal decreased rapidly during 1960-2003 due to irrigation expansion. Biggs et al (2007:v) conclude:
Basin closure, combined with the pending renegotiation of water allocation among the three states that share the basin, has resulted in disputes over the remaining water resources. One consequence of the political and legal dispute is a lack of data availability and transparency, particularly for stream flow, canal flow, and groundwater levels. The restrictions on data access remain a key constraint to further research and planning for water resources in the basin.

Interstate water allocation policies need to be reexamined in the context of drought years, particularly the tradeoffs between domestic, irrigation hydropower and industrial uses should be well defined.

During periods of low flow, irrigation sector does not receive its full allocation. The national water policy, as well as Andhra Pradesh and Karnataka, gives priority to drinking water and then to irrigation and hydropower during periods of drought. In contrast, Maharashtra gives priority to industry over irrigation. The absence of a basin-wide single authority to regulate the drought water allocation policy is increasingly felt.

While the Krishna Water Disputes Tribunal formed in 1969 expired in 2000, the new Tribunal constituted in 2004 is expected to provide revised allocations between 2008 and 2010. Meanwhile, each riparian state continues to invest in large scale projects in order to influence the final award, although the basin is already fully allocated. Maharashtra state proposes to expand storage for hydropower generation. The upper states are demanding additional allocations, considering the inter-basin water transfer to Lower Krishna through the Godavari link projects. Andhra Pradesh objects to all up stream developments, demanding more reliable flows from the upper basin, while proposing its own additional projects. The question of raising the height of the Alamatti hydropower dam is before the tribunal for adjudication. (Gaur et al, 2007:592).

3.1.3 Ravi Beas Dispute

Both Punjab and Haryana are agricultural surplus states using large quantities of irrigation water. An interstate meeting convened by the Union Government paved the way for an agreement to share the waters of Ravi and Beas in 1955. According to this agreement, 8.0 MAF (million acre feet) was allocated to Rajasthan, 7.2 MAF to Punjab and 0.5 MAF to Kashmir. Soon after the signing, India commenced work on the ambitious Rajasthan canal project (now called the Indira Gandhi canal). The present dispute about Ravi-Beas water commenced with the re-demarcation of Punjab and Haryana, as successor states to Punjab. With the adoption of high yielding varieties of wheat, the demand for irrigation water increased considerably. Consequently, the sharing of river water became contentious.

On the principle of equitable distribution, the State of Haryana laid claim to over 4.8 out of 7.2 MAF (million acre feet), which was the entitlement of the composite Punjab State. The new State

of Punjab, on the other hand, conceded nothing to Haryana, on the ground that, Haryana was not a riparian state. Acting under section 78 of the Punjab Reorganisation Act, 1966, the Union Government, allocated 3.5 MAF each to the parties and 0.2 MAF to Delhi. Both states moved the Supreme Court, Punjab against the statutory decision and Haryana, for compelling Punjab to implement it. In 1978 Punjab and Haryana started to link the tributary Sutlej in Punjab via a canal to the Yamuna River in Haryana. This link (SYL) was necessary to provide the allocated 3.5 MAF to Haryana as it could not be imported from the Ravi-Beas system.

In the meantime, Chief Ministers of Punjab, Haryana and Rajasthan arrived at an agreement on 31st December, 1981. It was agreed that out of the surplus waters of Ravi-Beas allocated to Rajasthan (namely, 8.5 MAF), until such time when that state was able to utilise its full share, the unutilised portion could be used by Punjab, whose normal share would otherwise be 4.22 MAF, that of Haryana being 3.5 MAF. It was further stipulated that Punjab would complete the SYL canal within a period of two years. The petitions pending in the Supreme Court were withdrawn, and Punjab issued a White Paper on 23rd April, 1982, hailing the agreement, which had resulted in the increase of 1.32 MAF of waters to Punjab over the allocation made by the Central Government (the allocation to Haryana remaining unchanged).

In 1985, the Punjab Legislative Assembly repudiated the Agreement of 31st December, 1981. After prolonged negotiations, the Punjab settlement of 24th July, 1985 was reached. It declared that the farmers of Punjab, Haryana and Rajasthan would continue to get water from the Ravi-Beas system, to the same extent as on 01-07-1985. Waters used for purposes of consumption would also remain unaffected. Further, it stated that the claim of Punjab and Haryana regarding their shares in their remaining waters would be referred for adjudication by a Tribunal to be presided over by a Supreme Court Judge.

On 2nd April, 1986, the Union Government constituted the Ravi and Beas Waters Tribunal, for the adjudication of the matters referred to in the Punjab Settlement of 24th July, 1985. The contentions of Punjab were that the waters of the Ravi and the Beas belonged to the Punjab State. It was only a concession made by it to the farmers of Haryana and Rajasthan, to continue the committed uses as on 1st July, 1985. It was for the tribunal to verify the quantum of usage in those states, as well as in the Punjab.

Also, the quantities of actual usage should be set apart as guaranteed for the users and the balance left out from the total available supply should be taken as the remaining waters. Haryana and Rajasthan, not being riparian states, should not claim any share from such balance, which was the entitlement of Punjab alone.

Haryana contended that the tribunal should first verify the quantum of usage as on the specified date and thereafter adjudicate on the claims of Punjab and Haryana as to the remaining waters. The tribunal must verify the use of waters by the farmers at the farm gates and not at the canal heads. The basis of distribution should have been actually the water year ending 30th June, 1985.

Rajasthan countered that the jurisdiction of the Ravi Beas tribunal was restricted to verification of the usage from the Ravi-Beas system as on 1 July 1985. Since the state's share was settled by the 1955 Agreement and re-enforced by the 1981 Agreement, the Tribunal had no jurisdiction to alter on vary Rajasthan's share. Item 2 of the reference called for adjudication of the claims of Punjab and Haryana, regarding their shares in the remaining waters.

The Ravi Beas Tribunal did not agree with the plea of Punjab, that the use by farmers for one year should be counted on the basis of the release at the canal head as on 1 July 85, multiplied by 365. The tribunal concluded that the most feasible course was to take an average of the figures for the years 1980-81 to 84-85 re-constructing the data for breach periods. In regard to Haryana's plea, the tribunal came to the conclusion that as the actual deliveries to the farm were not being measured at the farm gates, it was not possible to verify the water used by farmers on that basis.

The Ravi-Beas Tribunal concluded that the quantum of Ravi and Beas water used by Punjab as on 1 July, 1985, excluding pre-partition use was 3.106 MAF, including 0.352 MAF of permissive use by Punjab out of Rajasthan's share. Quantum used by Rajasthan as on the date, excluding pre-partition use, was 4.985 MAF. Use of Haryana as on the date was 1.62 MAF.

With regard to the claims of Punjab and Haryana for the remaining waters, the tribunal agreed with the contention of Rajasthan, that its share had been settled by the previous agreements. The tribunal held that the plea of Punjab, that the waters of the Ravi and the Beas belonged to it absolutely, and in its entirety, to the exclusion of both Haryana and Rajasthan, was not sustainable.

Punjab's contention, that the State of Haryana was situated outside the basin, was also rejected by the tribunal. It made an allocation of 5 MAF to Punjab, and 3.83 MAF to Haryana, the total quantity apportioned being 8.33 MAF, including 1.11 MAF surpluses available. The fluctuations in flow were to be shared in the same ratio as the allocation. The claim of Delhi for additional supply over the existing 0.2 MAF of water was rejected, as falling outside the scope of the reference to the tribunal.

In conclusion it may be stated that the Ravi-Beas Waters Tribunal upheld the legality and validity of prior agreements that had been entered into, by the respective states. The doctrine of riparian rights, as also the theory of absolute ownership rights of a state in river waters, was rejected. By rejecting the plea for treating Ravi and Beas as separate entities, the concept of integrity of river basin was also upheld. Neither arbitration nor central intervention has been successful in resolving the Ravi-Beas water dispute among Haryana, Punjab and Rajasthan, Jammu and Kashmir.

As seen above, in India a large number of interstate water disputes arose after independence over the use of rivers. Water scarcity has emerged as an important theme in discussions on India's future. Although the Union Government set up the three tribunals to adjudicate interstate disputes, none has been successful in settling the disputes to the satisfaction of contending parties. Although the general principle of equitable apportionment has been adduced often, in practise the contending state has given this principle an interpretation that suited it. There are simply too many stakeholders and too few resources to satisfy all the needs. What has to be done is to stimulate farmers to harvest rainwater in order to reduce their dependence on irrigation water. Furthermore, less water intensive farming methods and crops have to be promoted. In the long term, adopting a package of best practises for improved management of water resources with strong emphasis on demand side management will help alleviate the water crisis.

3.2 Water Rights in Chile

The comprehensive water code adopted by Chile in 1951, provided for a system of water rights administration, similar to that in the Western United States. Under this code, water rights became protected property rights where an applicant was required to specify its intended use of water, while certain uses were given preference over others. As part of agrarian reform, the 1951 code was replaced in 1967 by a new water code to empower the new landowners, who came into being after redistribution of large landholdings. In 1973, the new government opened the Chilean economy adopting an export-oriented development model. In 1981, Chile adopted a new water code.

Chile is considered a model where sound macro-economic policies and strengthening the role of the market in the allocation of resources have been applied to facilitate the reallocation of water resources. Allocation of water rights through markets in tradable water rights has fostered efficient use of water, facilitated a shift to high value crops which use less water per unit value of output.

It recognizes rights of use as both consumptive and non-consumptive. The holder of a consumptive right can physically consume the water without any replenishment. In non-consumptive rights, the holder can use the water, but has to replenish it. According to the Constitution, the Civil Code and the Water Code in Chile, water is considered a public good but individuals can obtain private rights by receiving a grant from the state, by prescription or by purchasing water rights. Types of water rights are spelt out in the Water Code. It established a system of water rights that are transferable and independent of land use and ownership (Dinar, Rosegrant and Meinzen-Dick, 1997). The exercise of water rights can be permanent or contingent, continuous, discontinuous or alternate. Permanent water rights allow an owner to use in volumetric shares a source of supply without restriction. Contingent rights allow water use after the needs of all permanent users have been met.

Continuous rights allow uninterrupted use throughout the day. Discontinuous rights allow such use during certain periods. Alternate rights exist when use is distributed among two or more users in successive turns. Return flows to neighbouring areas may be used by the recipients of the return flow without the need to establish a right of use. Use rights are needed for groundwater exploitation.

What has Chile achieved through the new system? By granting water rights to the economically most beneficial and valuable use, the regulatory function of the free market has increased the value and the efficiency of water use. Yet, the rights holders with more "water shares" have greater decision making powers increasing the insecurity of the collective and indigenous systems.

3.3 Australia: Murray Darling Basin Experience

At the time of European colonization, the Murray-Darling Basin supported a complex mosaic of temperate woodlands, large tracts of shrub land, saline and freshwater wetlands, bush lands and grasslands, providing a rich variety of wildlife habitats. Many of the catchments natural habitats have been degraded during the past 200 years leading to a decline in the native flora and fauna species.

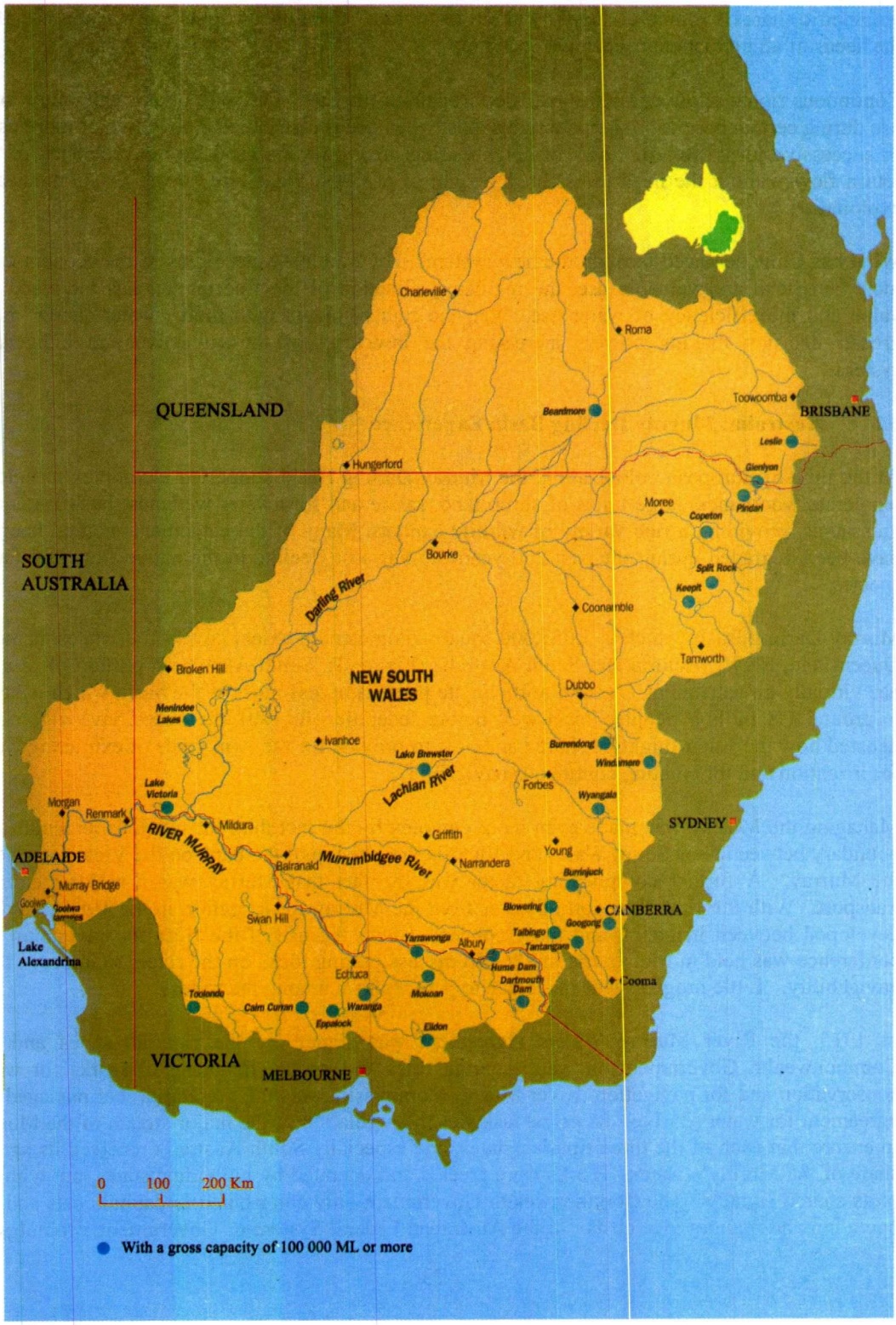
Murray-Darling Basin which is 1,057,000 square kilometers in extent covers four states, namely, Queensland, NSW, Victoria and South Australia (Figure 3). South Australian portion of Murray has virtually no catchment. A semi-arid climate prevails across most of the basin which is home to around 1.8 million people. From well before federation in 1901 the states have vigorously debated how the water might be shared and how to provide for the twin goals of extracting water for irrigation and for creating continuous navigability.

Managing the Murray was made even more complex by the fact that, for much of its length, the boundary between New South Wales and Victoria was the top of the bank on the Victorian side of the Murray. A further complicating factor was the fact that Murray was a major means of transport. With the first diversion of water from the Murray for irrigation in the 1980s, conflict developed between irrigation and those concerned with the use of the river for navigation. A conference was held in Melbourne in 1863 to discuss putting locks on the rivers to improve their navigability. Little progress was made due to parochialism among the states.

In 1915, the River Murray Waters Agreement was signed by the riparian states and the Commonwealth Government on water sharing rules and on the financing of works for water conservation and for navigation. River Murray Commission was the secretariat that managed the agreement for water sharing. Its prime task was the regulation of the major stream of the Murray to ensure that each of the three riparian states, and especially South Australia received its agreed share of the Murray's water. Works were erected and operated by individual states, but with the costs shared equally. The Commonwealth Government only contributed to capital costs and not operation and maintenance costs. In the Australian Federal System of Government, promulgated

in 1901, the constitutional division of competencies left most of the natural resources, including water largely within the jurisdiction of the states. The ever-increasing demand for water from the start of the European settlement in the late 18th century to the 1990s was met through the construction of dams and weirs regulating and storing water for use during periods of low flow.

Figure 3.3: Murray - Darling Basin



Despite great socio-economic benefits of river regulation, long term environmental sustainability was affected by inverting natural seasonal patterns of flow variability, reduction in stream flow at the mouth of Murray to less than a third of its natural discharge and transformation of the lower reaches of the river from a dynamic system to a series of slow moving lakes. South Australian River Murray drought water allocation policy recommends strategies to ensure that during periods of drought, the available resources are shared equitably by all water-users in South Australia.

The objectives of the River Murray Drought Water Allocation Policy (Government of South Australia, 2006:4) are to:

- Ensure that any detrimental impacts associated with drought or poor water quality are shared equitably across all water-users (including the environment) by applying a whole of system approach to the management and use of the water resources of the River Murray within South Australia.
- Ensure that water-users are provided with the best available, up-to-date information regarding the potential for restrictions on diversions to assist with their business planning and decision making, and
- Ensure that a clear and transparent decision-making process is established to set water restrictions during periods of drought or poor water quality and provide water users with an understanding of this process

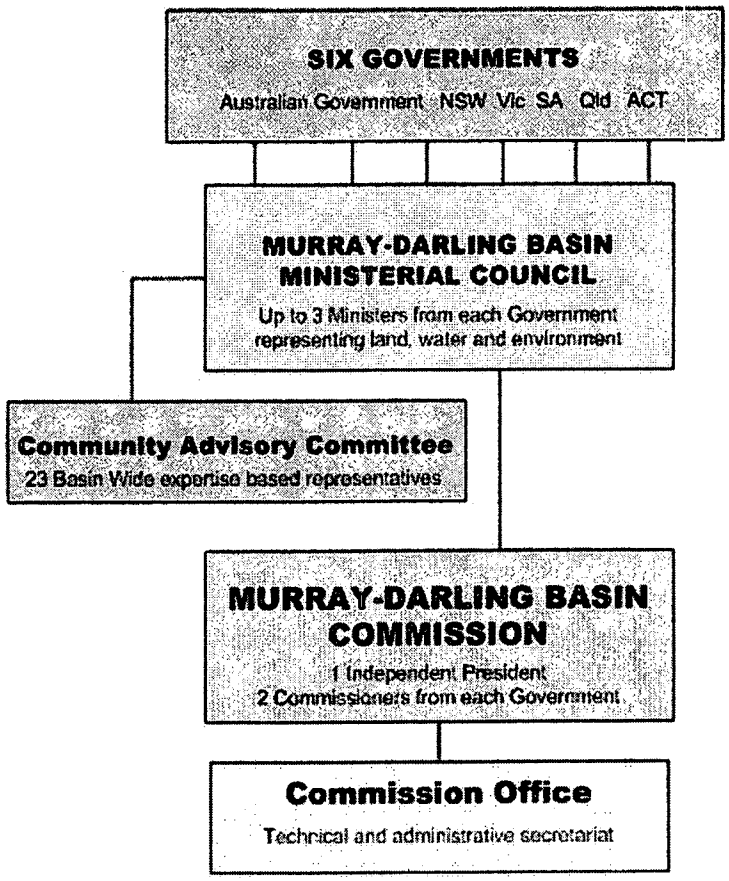
In the 1960s, the commission undertook salinity investigations in the Murray Valley. This initiative led to the broadening of the commission's role in 1982 to take account of quality issues in its water management responsibilities. With the realization that the successful management of the Basin's river systems was directly related to land use throughout the catchments, further amendments were made to the agreement in 1984 to enhance the commission's environmental responsibilities (Peter Crabb, 1997:284).

Despite these changes to the River Murray Waters Agreement, it was felt inadequate to address the basin management and its growing environmental problems. Critical issues such as rising water salinity and irrigation induced land salinisation could not be tackled within distinct state jurisdictions. The outcome of these mounting pressures was the initial Murray-Darling Basin Agreement of 1987 and the final agreement in 1992, which established three new institutions at political, bureaucratic and community levels, namely, the Murray Darling Ministerial Council, the Murray Darling Basin Commission and the Community Advisory Committee. The management structure of the overall governance of the agreement is shown in Figure 3. 4.

The ministerial level comprises the ministers responsible for land, water and environmental resources in each of the contracting governments, namely, the Commonwealth, NSW, SA, Victoria and Queensland. Its prime functions set out in part III, clause 9 of the Murray Darling Basin Agreement, 1992 were as follows:

- "to consider and determine major policy issues of common interest to the contracting governments concerning effective planning and management for the equitable, efficient and sustainable use of the water, land and other environmental resources of the Murray-Darling Basin; and
- "to develop, consider and, where appropriate, to authorize measures for the equitable efficient and sustainable use of such water, land and other environmental resources." (Crabb, 1997:289)

Figure 3.4: Governance of the Murray-Darling Basin Initiative

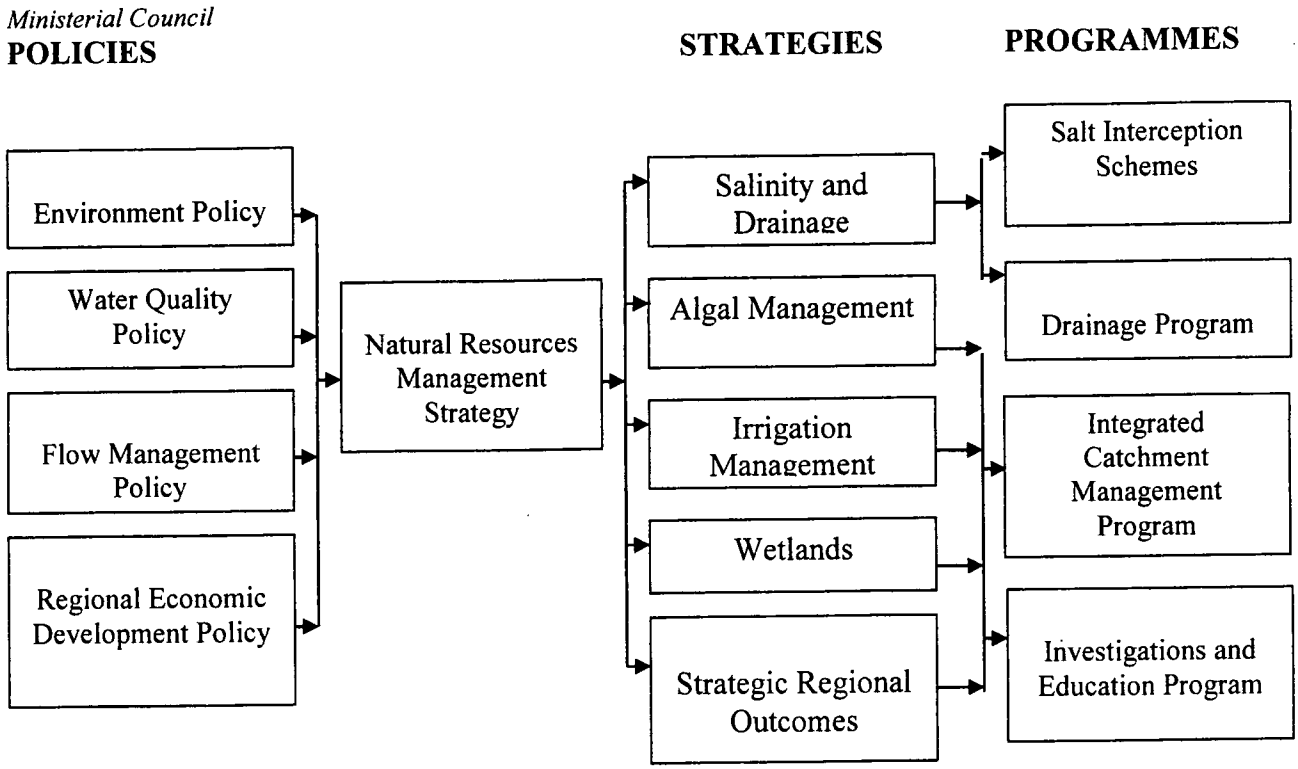


NSW = New South Wales
Vic = Victoria
SA = South Australia
Qld = Queensland
ACT = Australian Capital Territory

Source: Murray Darling Basin Commission, 2007, p. 284

The strategic and philosophical framework for achieving the purpose of the agreement is the natural resources management strategy approved by the ministerial council in 1990. The ctrategy provides the broad charter for a community-government partnership to develop plans for the integrated management of the basin's water, land and other environmental resources on a catchment basis. In order to improve the performance and accountability of work undertaken under the natural resources management strategy, in 1996 the ministerial council put in place the basin sustainability plan. The programme provides a planning, evaluation and reporting framework for the natural resources management strategy, and covers all government and community investment for sustainable natural resources management in the Basin. The natural resources management strategy and basin sustainability plan are the foundation of the commission's basin-wide planning processes for natural resource management. The present basin planning process is illustrated in figure 3.5.

Figure 3.5: Murray-Darling Initiative – Planning Process



Source: Brain Haisman, 1999

A severe drought grips large parts of Australia. Its severity is magnified by the fact that water resources are over-allocated. During the coming decades, average inflows to the Murray Darling Basin will decrease even further. A national plan for water security articulated in January 2007 incorporates a nationwide investment in irrigation infrastructure to line and pipe major delivery channels, a nationwide programme to improve on farm irrigation technology and metering and the sharing or water savings on a 50:50 basis between irrigators and the Commonwealth government leading to greater water security and increased environmental flows. A new set of governance arrangements addresses once and for all, water over-allocation in the Murray-Darling basin (Murray Darling Basin Commission, 2007)

To prevent an unfolding environmental disaster the Federal Government implements a plan to buy water entitlements from farmers in Queensland and northern NSW. The Economist October 25th 2008 reported: *Last month Australia's federal and NSW state government bought Toorale [a sprawling outback property near Bourke in Western New South Wales with 30,000 sheep, 1200 cattle and irrigation machinery] for almost A $ 24m, ($ 17m), not to run it as a farm but to take control of a commodity that now seems more precious than the food and fiber it produces: water.* This water-buy-back scheme is a last ditch bid to save the Murray Darling System, suffering from the worst drought in a century.

As for priorities amongst users, across states, the consumption of water by people and animals is the highest priority followed by agriculture. Legislation indicates that water needed for domestic purposes and livestock production is a prior right. However, where in the list of priorities the environment is actually placed is not always well defined. Finally, in the list of priorities, there is some industrial use of water in the Basin. (Mac Donald & Young, 2000:25-27)

3.4 USA: Tennessee Valley Authority

Modern river basin planning and management had its beginnings in the Tennessee Valley Authority (TVA) established in 1933 in the US Midwest. It is responsible for stewardship of the Tennessee River watershed, a 106,000 square kilometer region including parts of seven states in the Southeastern US. It includes 54 dams that work as a unified system to provide flood control, navigation, power supply and recreation benefits to nearly 8 million residents in the valley. The Tennessee River is a tributary of the Ohio, which itself is a tributary of the Mississippi. The Tennessee Valley in 1933 was a relatively backward region with a population of over 3 million people, living in poverty.

The TVA's multipurpose development sought to release the total benefit of the Tennessee River for the people by balancing the use of water for generation of hydro-electricity, water supply, navigation and recreation while controlling flows to reduce flood damage and erosion. It had become an exploratory concept in soil and water management because of its approach to erosion control. The integrated water control system has tamed the Tennessee's unpredictable flow, prevented flood damage in the valley, generated electricity and opened a 1050 kilometer navigable channel. The most praiseworthy achievement of the TVA was the integration of land and water management. It is a model river basin project which President Theodore Roosevelt called, 'a corporation clothed with the power of government, but possessed with the flexibility and initiative of a private enterprise (Palmer, 1986: 34).

At the time the TVA was created in the 1930s, navigation and flood control were the priorities. Yet, as time passed by, greater public attention was given to water quality and recreational benefits. Hence, the TVA undertook a major review of its reservoir operating policies which resulted in a lake improvement plan. Consequently, the TVA adopted a new year-round minimum flow requirement for tributary and mainstream dams, installed aeration equipment to improve dissolved oxygen levels. An important planning lesson is the fact that environmental assessment must be a continuing process of refinement an integral part of all stages of system construction, operation and management.

The TVA marked a turning point in river development by going through four broad stages of evolution:

1. *Mainly specified goal* ('single-purpose') flood control or hydro-electricity or irrigation supply.
2. *Multipurpose planning approach* multiple use but water simply divided between users. In practise there is a possibility of conflicting of which simplistic division of the resource fails to resolve (e.g. industrial use may pollute and make allocation to fisheries pointless).
3. *Integrated river basin planning approach* attempt to coordinate and develop use of water in basin 'in harmony with other development processes both within and outside the basin'
4. *Comprehensive river basin planning and management* is an extension of integrated river basin planning which goes beyond water development to involve other resources. It is a multi-objective approach in which water is seen as a 'tool' for development (Solanes and Jouravlev, 2005).

Evidently, the Tennessee River is more than a source of power. It is an immense and delicate eco system with a major transportation artery linking regional industries to world markets. It is a recreational outlet for nearly a tenth of the US population and provides drinking water for more than four million.

Tennessee Valley is one river management system with six distinct areas of responsibility, namely, flood control, navigation, power supply, land use, water quality and recreation. TVA's system of 54 dams works as a unified system to regularly adjust the river's water level to optimize the rivers potential, returning multiple benefits to citizens and the environment.

3.5 Legal Doctrines Relating to Water Allocation

The case studies presented above clearly demonstrate that water has unique features which distinguish it from other natural resources. These characteristics usually result in legal systems in which water belongs to the public domain, but rights granted to economic agents to use it are protracted under constitutional guarantee of private property. The allocation and retention of water rights are always contingent upon putting them to a socially recognized beneficial use. To deal with the problem of reallocation, countries have to decide whether to use administrative mechanisms or water markets; it is compatible with water marketing as well as with the nature of the water resource itself. A water market without regulations to protect the resource base, third parties and the environment and to prevent monopolization will result in uncontrolled private appropriation of a scarce resource and problems in related markets rather than in efficient resource allocation.

A brief look at the subject of legal doctrines relating to inter-state waters, although some of them evolved in an international context, may be relevant in this area.

1. Doctrine of territorial sovereignty (Harmon doctrine)

Under this doctrine, property rights have been claimed on the basis of the maxim, that "what falls on our roof is ours to use, without regard to any potential harm to downstream parties." Applicable to international rivers, this doctrine was developed by Attorney General Harmon of US in 1896. It justified the US action in reducing the flow of the river Rio Grande into Mexico. According to this doctrine, the rules of international law imposed upon the US, no duty to deny to its inhabitants the use of the waters of that part of Rio Grande which was lying wholly within the US, although such use resulted in reducing the volume of water in the river below the point where it ceased to be entirely within the US. To suppose that such a duty exists is inconsistent with the jurisdiction of a sovereign country over the national domain. See Connecticut Vs. Massachusetts (1931) 282 US 670.

2. Doctrine of riparian rights

The "riparian doctrine" relates to the right to use water by all owners of land abutting a river, as long as there is no resulting interference with the rights of other riparian owners. Landowners are allowed to remove water from streams only for basic domestic purposes, such as drinking, bathing, cooking and needs of livestock. It recognizes the rule of the common law that owners of lands on the banks of a river are entitled to receive the benefit of free-flowing water in the stream. The right exists whether or not the water is actually used, where the actual use may be initiated at any time. Water must be utilized on the riparian land and not outside the watershed of the stream.

The common law doctrine of water rights was based upon the riparian system which limited the use of water to the stream, or to lands adjacent to the stream bed and required the water to be returned to the stream's natural drainage, thus preventing any use which effectively diminished or removed the water from the stream channel on a permanent basis.

"Riparian land" can be defined as a parcel of land which includes therein a part of or is bounded by a natural watercourse. Thus, land abutting on an artificial watercourse has no riparian rights (See Thompson r. ENZ 379 Mich 667 SC of Michigan, 1967 (Trelease, 1986). The underlying principle is that each riparian proprietor has a right to use the stream as at passes his property, but

no riparian proprietor has a right to use water to the injury of another. This developed into what has been called the natural flow theory, which required the stream to be kept substantially unchanged at the normal level except for minor effects of reasonable means of harnessing and using it as it passed.

Under this theory, the fundamental right of each riparian proprietor of a water course is to ensure its natural flow subject to making limited use. This generally means that a riparian can take water for domestic purposes only, such as water for the family, livestock and gardening. Under the reasonable use theory, the fundamental right of a riparian proprietor to use a stream is limited to what is reasonable provided he does not cause harm to the rights of others, above, below or on the opposite shore.

Riparianism works reasonably well in wet climates, such as the eastern United States where precipitation ensures physically abundant water supplies and conflicts are less frequent. It does not adapt well to the American west where streams run dry by mid-July. Thus, a system more suitable for the geographical area, an appropriation doctrine developed in the arid West.

3. Doctrine of prior appropriation

The cardinal rule in the doctrine of prior appropriation or the 'first in time, first in right' principle is that the priority of appropriation gives seniority of rights. The first person to make a beneficial use acquires the right to its future use as against later users. This doctrine allocates property rights to water on the basis of historical use. This doctrine has been applied in some decisions of the US Supreme Court, such as Wyoming vs. Colorado (1922) 259 US 419. Under the doctrine of prior appropriation the one who first appropriates water and puts it to beneficial use thereby acquires a vested right to continue to divert and use that quantity of water against all claimants junior to him in point of time. Beneficial use involves the application of a reasonable quantity of water to a non-wasteful use such as domestic, irrigation, manufacturing, mining, hydropower, recreation, wildlife and fish. A diversion is generally required in order to perfect water rights by appropriation. For a valid appropriation of water there must be intent to apply it to some existing or contemplated beneficial use and an actual physical diversion from the natural channel.

This doctrine evolved in the 19th century, in response to the needs of miners. It differs from the riparian doctrine in that it can fully satisfy a water right by diverting the full entitlement regardless of stream or aquifer conditions. All junior claimants can divert water after the senior claimants' rights are met. Thus, a junior water-user, even if located upstream has to allow enough water to pass to meet the need of a senior downstream appropriator. In the mining rich, water scarce Western United States, the prior appropriation doctrine has gained primacy. It turns out to suit modern farmers rather well. Besides, California's landowners are allowed to drill for groundwater. Thus, the farmers in the US west have historical precedent to thank for their liquid bounty. Daina D. Apple (2001) identifies the basic features of the doctrine as:

a) The right to use water could be obtained by taking the water and putting it to beneficial use.
b) The right is limited to the amount of water that is beneficially used.
c) First in time is first in right.
d) The water must be used or the right is lost

4. Doctrine of Community of Interest

According to this theory, a river passing through several states along with the whole basin is regarded as a single unit. It should be treated as such for securing the maximum utilization of its waters. Kosi project, which requires mutual agreement by India and Nepal, is often cited as an example of this approach.

5. Doctrine of equitable apportionment

This doctrine asserts that there should be equitable utilization of common rivers by mutual agreement among concerned parties. It governs disputes between states concerning their rights to use the water of an interstate stream. See, Kansas v Colorado 206 US 46(1907); Connecticut v Massachusetts 282 US 660 (1951). It is a flexible doctrine which calls for "the exercise of an informed judgment on a consideration of many factors" to secure a "just and equitable" allocation. It establishes that equitable apportionment will protect only those rights to water that are "reasonably acquired and applied." Wyoming v. Colorado 259 US 419 (1922).

Mr. Justice Brewer in delivering the opinion of court in Kansas V. Colorado (1907) 206 US 46 stated:

> "One cardinal rule, underlying all the relations of the states to each other, is that of equality of right. Each state stands on the same level with all the rest. It can impose its own legislation on no one of the others, and is bound to yield its own views to none. Yet, whenever the action of one state reaches through the agency of natural laws, into the territory of another state, the question of the extent and the limitations of the rights of the two states becomes a matter of justifiable dispute between them, and this court is called upon to settle that dispute in such a way as will recognize the equal rights of both and at the same time establish justice between them (Trelease, 1986: 581).

Further, in Idaho V. Oregon 462 US 1017, 103 S.Ct, 2817, 77 LED 2 d 387 (1983), the court held that the rule of equitable apportionment was applicable to interstate disputes over fish as well as to disputes over water:

> At the root of the doctrine is the same principle that animates many of the court's commerce clause case: a state may not preserve solely for its own inhabitants natural resources located within its borders. Consistent with this principle, states have an affirmative duty under the doctrine of equitable apportionment to take reasonable steps to conserve and even to augment the natural resources within their borders for the benefit of other states (Ibid: 593).

The foregoing cases provide insights into the nature of the problems of apportionment and the delicate adjustment of the interests of stakeholders in defining water rights and allocations as they evolved in diverse geographical regions. It is interesting to note that in the Kirindi Oya Irrigation System in Sri Lanka, the government acknowledged the prior rights of the farmers in the old area to receive as much water as in the past. Prior appropriation doctrine has thus been applied in the case of a conflict between the older farmers at Ellegala and the new area farmers over rights to water in a situation of water shortage (Jeffrey D. Brewer, 2000). Efforts to distribute the additional water captured by the new Lunugamvehera reservoir meant that the new areas received less intensive irrigation than the old (Brewer, 2000). Thus, in times of shortage, senior rights are satisfied fully before junior rights are addressed. This seems to contradict the doctrine of equitable apportionment and may appear inequitable to some.

While the growing water crises threaten the security, stability and environmental sustainability, the above doctrines offer a diverse means of reconciling competing demands in the face of dwindling supplies. The analysis leads to the conception that an adequate approach to water allocation and apportionment requires combining insights from various doctrines and perspectives and that a negotiated approach is essential to allocate water efficiently and equitably in the face of ever increasing demands.

Chapter 4

Allocation of Water between Agriculture and Domestic Use

4.1 Socio – Economic Features of the Study Area

4.1.1 Demographic Features

Data was gathered from 47 households in the Anuradhapura city area (drinking water users) and 43 households from the Thuruwila village, and the total population in the sample are 213 and 176 respectively. The survey respondents are mostly farmers and farmer leaders in the Thuruwila area, but in Anuradhapura area they are housewives and pensioners as given in table 4.2.

Average household size at Anuradhapura is 4.53, while it is 4.09 at Thuruwila. In both areas, about 52 percent of the population represents the youth in the age category of 15 – 45 years. According to the findings, achievements in education are higher in the Anuradhapura city area as compared with those of the Thuruwila village. About 66 percent of the population in Anuradhapura has received education upto G.C.E. (O/L) and above, while the corresponding figure for Thuruwila is 36 percent (table 4.1).

Table 4.1: Level of Education

Level	Anuradhapura		Thuruwila	
	No.	Percentage	No.	Percentage
No schooling elders	3	1	4	2
1 – 5 years	24	12	33	20
6 – 10 years	42	21	68	42
G.C.E. (O/L)	62	31	44	27
G.C.E. (A/L)	59	30	13	8
Graduates	9	5	2	1
Total	199	100	164	100

Source: HARTI Survey Data, 2007

4.1.2 Economic Features

About 80 percent of the households in the selected areas of Anuradhapura do not own agricultural land, while the rest have rain-fed highland only. Majority of the households in Thuruwila area are primarily dependant on agriculture for their livelihood as reflected in table 4.2. Agricultural land utilization in Thuruwila area shows that about 50 percent of land in the area is lowland (see figure 4.1) mainly utilized for paddy cultivation in both seasons. In Thuruwila, 50 percent of agricultural lands are 0.5 to 2 ac in extent. Only about 5 percent of households have lands over 5ac in extent. The distribution of land according to land extent and type of ownership is given in table 4.3 and 4.4. Majority of the extent under lowland and home garden are owned by single owners and about 67 percent of *chena*[2] are encroached lands.

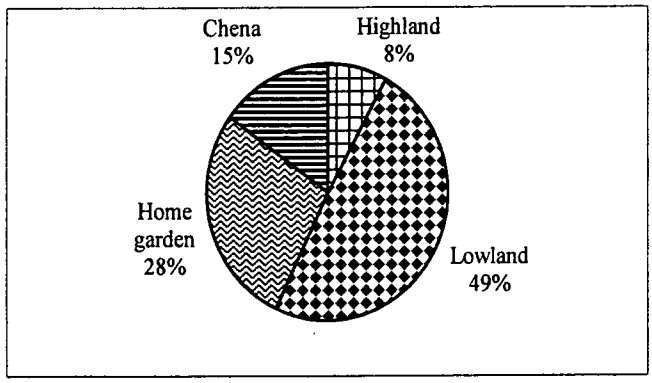
[2] Chena is variously defined as shifting cultivation, slash and burn cultivation, dry farming or swidden cultivation

Table 4.2: Status of the Respondents

	Anuradhapura		Thuruwila	
	No.	Percentage	No.	Percentage
General farmer	3	6	36	84
Farmer leader	-	-	4	9
Skilledworker	1	2	-	-
Government officials	4	9	2	5
Housewife	20	43	1	2
Private sector employee	1	2	-	-
Labourer	2	4	-	-
Pensioner	11	23	-	-
Self employed/business	5	11	-	-
Total	47	100	43	100

Source: HARTI Survey Data, 2007

Figure 4.1: Land Utilization (Thuruwila)



Source: HARTI Survey Data, 2007

Table 4.3: Distribution of Land Extents according to Size Class in Thuruwila

Range of Land Extent (ac)	Total extent (ac)	%
<¼	1.50	0.8
¼ - ½	15.00	7.6
½ - 1	35.00	17.8
1 – 2	43.00	21.8
2 – 5	93.50	47.5
>5	9.00	4.6
Total	197.00	100

Source: HARTI Survey Data, 2007

Table 4.4: Distribution of Land by Ownership in Thuruwila

Type of ownership	Lowland		Highland		Home garden		Chena	
	Extent (ac)	%	Extent (ac)	%	Extent (ac)	%	Extent (ac)	%
Single owner	50.5	52	2.25	14	48.75	87	3.5	12
Share owner	10.75	12	5	32	4.5	8	-	-
Share tenancy	6.25	6	0.5	3	2	4	-	-
Leased in	23.5	24	-	-	-	-	-	-
Mortgage in	6	6	-	-	-	-	-	-
Encroached land	-	-	3	19	0.5	1	19	67
Permit holder	-	-	5	32	-	-	6	21
Total	96.98	100	15.75	100	55.75	100	28.5	100

Source: HARTI Survey Data, 2007

The rate of unemployment is rather higher in Anuradhapura and scarcity of land for cultivation is predominant in the city area. Here, the employed majority is engaged in white collar jobs. Conversely about 36 percent of the sample population at Thuruwila pursues farming as their mainstay while a similar percentage rely on hiring out of their labour for on-farm and non-farm activities. The detailed breakdown of sources of primary and secondary income in the area is given in table 4.5.

Average household income varies from Rs.3,000 to 90,000 and 1,500 to 33,500 in Anuradhapura and Thuruwila respectively indicating that the average income is almost double in Anuradhapura. About 22 percent of households in Anuradhapura are in the income range of over Rs.35,000 while in Thuruwila where main household income source is farming, no households get such an income.

Table 4.5: Employment Pattern in the Sample Area (non-schooling over 15 years)

Type of employment	Anuradhapura				Thuruwila			
	Primary employment		Secondary employment		Primary employment		Secondary employment	
	No.	% N=137	No.	% N=113	No.	% N=137	No.	% N=113
No employment	82	52	71	94.7	13	10.5	95	84
Farmer/fisherman//livestock farmer	2	1	1	1.3	45	36	10	9
Labourer	9	6	2	2.7	44	35	3	3
Government sector employee	19	12	1	1.3	7	6	-	-
Private sector employee	17	11	-	-	5	4	-	-
Employed in security forces	11	7	-	-	6	5		
Self-employed/business	11	7	-	-	-	-	4	3
Migrant worker	2	1	-	-	3	2.5	-	-
Skilled worker	4	2.5	-	-	1	1	1	1
Total	157	100	75	100	124	100	113	100

Source: HARTI Survey Data, 2007

Table 4.6: Range of Monthly Household Income

Income range (Rs)	Anuradhapura			Thuruwila		
	No.	Mean (Rs)	% of households in income range	No.	Mean (Rs)	% of households in income range
<5000	2	3000	4	1	1500	2
5000 - 15000	6	11078	13	17	10700	40
15000 - 25000	14	17714	30.5	16	19523	37
25000 - 35000	14	27929	30.5	9	33500	21
35000 - 50000	2	37500	5	-	-	-
>50000	8	89500	17	-	-	-
Total	46	32662	100	43	18563	100

Source: HARTI Survey Data, 2007

4.2 Competition for Water in the Area and the Process Adopted for Water Allocation[3]

4.2.1 Background of the Problem

Anuradhapura town a fast growing city in Sri Lanka is also one of the proposed metro cities under the latest national physical planning policy. Since Anuradhapura is predominantly an agricultural area, the available surface water is primarily utilized for farming pursuits to the maximum. The reservoirs in the area have been built and maintained over the years mainly to cater to the demands for irrigation, and the Irrigation Department (ID) has been responsible for operating and maintaining these water resources. The pollution of available water sources also takes place at lower parts of cascades through the flow of drainage canals due to modern agricultural practises, intensive methods of cultivation and the use of high doses of fertilizers and agrochemicals.

The demand for drinking water Anuradhapura is very high resultant on the development taking place in the area, drier environment, low quality groundwater and increasing number of water users, particularly the security force personnel camped there. A drinking water supply project for the people in Anuradhapura first commenced in 1956 and was upgraded in 1972. The ID had permitted the drinking water providing agency, the National Water Supply and Drainage Board (NWSDB) to abstract water from Nuwarawewa (9,000 m^3/day) and Tissawewa (2,250 m^3/day) in 1954, since there was no much competition for water during that time. The abstraction of water from these two tanks increased to 11,000 m^3/day and 4,600 m^3/day respectively with the augmentation made to the drinking water system in 1972. The scheme had the capacity of providing water for a population of 56,000 which is only 46 percent of the total population in the Anuradhapura city area. The available water was just sufficient to provide a restricted supply of drinking water for 8-12 hours per day.

As a solution for the growing demand in the area, Anuradhapura Group Town Water Supply scheme (AGTWS) was implemented during the period 2002-2005. Anuradhapura, one of the major agricultural areas in the dry zone experiences water scarcities and the massive challenge the NWSDB confronted was access to a water source in adequate quantity and quality for a project to augment the supply of drinking water.

The implementation of a pipe-borne water supply programme was very much delayed because of the paucity of raw water, although clean water is one of the basic needs of the people. Most of the water storages/tanks received water from the Mahaweli project based on the seasonal water

[3] This section is based on Aheeyar (2007)

planning done by Mahaweli Water Panel mostly to suit the paddy cultivation in both seasons. However, the latest situation is quite different with the increased demand for water and difficulties in reaching an acceptable solution in allocating water between the two stakeholder groups involved.

The AGTWS scheme requires 36,600 m^3 of water per day until the year 2020 to meet the current water demand and provide a satisfactory water supply service for a population of about 156,000. Although providing safe water has prioritized the government development agenda since early 90s, the implementation of any course of action for this purpose was delayed due to the difficulties of allocating available water. Securing a socially, technically and economically feasible and reliable water source has been an unresolved issue for several years. The following sources had been mentioned at different times for the augmentation of the scheme (ADB and NWSDB, 1997).

i. Nuwarawewa tank
ii. Tissawewa tank
iii. Thuruwila tank
iv. Malwathu-Oya river
v. Nachchaduwa tank
vi. Rajangana tank
vii. Kalawewa tank
viii. Ground water

Nevertheless, considering the required capital, and the operation and maintenance (O&M) cost of the water supply project, reliability of the water source and the quality of water, the NWSDB initially recognized Nuwarawewa, Tissawewa, Thuruwila wewa and Nachchaduwa wewa as possible sources. However, the NWSDB had to drop the Nachchaduwa wewa option after the objections of the ID based on complexity of operations and possible farmer disputes in abstracting water. Therefore, three different options were studied under different scenarios for possible abstraction of water viz. Nuwarawewa, Tissawewa and Thuruwila wewa.

(a) **Option 1:** Abstracting total water requirements from Nuwara wewa and Tissawewa which are closer to the city area.

The ID was vehemently opposed to this option and they urged to extract the total drinking water requirement from a third source. The reasons for the objection were the present inadequacy of inflow, the high percentage of losses in transmission along the canal, cultural, archeological and aesthetic values of the sources and the possible disputes with the farmers. In economic terms, the capital cost requirement was little higher in this option because of the need for extensive improvements of the canal network and also for increasing the tanks storage capacity, but the O&M cost in this option was the least costly. It is noteworthy to mention that a survey was conducted by the NWSDB on the possibility of paying compensation to the farmers in lieu of their irrigation water rights from Nuwarawewa, but seventy percent of the farmers had strongly rejected the idea.

(b) **Option 2:** Extract the current quantity from the city tanks and the balance from Thuruwila, including future needs.

According to the economic analysis, this option involved the least capital investment to improve the canals, and do a little dredging and some improvements to the Thuruwila tank. In addition, a 16 km long transmission from Thuruwila to Anuradhapura was needed with a treatment plant and an intake at Thuruwila and also rehabilitation of the already existing treatment plants at Nuwarawewa and Tissawewa. However, pumping of water from a distance of 16 km, produces the highest O&M cost which was in the range of Rs. 60 per cubic meter. This rate was three times higher than the national average of water production in the drinking water sector.

(c) Option 3: Extract total water requirement from Thuruwila.
According to this option, the NWSDB had to abandon the already available treatment plants and other facilities at Nuwarawewa and Tissawewa (city tanks) and to make a fresh investment for new facilities and transmission lines from Thuruwila.

As an outcome of a series of negotiations between the NWSDB, the ID and the MASL on the allocation of required quantities of water, it was agreed to allocate a total of 6.6 million gallons per day (mgd) from Mahaweli water for the purpose of drinking water supply to the Anuradhapura city until the year 2017 and increase the quantity upto 10 mgd after completion of the Moragahakanda reservoir. Although allocation of water for drinking purposes was not complicated, the storage and reserving of the allocated water in a common reservoir for drinking purpose when there is a shortage of water for irrigation was the major problem for the authorities.

The NWSDB required the allocation and issue of water as follows based on the above mentioned option 2:

(a) Thuruwila tank – 21,000 m^3/day;
(b) Nuwarawewa tank – 11,000 m^3 / day; and
(c) Tissawewa tank – 4,000 m^3 / day.

The ID constantly opposed the withdrawal of water from Nuwarawewa and Tissawewa and requested to abstract the total requirement from Thuruwila. The NWSDB argued that, the ID proposal would lead to an increase in capital and O&M cost by 50 percent and ultimately the project would become financially non-valuable. Therefore, the main funding agency of the project, the Asian Development Bank (ADB), was not agreeable to finance this option at which time, the Minister of Mahaweli Development, the Chief Minister of North Central Province (NCP) and the Deputy Minister of Urban Development had to intervene with the stakeholders to settle the unresolved issue. Finally, the ID agreed with the NWSDB proposal on some conditions. The ID and the NWSDB signed two agreements namely, for sharing of water, and for the O&M of Thuruwila tank and its feeder canal system. The major components of the water sharing agreement signed between these two parties were, that water abstraction from Nuwarawewa and Tissawewa was limited to a ceiling and any further development for water abstraction after 2020 should be carried out at Thuruwila or any other suitable alternative source. The intake structures to be constructed at Thuruwila for water abstraction was the sole responsibility of the Director General of Irrigation and the NWSDB should allow the ID to inspect and observe any structure or a part of it in the irrigation infrastructure at any time. It was made obligatory on the part of the NWSDB to abstract a cumulative quantity not exceeding 36,000 m^3 / day in which abstraction from Nuwarawewa and Tissawewa could not exceed 11,000 m^3/day and 4,600 m^3 /day respectively. According to the agreement signed on O&M, the NWSDB has to allocate and release funds based on the estimate submitted by the ID for O&M of feeder canal from Amunukole to Mawathawewa (Nachchaduwa feeder canal) and the feeder canal from Mawathawewa to Thuruwila (Thuruwila feeder canal) including salary, fuel allowance and subsistence of the caretaker at Thuruwila operation centre, telephone bills of the operation centre, cost of maintenance of operation centre and the over-heads.

The striking feature of this exercise is the long time taken to reach a consensus between the ID and the NWSDB, though the MASL had agreed to release additional amount of water to meet the drinking water needs without the farmers' earlier water rights being affected. The ID was very careful in defending the farmers' water rights and well-being in spite of the delay in the process.

4.2.2 Conflict between Farmers and the Water Supply Project

The AGTWS project was co-financed by the ADB and the Government of France. Thuruwila farmers were misguided by some interested parties to harbour suspicion about the water

abstraction project, linking it with the selection of the French Consultancy Firm to construct the water treatment plant at Thuruwila. The farmers were also given the impression that the NWSDB was to sell the Thuruwila tank to the French company to establish a water trading business. The people in the Thuruwila area are '*purana*[4]' village farmers whose livelihood is primarily paddy cultivation practised in two seasons per year using Thuruwila tank water. Involvement of 70 % of the labour force directly in agriculture (farmers or farm labourers) and the lack of secondary employment for about 85% of the people indicate the prominent nature of the agriculture for the villagers and limitations in the availability of non agricultural livelihood options (table 4.5).

The farmers were convinced by some external interested parties that following the implementation of the water supply project they would have to lose their farming activities or have to face frequent crop failures due to water shortages in the aftermath of sharing their water. It was at this juncture that the "interested parties" attempted to exploit the under informed farmers to achieve some of their ulterior motives. The present survey sought to obtain the farmer perception about the mode of information they received about the water supply project. The findings are arrayed in table 4.7. The findings reveal that, the major channels the farmers depended on were informal and unauthentic sources such as neighbouring farmers and politicians. The response on information received through formal channels such as the government officials, the meetings/discussions was very minimal. The situation indicates the failure of the implementing agency in disseminating the required information and mobilizing people in the village to support the project.

Table 4.7: Role of Different Media on Awareness Creation about the Drinking Water Supply Project

Mode of Information	No. of responses N=43	% of total responses
Neighbours	28	65
Politicians	18	42
Meetings /Discussions organized by NWSDB	9	21
Farmer organizations/other rural organizations	6	14
NGO officials	2	5
Meetings/discussions organized by ID	1	5

Source: HARTI Survey Data, 2007

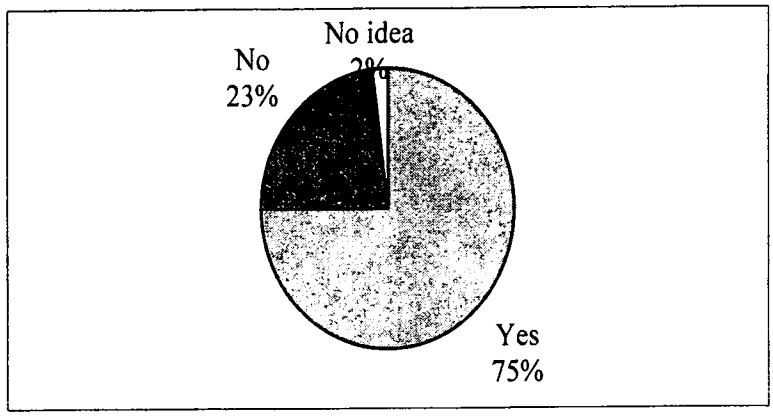
In the mean time, the interested parties organized these farmers against the project and formed a new village organization called the "Organization for Thuruwila Tank Protection". Anti-project NGO officials tried various strategies primarily to obstruct the information flow to the villagers on the factual situation of the project. They attempted to disrupt village awareness meetings conducted at the village level by the project by creating confusion among the villagers. Once the NGO organized a procession from the village to the Anuradhapura city and manhandled and threatened the officials of the NWSDB. Figure 4.2 illustrates that about 75 percent of the sample farmers objected to the water supply project at the initial stage.

Surprisingly, some key people of the village including as a leader of one prominent farmer organization, a retired school principal, and some young active members of the community, stood by the water supply project realizing its broader benefits. They played an active role with the officials of the NWSDB in creating awareness about the project in the village. Despite the intense awareness campaigns, a considerable section of villagers were still opposed fearing the possible ill-effects to their livelihood.

[4] Purana villages are the traditional villages in the area

At this juncture, then the Chief Minister of the NCP personally interfered and participated in a series of discussions with the villagers and the project officials. Although the meetings succeeded in creating a positive attitude among the villagers towards the project, yet some proportion of the villagers constantly worked against it. They believed that, Thuruwila tank and the water was the sole right of the Thuruwila people and there was no reason to give the Thuruwila water to benefit of the people living in the city. They not only damaged some initial structures of the project, but also threatened some of the project officials. The project had to obtain police security on several occasions.

Figure 4.2 : Objection to the Drinking Water Supply Project at the Initial Stage



Source: HARTI Survey Data, 2007

The civil society protesting against the water project resorted to legal action as their next step. They first filed a case at the Human Right Commission and proceeded to the Supreme Court arguing that the proposed project had violated the fundamental rights of the people of Thuruwila village. The NGO fully backed the entire process. Major issues highlighted in their petition were, deprivation of their traditional water right to cultivate paddy in two seasons per year, possible damages to the tank bund by the project and probable environmental pollution concerns. Simultaneously, they used the print media against the NWSDB and the project staff at village level distributing handbills and posters.

The Supreme Court accepted the fundamental rights case for hearing. Respondents to the case were the Minister of Irrigation and Water Resources Management, the Chief Minster of NCP, the Director General of Irrigation, the NWSDB and the MASL. Notably, during the hearing of the case, the Supreme Court was very concerned about the high quantity of fluoride and other quality parameters of water available in shallow wells and tube wells used for drinking purpose in the area and improvement of public health and sanitation of the people through implementation of the current water supply project. The court was equally interested to ensure proper compensation to be paid to the people whose lands are to be inundated by increasing the spill level of the Thuruwila tank. Finally, the relevant parties came to a mutually agreed settlement at the Supreme Court with following conditions.

a. The MASL agreed to release water to Thuruwila tank to represent a daily input of 27,000 m^3/day as far as practicable until the year 2020.
b. The ID and the NWSDB agreed to ensure not to exceed the maximum daily extraction of 21,000 m^3/ day until the year 2020.
c. The NWSDB agreed not to draw water from the Thuruwila tank in excess of the input at any given time.
d. It was agreed to measure input and output of water to the Thuruwila tank through appropriate measuring instruments on a daily basis and maintains permanent records. The records and measuring instruments are to be open for inspection by the members of public and the petitioners.

e. The respondents agreed to dispose of the waste generated by the water treatment plant without harming the health and environment of the community of Thuruwila.
f. The NWSDB agreed to allocate Rs. 02m to pay compensation through respective divisional secretariats to persons who may suffer loss or damage as a result of the implementation of the project.
g. The ID, the NWSDB and the MASL affirm that, it is their responsibility to implement the project without making damages to the Thuruwila tank bund. In the event of any damage caused to the bund, whoever suffers any loss of damage thereby are entitled to seek compensation from the relevant authorities.

4.2.3 Transform of Approach of NWSDB in Project Implementation

After continuous protests, processions and the court case, the project implementers realized the importance of obtaining co-operation and support of all stakeholders commencing from the project design and planning stage. With these lessons and experiences, the implementing agencies became more flexible than before in working with the village community. They used a bottom up approach which was expected to build trust with the community on the project and to obtain more co-operation for the success of the project. The project implemented a series of community activities beneficial to Thruwila villagers in order to keep the community intact with the project.

The NWSDB implemented a pilot project among the communities at Nuwarawewa and Thuruwila wewa aimed at protecting the catchment and command area, minimizing pollution of tank water and improving the socio-economic conditions of the community in the vicinity of the tanks (NWSDB, 2006). The project resorted to an integrated approach through the active participation of all the stakeholders. A systematic approach was made to build the social capital and the organizational capacity of the community and various income earning projects were put in place among the potential community members, selected through community level planning in order to maintain a cordial relationship with the community. Planting of forest plants, homegarden development, seed paddy cultivation, establishment of plant nurseries, a livestock development programme including poultry keeping, goat farming, piggery and inland fishery, herbal plant cultivation, bee keeping, mushroom cultivation and handicraft industries were some income earning projects implemented in the area. The livestock farmers received a good stock of animals and inland fishermen were provided with fishing equipment, fishing nets and canoes through fishermen's organization established by the project (ibid). In addition, the water supply project created employment opportunities to a large number of villagers on construction sites. These activities shaped the environment to develop a mutual understanding between the project officials and the villagers.

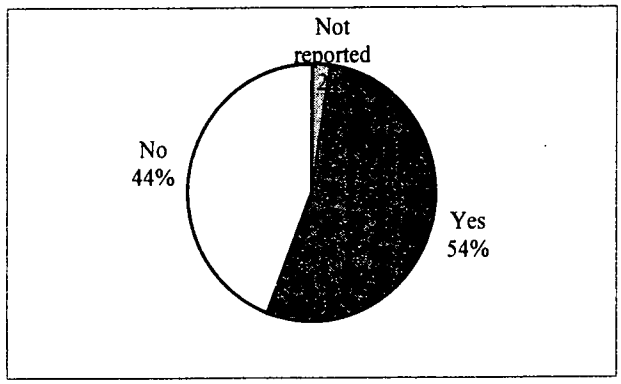
The project also donated a new building worth Rs. 1m to the village school to be used as an environmental resource centre, which was equipped with a computer center and a library. The centre has been used to conduct training programmes for the youth in the area in addition to being used by school children. The building has been formally handed over to the Department of Education.

The project identified that, 47 percent of families living in the villages around the Thuruwila tank, lacked sanitary toilet facilities causing serious environmental hazards including pollution of water resources. The project provided financial assistance on installment basis for 200 families at Thuruwila to construct sanitary toilets. On a request made by the villagers, the project constructed several bathing spots around the Thuruwila tank. Promotion of fishing and construction of bathing spots by the project assured their earlier demands for ensuring their traditional rights at the village tank to be used for bathing, fishing and other recreational activities.

The shift of approach adopted by the line agency in implementing the project and the agreement reached at the Supreme Court led to a positive change of mind among the community about the

drinking water project. It is interesting to note that about 54 percent of the sample farmers who were against the project at the initial stage perceived that they later had second thoughts and decided to support the project (figure 4.3). The factors leading to this change of attitude are listed in table 4.8. About 74 percent of these farmers accepted that they were misguided by various authorities and personnel at the initial stage mainly by the neighbours and the NGO officials as indicated in table 4.9.

Figure 4.3: Change of Attitude towards the Project



Source: HARTI Survey Data, 2007

Table 4.8: Factors Responsible for the Attitudinal Change

	No. of Responses	%of responses
Assurance given by the Supreme Court	14	61
Understanding the real situation of the project	5	22
Assurance given by the state officials	5	22
Realizing the broader benefits to be received to the entire society	5	22
Supplying of clean drinking water to the village	1	4
Assurance of water availability in the tank	1	4

Source: HARTI Survey Data, 2007

Table 4.9: Person Responsible for Misguiding the Farmers

Person	No. of Responses (N=23)	%of responses
Neighbours	12	52
NGO officials	4	17
Respectable people in the village	3	13
Members of some political parties	2	9
Not relevant/not misguided	6	26

Source: HARTI Survey Data, 2007

Box 1: Water-Sharing Conflict in Muruthawela Irrigation Scheme

Muruthawela is one of the major irrigation schemes in the Hambanthota district. The irrigated command area under the scheme is divided into tract 1, tract 2 and tract 3 with the low land area of 800ac, 1500ac and 1200ac respectively. At the Initial phase of the project, the total irrigated area was cultivated by 2100 families, but presently there are about 4000 families of 2nd and 3rd generation of the original farmer families.

Tract 3 was initially planned to develop under the Udawalawe scheme subsequently it was brought under the Muruthawela scheme and has created water scarcity in the scheme resultant to lower annual cropping intensity of around 130%. Farmers of the Tract 1 and 2 cultivate alternative seasons due to water scarcity and have to depend on off-farm income or other activities for one season per year.

In this context, NWSDB proposed to abstract water from the Muruthawela reservoir to meet the drinking water demand of the people in Weeraketiya and Walasmulla area with some strong political backing. ID and farmers strongly oppose the project considering the water scarcity already experience in the scheme. At this juncture, MASL agreed in writing to release 25000ac-ft of water per year from Chandrika Wewa under the Udawalawe scheme. Therefore, ID agreed to commence the construction of water supply project in 1995.

However, MASL failed to fulfill their commitment of releasing additional water to the Muruthawela reservoir to compensate the abstraction, because, the tail-end farmers under Chandrika Wewa experiencing water scarcity problem. It has been reported that, written agreement issued by higher authority of MASL was without consulting field level officers.

However, the construction of drinking water Supply project was completed without reaching any agreement between main stakeholders- farmers, ID, NWSDB and MASL. Farmers and ID did not allow the abstraction of water from the reservoir for drinking water for several years. Finally, water abstraction from reservoirs has begun since 2006 without any consensus under the political backing after a long delay. The current drinking water requirement is about 176,000 ac-feet per day. The impact of water abstraction to farmers is crop-damage or reduced yield for about 200-300ac per season during last couple of years.

The case is a clear example of top-down approach and the absence of transparency in development and outcome of the lack of proper bulk water allocation policy and institutional arrangements to manage the multiple needs of water.

4.3 Impacts of the Current Water Sharing Arrangement on the Farmers and the Drinking Water Users

4.3.1 Impacts on Domestic Water-Users of Anuradhapura

1. Saving of time spent on water fetching

People of Anuradhapura had to depend on different types of water sources in the past for different needs such as drinking, cooking, washing clothes, sanitary requirement and bathing. They had to walk or use bicycles/tractors/hired vehicles to carry water to households. Table 4.10 shows the dependency on multiple water sources for different needs before the project, but people have largely shifted their dependency on pipe-borne water after the project. The use of multiple sources to fulfill water requirements itself indicates the degree of water scarcity at a given point of time. However, the survey indicates that dug wells are the most commonly used water source. Reliability of the given water source and water quality parameters such as taste, colour and turbidity lead to a use of several water sources, which are spatially distributed much away from residences and warrant householders to spend more time to fetch water at a considerable cost.

Nevertheless with all these multiple water sources, about 9 percent of the people had experienced problems in meeting their daily water requirement during the dry seasons, while 28 percent and 50 percent of people have suffered without adequate water during festival seasons and special occasions respectively.

Table 4.10: Water Sources for Different Needs in Anuradhapura (Pre vs Post project Conditions)

Source of water	Drinking		Cooking		Sanitation	
	% of responses (before the project)	%of responses (after the project	% of responses (before the project)	%of responses (after the project	% of responses (before the project)	%of responses (after the project
Household well	19.1	4.2	23.4	4.2	35	13
Common well	2.1	-	2.1	-	2	-
Tube well	46.8	2.1	46.8	2.1	30	2
Neighbour's well	4.2	-	4.2	-	6	-
Irrigation tank/canal	-	-	-	-	13	2
Water Bowser	8.5	-	8.5	-	11	-
Tap water	4.2	95.7	4.2	97.8	-	83
Tap water from Neighbour/ relative's house	21	-	15		4	-

Source: HARTI Survey Data, 2007

Table 4.10 highlights that, dependency of people on different water sources other than pipe-borne water supply and the distance covered to fetch water has reduced tremendously after the project. The findings also show that about 25 to 27 percent of people had travelled over 1km daily to fetch water (table 4.11). One of the good features of the availability of different sources is that over 15 percent of people still use dug wells for their sanitary requirement after receiving purified pipe borne water. The main reasons for using dug wells for some of the water requirement were to reduce the water bills and maintaining the household well in the long run (not to abandon the well) as a water security measure.

Table 4.11: Average Distance to Water Source – Anuradhapura

Distance	Before the project		After the project	
	Dry season (%N=47)	Rainy season (%N=47)	Dry season (%N=47)	Rainy season (%N=47)
< 50m	48.9	48.9	11	
50 < 150 m	17	17	2	
150 < 250m	8.5	8.5	-	
250 < 500m	8.5	6.4	-	
500 < 1 km	17	10.6	-	
> = 1 km	27.6	25.5	-	

Source: HARTI Survey Data, 2007

This has resulted in the saving of labour time previously incurred in water fetching. According to table 4.12, over 90 percent of the beneficiaries are not spending time at all in fetching water following the implementation of the project, and the rest spend 5-25 minutes walk to the alternative water sources to meet some of their water requirement in order to reduce the water

tariff. However, about 34 percent of the beneficiaries had spent over 45 minutes each day to fetch water as a routine work, prior to the project.

Table 4.12: Average Time Spent for Water Fetching in Anuradhapura during Dry Seasons

Time range (per day in minutes)	Before the project		After the project	
	No. of responses N=47	% of responses	No. of responses N=47	% of responses
0<1	-	-	42	90
1<5	3	6	3	6
5-15	9	19	-	-
15-25	7	15	2	4
25-45	10	21		
45-60	6	13		
>60	10	21		

Source: HARTI Survey Data, 2007

The study attempts to analyse the method of utilization of saved time due to the supply of pipe borne water. The results are arrayed in table 4.13. Saved time is mainly used for household work, leisure and looking after the children and helping their education or engaging in income earning activities, such as business/boutique and self employment, or working longer hours in the work places. This has helped to supplement the income of the beneficiary households.

Table 4.13: Method of Utilization of Saved Time

Method	No. of responses N=47	% of responses
Leisure	26	55
Household works	22	46
Child care/education	17	36
Income earning activities	5	11
Home gardening	3	6
Community works	2	4

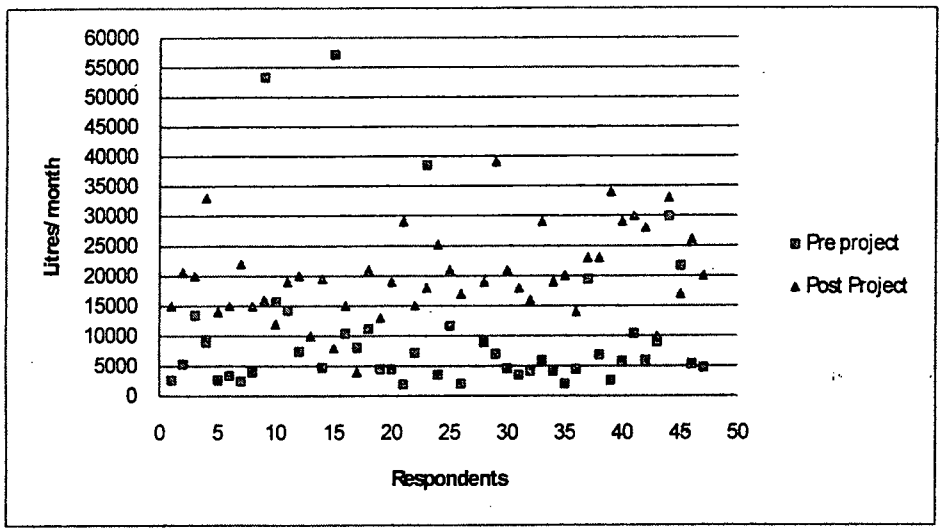
Source: HARTI Survey Data, 2007

2. Improvement in household water security

The main objective of any drinking water supply project is to improve the household water security in terms of both quality and quantity. The term 'water security' can be defined as timely availability of adequate quantity of water at the required quality from an accessible distance. This research analyses the change in household level water consumption by assessing the total quantity of water fetched before the project from different water sources and the metered reading of water use plus water fetched from other sources after the project. Figure 4.4 clearly illustrates the higher level of improvement in household level water consumption among the beneficiaries in the post project scenario.

The quality perception of the water they used in the past from dug wells and tube wells (the main sources used for drinking) is given in table 4.14. The majority of the users were not happy with the quality of the water they used in the past.

Figure 4.4: Average Monthly Water Use in Anuradhapura (Pre vs Post Project)



Source: HARTI Survey Data, 2007

Table 4.14: Quality Perception of Drinking Water Used from Household Wells and Tube Wells – Anuradhapura

Quality	Dry season		Wet season	
	Household well % of responses N=23	Tube wells % of responses N=26	Household well % of responses N=23	Tube wells % of responses N=26
Good	22	42	26	35
Average	48	31	37	45
Poor	30	27	37	20

Source: HARTI Survey Data, 2007

3. Impact on women's and children's welfare

The research results show that the women and the female children are the main water fetchers at household level. Men leave the households early in the morning and women have to undertake the burden of fetching water during the day time. The school children had to devote their leisure hours to fetch water from distant areas. They had to be in the queue at the tube wells and common wells for hours during dry seasons to fetch a bucket of water. (see table 4.15)

Table 4.15: Water Fetchers at Household Level – Anuradhapura (pre-project)

Water fetchers	No. of responses	% of responses
Women	19	41
Men	11	23
Both women and men	8	17
Children	3	6.5
Women and children	3	6.5
Women, men and children	1	2
No special task allocation	2	4

Source: HARTI Survey Data, 2007

Availability of water at homestead following the implementation of the project has a greater advantage for women and children in meeting their sanitary and bathing requirements in a socially

and culturally acceptable manner. They now can obviate the public open places such as irrigation tanks, irrigation channels, public wells and street taps for bathing.

4. Impacts on health and well-being

Provisions of safe water and access to safe sanitation have a positive effect on health aspects of the people. The survey findings reveal that, 40 percent of the people (19 persons out of 47) have realized the improvement in health and well-being in their life resultant on the operation of the drinking water supply project. It does not mean that, the project has overlooked the health condition of the rest of the people, but, it may be that they are in the dark about the health impacts made by having safe water. The major health benefits as perceived by the beneficiaries are improved quality of cooked food, safety from urinary disorders, prevention from fluoride deposition in teeth/discolouration of teeth, healthy maintenance of hair and relief from body pains they had earlier due to carrying water from long distances (table 4.16 & 4.17).

Table 4.16: Health Related Problems Experienced before the Project – Anuradhapura

Health aspects	No. of responses N=47	% of responses
Health problem related to urinary system	07	15
Fluorite deposits in teeth and discolouration	07	15
Problem of hair loss and other related conditions	01	2
Joint pains due to carrying water	01	2
Not aware of health problems	31	66

Source: HARTI Survey Data, 2007

Table 4.17: Health Benefits of the Drinking Water Project - Anuradhapura

Health Impacts	No. of responses N=19	% of responses
Safety from urinary disorders	10	53
Improved quality of cooked foods	5	26
Safe water is essential to maintain good health	6	32
Good management of hair with quality water	3	16
Health benefit from availability of good sanitation	3	16
Prevention from discolouration of teeth	2	10
Relief from body pains	6	32

Source: HARTI Survey Data, 2007

5. Other impacts

Water supply project has directly and indirectly benefited the area. Increase of household income, higher land values, improved social status and leisure, peace and harmony at household level are some of the key benefits the villagers have received through the project. Table 4.18 shows some of the impacts made by the project on day to day life of the people in the area.

Table 4.18: Other Impacts of Drinking Water Supply on Day to Day Life

Other impacts	No. of responses N=47	% of responses
Time saving	38	81
Improvement in health and sanitation	32	68
Enhanced quality of cooked foods	18	38
More opportunities for livelihood activities	7	15
Home gardening	11	23
Rest, relief, freedom, peace and harmony at household	17	36
Increased social status	03	6

Source: HARTI Survey Data, 2007

4.3.2 Impacts on Farming Community in Thuruwila

1. Access to secure water and improvement in social well-being

As in Anuradhapura, people in the Thuruwila village also depended on multiple water sources for their daily water requirements such as household well, common well, neighbour's well, tube well and irrigation tank. About 33 percent of the sample farmer families had to walk over 500 meters per day to fetch their water, spending about 45 minutes to more than one hour of their valuable labour time. Table 4.19 and 4.20 show the distance they had to travel and the time spent in fetching water. After the drinking water supply project 53 percent of households have opted for pipe water connection, while 35 percent of the people have expressed their unwillingness either because they have wells or by way of a protest to the project.

Table 4.19: Distance to Water Source for Household Requirements – Thuruwila

Distance (m)	Dry season		Wet season	
	No. of responses N=43	% of responses	No. of responses N=43	% of responses
<50	26	60	22	51
50-150	12	28	8	19
150-250	-	-	1	2
250-500	4	9	4	9
>500	14	33	12	28

Source: HARTI Survey Data, 2007

Table 4.20: Average Time Spent to Fetch Water – Thuruwila

Time (minutes)	Dry season		Wet season	
	No. of responses N=43	% of responses	No. of responses N=43	% of responses
<5	3	7	3	7
5-15	12	3	10	23
15-25	14	33	12	28
25-45	9	21	9	21
45-60	4	9	5	12
>60	13	30	8	19

Source: HARTI Survey Data, 2007

2. Impact on irrigated agriculture

One of the major reasons that misguided the people to act against the drinking water supply project was fear of crop failures or the possibility of water scarcity for irrigated agriculture. The research findings suggest that according to the responses of 45 percent of the farmers, the project has not affected the irrigated farming in any form. 19 percent of the farmers perceived that, reliability of irrigated water in the tank in fact has improved after the project due to the assured water supply from Mahaweli water (table 4.21).

The farmers are rather dissatisfied with the adoption of the strict water management mechanism under the rotational water issue system after the rehabilitation of the canal networks by the project, but there is no crop failure reported due to the project.

Table 4.21: Impacts of Drinking Water Supply Project on Irrigation Water Issues

Impact	No. of responses (N=43)	% of responses
No any harmful effect	11	26
Increase reliability in water issue	8	19
Adoption of rotational water issue and less freedom in water use	20	46
Reduced waste of water	4	9

Source: HARTI Survey Data, 2007

The present study made an attempt to assess the impact of the current water sharing arrangement on the agricultural output. The results are given in table 4.22. The main highlight of the findings is that the majority (84 percent) of the farmers have not experienced any significant impact on their agricultural output due to the project.

Table 4.22: Impacts of Drinking Water Supply Project on Agricultural Output

Type of effect	No. of responses (N=43)	% of responses
No any effect	36	84
More crop failures in *yala* season	05	12
No production in inundated paddy land	01	2
Increase agricultural output by better water management	01	2

Source: HARTI Survey Data, 2007

3. Other impacts

The drinking water project implemented in the area has brought forth various other direct and indirect benefits. One of the major direct impacts is the development of rural infrastructure such as the road network, lining of irrigation channels and development of some of the community facilities such as school buildings. The water supply project has made a remarkable contribution in developing knowledge and skills of rural organizations on various aspects of community development, organizational development, environmentally friendly agricultural practises and techniques of water resource management. The strength of the farmer organization (FO) and other community based organizations (CBOs) has increased after the water project, and they have developed the capacity to handle future village development activities and has created wider linkages with other organizations.

Table 4.23: Other Impacts of the Water Supply Project to the Village as Perceived by Thuruwila Farmers

Impacts	No. of responses	% of responses*
Lining of irrigation channels	37	86
Safe water and improved status	27	63
Improved village infrastructure	25	58
Provision of community facilities	07	16
No remarkable impacts	04	09
Cleaner environment	02	05
Capacity building of rural organization	01	02
Increased land value	01	02
Loss of cultivation due to lack of seepage after channel lining	01	02

*Due to multiple answers given by respondents, percentage sums to more than 100.
Source: HARTI Survey Data, 2007

About 45 percent of the beneficiaries were of the view that, they could save their valuable labour time after the project because of the rotational irrigation water issue, availability of drinking water at the household and lining of canal network, which needed minimum labour contribution for seasonal routine maintenance. However, about 15 percent of the farmers said that, they had lost their freedom in using irrigation water due to the introduction of rotational irrigation issues.

The major water source used for drinking needs was dug wells. About 40 percent of the dug well users both in dry and wet seasons believed that, the quality of the water they were using was not of good standard (table 4.24). Although, the rest perceived otherwise the groundwater quality in north central province is questionable.

Table 4.24: Quality Perception of Drinking Water (Thuruwila)

Perception	Dry season Dug wells N=38		Wet season Dug wells N=34	
	No.	%	No.	%
Good	23	60	21	62
Average	7	18	6	18
Poor	8	21	7	20

Source: HARTI Survey Data, 2007

Table 4.25 highlights the water fetchers at household level. As in other areas, women and female children are the main water fetchers in Thuruwila. Therefore, the pipe-borne water supply project has more benefitted the women and children.

Table 4.25: Water Carriers at Household Level – Thuruwila

Water fetcher	No. of responses	% of responses
Both men and women	15	35
Usually women	10	23
Children	7	16
Usually men	7	16
Men, women and children	2	5
No special effort	2	5

Source: HARTI Survey Data, 2007

About 7 percent of households had experienced difficulties in managing daily water requirements during dry periods, while 12 percent and 26 percent of sample households had difficulties in meeting water requirements at festival seasons and during special occasions before the project.

4.4 Water Allocation Priorities among Farmers and the Drinking Water Users

The perceptions of the beneficiaries on the allocation of the limited available water during the dry season were elicited and prioritized among different uses. Beneficiaries were asked to prioritize the importance of water allocation on a scale of first priority (5) to "lowest priority" (1). A score of 5 was the maximum value. Results were analyzed by comparing the weighted mean to obtain each allocation priority. The sector that the respondents felt most strongly about received a higher mean value.

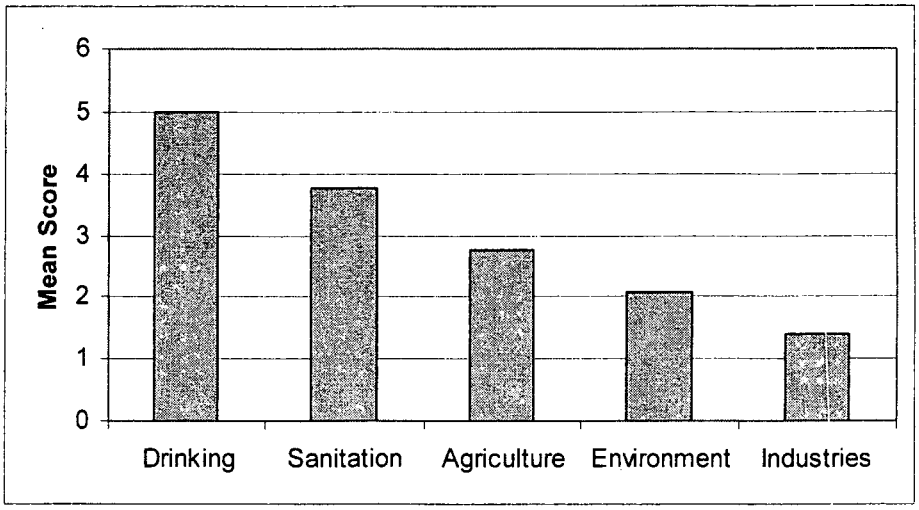
Water allocation priority in Thuruwila and Anuradhapura city areas obtained from this analysis is given in table 4.26. Although the majority of the farming community in Thuruwila opposed the drinking water project at the initial stage about 98 percent of the farmers chose that drinking water allocation should be the first priority during the water scarcity in allocating limited amount of water, and this was followed by water for sanitary needs (figure 4.5).

Table 4.26: Water Allocation Priorities in Thuruwila and Anuradhapura

Water Allocation Sector	Thuruwila		Anuradhapura	
	Weighted Mean Score	Rank of Allocation Priority	Weighted Mean Score	Rank of Allocation Priority
Drinking Water	4.98	1	5.00	1
Sanitation	3.77	2	4.00	2
Agriculture	2.77	3	2.09	4
Environmental needs	2.09	4	2.47	3
Industrial Requirements	1.04	5	1.45	5

Source: HARTI Survey Data, 2007

Figure 4.5: Water Allocation Priorities – Thuruwila (Rural Water Users)

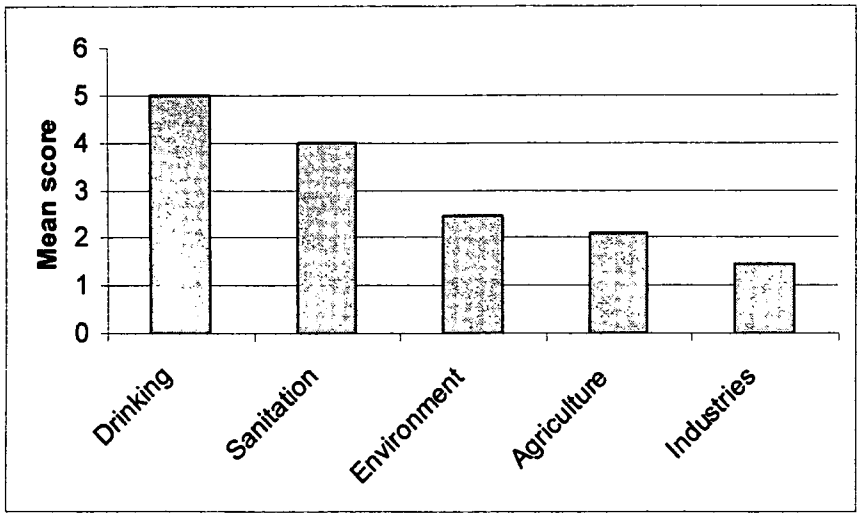


Source: HARTI Survey Data, 2007

The order of water allocation priority of the drinking water users (mainly non-farmers) in the city areas of Anuradhapura also shows a similar pattern except the change of the third and fourth priority as illustrated in figure 4.6. The order of allocation priority in Anuradhapura is listed below.

1. First priority –Water for drinking needs
2. Second priority- Water for sanitation
3. Third priority- Water for ecological needs
4. Fourth priority- Water for agriculture
5. Fifth priority- Water for industries

Figure 4.6: Water Allocation Priorities – Anuradhapura (Urban Water Users)



Source: HARTI Survey Data, 2007

Chapter 5

Allocation of Water between Agriculture and Hydropower Generation

5.1 Socio-economic Features of the Study Area

5.1.1 Demographic Features

The Kalthota Irrigation Scheme (KIS) was studied in order to understand the experiences of water allocation between agriculture and hydropower generation. The total number of households in the selected channel areas are 202 (DC_2 and DC_3). Out of 147 households in DC_2 and 55 households in DC_3, 25 and 21 households were randomly selected from the respective channels for the detailed study, making a sample of 46 in all. All the survey respondents were farmers, 20 percent of whom were farmer leaders/representatives.

Over 91 percent of the total households (46 households) surveyed were headed by males. The average family size is 4.15. Depending on the number of members in the households, sample households were grouped into three; namely households with 1-3 members, 4-5 members and over 5 members. About 50 percent of the total households have 4-5 members, and households with 1-3 members are 33 percent while families with 6 or more members are 17 percent. A balanced gender distribution could be observed among the population with the male: female ratio of 51:49.

Among the studied sample, only 44 percent of the total households represent the youth between 15-45 years of age. Population below 14 years and above 65 years of age account for about 22 percent and 7 percent respectively. A high literacy rate is generally observable in Sri Lanka and this is applicable to KIS also (99 percent). According to the survey data, about 30 percent of household population have received education up to GCE (O/L) and 14 percent up to GCE (A/L), while only 2 percent have achieved the graduate level. Table 5.1 shows the level of education in KIS.

Table 5.1: Level of Education

Level	No.	%
No schooling elders	1	1
1 – 5	47	27
6 – 10	45	26
GCE (O/L)	52	30
GCE (A/L)	24	14
Graduate	2	2
Total	171	100

Source: HARTI survey Data, 2007

5.1.2 Economic Features

Table 5.2 shows the employment status of the household heads. Majority of the household heads in the KIS are primarily depending on agriculture for their livelihood (93 percent), while only 7 percent is engaged in farming as their secondary source of income.

Table 5.2: Employment Status of Household Heads

Respondent	Primary Employment		Secondary Employment	
	No. (N=43)	%	No. (N=43)	%
General farmer	40	93	3	7
Government sector employee	2	5	2	5
Self-employed	-	-	2	5
Skilled worker	1	2	3	7
No employment	-	-	33	76
Total	43	100	43	100

Source: HARTI survey Data, 2007

Monthly average household income was calculated to include both on-farm and off-farm aspects. According to table 5.3, the average household income varies from Rs. 3,000 – 36,000 in the KIS area. About 41 percent of the households received a monthly household income of less than Rs. 5,000. Only 7 percent of the total sample belonged to the high income group of over Rs. 25,000 per month.

Table 5.3: Monthly Household Income Ranges

Income range (Rs)	No.	Sum of income (Rs.)	Mean income (Rs)	% of people in income range
<5,000	19	58,649	3,087	41
5,000 – 10,000	8	53,400	6,625	17
10,000 – 15,000	7	82,000	11,714	15
15,000 – 20,000	5	87,000	17,400	11
20,000 – 25,000	4	90,415	22,603	9
>25,000	3	109,380	36,460	7
Total	46	480,842	10,453	100

Source: HARTI survey Data, 2007

As shown in table 5.4, primary employment of 32 percent of the population is farming, followed by income earned form hiring out of labour. About 30 percent of the population (over 15 year's non schooling category) are without any primary employment, while 84 percent of this population group are without any secondary source of income.

Paddy is the main agricultural crop in both *yala* and *maha* seasons in the KIS and paddy cultivation accounts for 97 percent of the total cultivated land extent. Growing of other crops is negligible (table 5.5).

The available data revealed that the KIS farmers have enough water to cultivate paddy in both seasons. Although, the CEB has encouraged the farmers on the importance of cultivating the low water consuming, high value cash crops, the findings reveal that the farmers mainly rely on paddy in both seasons and no significant attempts have been made to change the cropping pattern except the cultivation of OFCs, such as, pulses, vegetables and oil crops in a limited extent of land.

Table 5.4: Employment Pattern in the Area (Non schooling over 15 years)

Type of employment	Primary		Secondary	
	No.	%	No.	%
No employment	44	30	87	84
Farmer	47	32	3	3
Labourer	38	26	4	4
Government sector employee	8	5.4	-	-
Private sector employee	6	4	2	2
Self-employed	3	2	4	4
Skilled worker	1	0.6	3	3
Total	147	100	103	100

Source: HARTI Survey Data, 2007

Table 5.5: Crops Cultivated in *Yala* and *Maha* Seasons (Low lands)

Crop	*Maha*		*Yala*	
	Extent (ac)	%	Extent (ac)	%
Paddy	74.38	97.0	73.63	97.0
OFC	1.75	2.28	1.75	2.3
Mixed crops	0.5	0.6	0.5	0.6
Total	76.63	100.0	75.88	100.0

Source: HARTI Survey Data, 2007

Table 5.6 describes the earnings from the agricultural activities by households in the area. Income from farming as the main income source is in the range of Rs. 5,000 to Rs. 20,000 per month for about 43% of the farmers. 56.5 percent of the farmers belong to the income range of less than Rs.5000. Farm income earners are in the low income groups, if their main income source is agricultural activities.

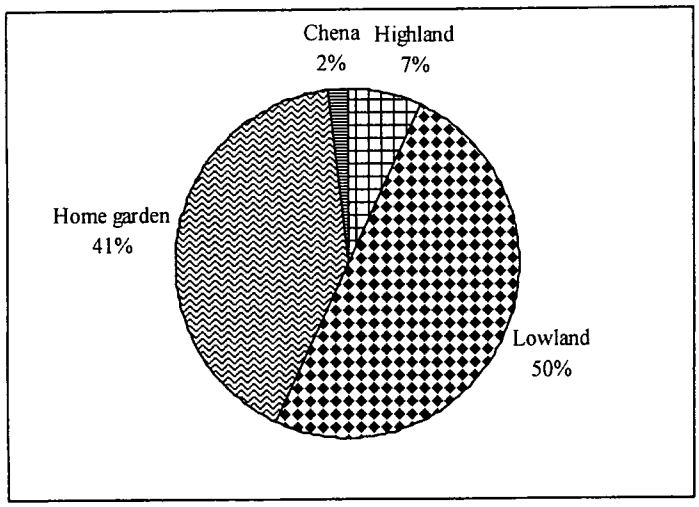
Table 5.6: Range of Monthly Household Income Earned from Agricultural Activities (Non-schooling over 15 years)

Income range (Rs)	No.	Mean (Rs)	% of households in income range
<5000	26	3,129	56.5
5000-10000	12	6,423	26
10000-15000	5	11,747	11
15000-20000	3	17,850	6.5
Total	46	5,886	100

Source: HARTI Survey Data, 2007

Land is the most basic natural resource to the agricultural community of the area. At the initial stages of the KIS, settler families were provided 1.2 ha of low land and 0.4 ha of high land (Molle, 2005). The findings show that, about 75 percent of the surveyed farmers at present own small land parcels of 0.5 to 1 acre extent. Also the findings show the effects of fragmentation among the second and third generation with low agricultural income at household level. 50 percent of the total land area is low land in KIS as illustrated in figure 5.1.

Figure 5.1: Land Utilization



Source: HARTI Survey Data, 2007

Ownership figures show that almost 60 percent of all land categories are operated by single owners (table 5.7). The encroachers and permit land holders are not of much significance in the KIS. As irrigation water is plentiful in the area, *Chena* cultivation is not a prominent activity.

Table 5.7: Distribution of Land by Ownership

Type of ownership	Lowland		Highland		Home garden		Chena	
	Extent (ac)	%	Extent (ac)	%	Extent (ac)	%	Extent (ac)	%
Single owner	50	61.16	2.25	60	21.12	75.8	1.5	60
Share owner	20.5	25	-	-	3.75	13.4	-	-
Share tenancy	8.5	10.4	-	-	2.5	9	-	-
Mortgage in	2.0	2.44	-	-	-	-	-	-
Encroached land	0.75	1	0.5	13.33	-	-	1	40
Permit holder	-	-	1	26.67	0.5	1.8	-	-
Total	81.75	100	3.75	100	27.87	100	2.5	100

Source: HARTI Survey Data, 2007

5.2 Process Adopted in Water Allocation

5.2.1 Background of the KIS

The KIS is an ancient diversion scheme constructed across the Walawe river. The water usage of the KIS is very high compared to other irrigation schemes in the country since the irrigated area consists of alluvial soil with high sand content, which is not appropriate for paddy cultivation due to low water holding capacity (Imbulana, 2006). The availability of plenty of water, poor irrigation infrastructure and the farmer's attitudes also cause a high level of water losses in this area (ibid).

Prior to the construction of the Samanalawewa reservoir, the KIS depended on the Walawe river for its water requirements but the completion of the reservoir made it possible for the KIS to get the water through the irrigation outlet of the Samanalawewa and also the water released through the reservoir leakage. With the completion of the Samanalawewa dam, the flow of the Walawe was diverted to another basin and the outflow of the power plant of the Samanalawewa returns to

the Walawe river precisely at the downstream tip of the KIS and it totally by-passes the KIS. The affected water users are located in the downstream of the dam. Downstream farmers were deprived of the quotient water they used to get before. With this background, the farmers in the KIS had to change their habitual practises of water use and totally depend on the water released from the Samanalawewa reservoir. This situation created a water sharing problem between the Ceylon Electricity Board (CEB) and the KIS farmers.

5.2.2 Water Sharing between Farmers and Ceylon Electricity Board

The Samanalawewa dam has been constructed mainly for power generation and flood control purposes. After its completion, an unexpected water leakage has been experienced from the dam which has made available approximately 55 million m^3 for the KIS without any control during the whole year. On average, Samanalawewa power plants were designed to generate 300 GWh of electricity annually, but the real achievement in 2007 was only 224GWh. The Irrigation Department (ID), the Kalthota farmers and the CEB are the main stakeholders involved in the water sharing between the KIS and the Samanalawewa hydropower project. Each party has their own agenda and different mandates in utilizing available water resources. Some of the problems surfacing from the acts of different stakeholders have implications at national level, while some others have social, economic, political and cultural magnitude. Most probably, the CEB and the ID have to meet the national and provincial level (macro level) requirements to cope up with water sharing mechanism in the KIS. But, the KIS farmers are interested in the micro level condition and ensuring traditional water use rights in their water sharing activities tied up with social and cultural situation in that area.

All these three parties have to share the available water among them with several difficulties. The ID has to maintain the system operations through organizing and coordinating institutional development activities with the farmer organization in the KIS. Due to upstream water intake for hydropower generation in the Walawe river, the farmers who live in the KIS were obliged to observe some controls in using their irrigation water compared to the free flow of water they had in the past. At the same time, the CEB also had to utilize the available water resources for maximum energy generation making use of the inbuilt capacity of the power plant to meet the ever growing country's energy demand.

It was revealed in the key informant discussions that, some farmers located in the tail-end areas of the system are not receiving enough water for their cultivation.

5.2.3 Gross Water Productivity in Paddy Cultivation and Hydropower Generation

Molle, *et al*, (2005) have estimated the value of water in both paddy production and electricity generation using the 2001 data. The calculations are based on the following assumptions.

1. The total irrigation release was 40 Mm^3 per year
2. Two season average yield (paddy) was 5187 kg/ha
3. The price of one kwh was considered the price paid, when bought by the CEB from independent producers (Rs. 7/unit).
4. Considering the calculation of hydropower foregone, fixed cost and recurrent expenditures remain unchanged.

The calculated figure by Molle, *et al* (2005) given below describes the "opportunity cost" of water released for irrigation

Total land extent cultivated in KIS	= 865.5 ha
Total paddy production (two seasons)	= 8,310 mt
Average selling price per kg of paddy (year 2007)	= Rs. 15
Average production cost per ha per season	= Rs. 22,000

The gross value of total yield (GV)	= Rs. 124,650,000
The net value of total yield (NV)	= Rs. 86,568,000
The value of one m^3 of water for irrigation	= Rs. 2.16
Total release for irrigation	= 40 Mm^3
The hydropower generation from 40 Mm3	= 30 GWh
Price paid by CEB for 1 KWh	= Rs. 7
The value of the hydropower generated	= Rs. 210,000,000
The value of one m^3 of water for hydropower	= Rs. 5.25

Based on our survey findings and available secondary data, cost of production of paddy, return from paddy cultivation and the value of water for both paddy cultivation and electricity generation were calculated. In this study the value of water for power generation is based on the recurrent cost of thermal power generation. It is assumed that the foregone value of water (irrigation release) covers the running cost of thermal generators. This calculation was carried out with the assumptions made by Molle, *et al* (2005). In addition, it was assumed that the cost of fuel is the cost of thermal power production and the operating cost and other overheads were not considered.

The ratio between the value of one cubic meter of water used for paddy cultivation and thermal power generation is 1:2.77 in the year 2007. In other words, the reduction of the amount of water used for the cultivation has an added advantage of producing hydropower by 2.77 times. Therefore saving of water in irrigation increases the thermal power generation and thereby cut down the fuel import cost.

Value of water (Irrigation) in 2007	
Total land extent cultivated in KIS	= 865.5 ha
Total yield (two seasons)	= 8,978.7 mt (5187*865.5*2)
Average selling price of paddy (year 2007 *Yala*)	= Rs. 20/kg
Average production cost per season	= Rs 34,500/ha
The gross value of total yield (GV)	= Rs. 179,574,000
The net value of total yield (NV)	= Rs. 119,854,500
The value of one m^3 of water for irrigation	= Rs. 2.99

Value of water (Hydropower) in 2007	
Total release for irrigation	= 40 Mm^3
The amount of energy unit lost due to Irrigation release (40 Mm3)	= 30 GWh
Average fuel cost per unit of energy (1 KWh)	= Rs. 11.07
The value of the thermal power generated (Value of fuel imports to cover up the loss)	= Rs. 332,100,000(30*11.07)
The value of one m^3 of water for thermal power	= Rs. 8.30

5.2.4 Method of Water Allocation

According to the feasibility study done by the CEB prior to the construction of the Samanalawewa dam, it was assessed to release about 46.36 Mm^3/year from the reservoir for the agricultural purposes (Molle *et al*, 2005). But, due to the unexpected leak that occurred in the dam, an yearly average volume of 55 Mm^3 is released to the river system without control of dam.

The leakage quantity varies based on the water height in the reservoir which is not in line with the irrigation requirements. Therefore, another 40 Mm^3 allotment is agreed to release through the sluice as irrigation quota other than the run-off generated by the small catchment between the dam and the scheme. However, according to the ID sources, actual irrigation use needs lesser than above figures. The ID has no record to prove the actual quantity of water they had taken out for irrigation needs due to the unavailability of calibrated measuring gauges installed in the scheme. The lack of proper irrigation structures and the deteriorated conditions of the channel network also lead to wastage of water which in turn creates difficulties in supplying the pre-determined quantity of water at farm level.

At the beginning of every season a water panel meeting is held at the KIS with the participation of the irrigation engineer in charge, the divisional secretary, relevant officers from the Agricultural Department and the farmer representatives. At this meeting, decisions are taken on the date of water issued and the quantities. These decisions are further discussed at the Water Management Secretariat with the participation of officials form the CEB, the Director and the Deputy Director of the Water Management Secretariat, officials from the Mahaweli Head Works and the representatives from the NWSDB. At this meeting, the final schedule is drawn up for water release to the KIS (Weerasinghe and Somathilaka, 2002). The progress and problems of implementing the planned schedule is reviewed at the weekly water management meetings. Any change to the existing water discharge plan cannot be made without the knowledge of the irrigation officer stationed at Kalthota (ibid).

It has been reported that water duty in the KIS is higher (10-13 acre feet) compared to that of many other irrigation schemes. It is more than double the duty of many of the well performing irrigation schemes in the country. The provision of continuous water issue to perform land preparation for 25-30 days in the KIS is relatively longer compared to 14-21 days in other irrigation schemes. The CEB made various efforts to reduce the water use at farm level with the collaboration of the ID through conducting awareness programmes and introducing various water management techniques without much success. Promotion of the System of Rice Intensification (SRI) and "Nawa Kekulam" method of cultivation and supply of tractors to selected farmers to reduce the duration of land preparation are some of the strategies adopted by the CEB.

Therefore, the study made an attempt to analyze the farmers' attitudes towards water saving and management at the field level. The farmer perceptions were obtained on the attitudes of the farmer community on their efforts of saving irrigation water through reducing the off-takes of water as soon as they received an adequate irrigation supply. The farmers are conscious that, excess water is not only bad for their crop, but also a waste that will cause bad effects for fellow farmers and loss to the country. However, only about 54 percent of the farmers believed that, all or most of the farmers in the scheme should take vigilant actions to reduce water wastages. The rest perceived that only some of the fellow farmers made efforts to reduce water wastages and save the precious resources (table 5.8). At the same time, the study considered the farmers' experiences of receiving the routine water share at the field level (table 5.9). Table 5.9 again validates the findings of the table 5.8, that almost 44 percent of the farmers perceived that only some of the farmers received their fare share of water at the field level. Therefore, the findings highlight the water management problems at the field level leading to wastage of water and higher irrigation demand.

Table 5.8: Efforts of Farmers on Saving of Water at Field Level in Past Seasons

Response	Frequency	Percentage
Every farmer has attempted to take measures to reduce water wastage and save the water	13	28.3
Most of the farmers has attempted to take measures to reduce water wastage and save the water	12	26.1
Some of the farmers have attempted to take measures to reduce water wastage and save the water	20	43.5
None of the farmers has attempted to save the water using measures to reduce water wastage	1	2.2
Total	46	100

Source: HARTI Survey Data, 2007

Table 5.9: Farmers Perception on Receiving Allocated Water Quota at Field Level

Perception	No. N=46	% of Responses
Every farmer gets his fair share of water	8	17
Most of the farmers get their fair share of water	17	37
Some of the farmers get their fair share of water	20	44
None of the farmers gets their fair share of water	1	2
Total	46	100

Source: HARTI Survey Data, 2007

The CEB introduced a compensation scheme for the farmers' water right for two *yala* seasons, in 1997 and 1998 after discussing with all the stakeholders, and the farmers received a cash compensation of Rs. 14, 000 per acre of paddy land per season. The CEB used the water meant to be released for agriculture, for much needed electricity generation in the dry season. However, the scheme failed after a couple of seasons, since the farmers were not ready to accept the compensation for their water right. Therefore, the CEB had to be satisfied with the remaining water for electricity generation after the release of irrigation issues.

5.3 Social and Economic Consequence of the Water Allocation Mechanism Adopted

5.3.1 Impacts of Water Sharing on Agricultural Activities

Farmers in the KIS are traditional, subsistence farmers and their livelihood is primarily based on paddy cultivation. There was sufficient water to cultivate paddy in the full command area in both seasons except in case of some tail end areas during a few acutely dry *yala* seasons in the past. The other income earning opportunities and off-farm income are very minimal in the area. Although the water use in the scheme is relatively high, the paddy yield in the area is around 5mt/ha, which is higher than the national average yield. With the implementation of the Samanalawewa hydropower project, the farmers were deprived of their traditional right of unlimited water they enjoyed throughout the season. They had to adapt to the rotational water supply method and a specific cropping calendar for the first time such a management was not in force prior to the Samanalawewa project. Therefore, the land preparation period had to be reduced and restricted for a specific period as practised in most of the other irrigation schemes. However the past production records of the KIS and the farmer's perceptions reveal that this has considerable effect on production and productivity in the area.

The most important benefit of the water sharing arrangement is reliability and timeliness of irrigation issues in both seasons, which assured cultivation of paddy even in dry years guaranteed through the water right of the Kalthota farmers. The other benefit is that the farmers have been slowly getting used to strict water management practises, despite the not-so-satisfactory progress.

5.3.2 Drawbacks of the Compensation Programme Adopted

The compensation programme was initially accepted but later rejected by the farmers with the experiences gained in two seasons for several reasons. According to the survey data, 50 percent of the farmers are in agreement with the payment made by the CEB for their irrigation water share. However, 47 percent were against the compensation payment. Based on the farmers' response regarding the amount of compensation, about 33 percent of the farmers mentioned that the amount distributed in lieu of water share was sufficient compared to the amount of income earned from irrigated agriculture in the past. Although the majority of the farmers were of the view that the actual earnings of paddy cultivation is much higher than the compensation, the cost of production figures of the area shows that the compensation package is higher than the income earned from the irrigated paddy farming. However, in this situation the loss of household income is evident for the small landholders due to the lack of labour hiring out opportunities in the area during non-cultivation seasons. On the other hand, as the farmers in the KIS are subsistence farmers they borrow money from boutique owners and informal money lenders at very high interest rates to purchase the agricultural inputs during the cultivation seasons. On some occasions, farmers purchased agricultural inputs on credit basis from the village traders signing an agreement to sell their paddy immediately after the harvest to the trader at a pre-determined price in order to settle the debts, which was an economic loss for the farmers. This was another reason for the farmers to agree with the proposed compensation formula of the CEB.

Number of drawbacks were listed by the farmers about the compensation payment implemented in the area. Lack of activities for the farmers during the non cultivation season and non payment of compensation for the legal tenant farmers whose names are not included in the paddy land register are some of their key problems. The non payment of compensation for the legal tenant farmers has brought forth social unrest among the tenant farmers, who are neither eligible for compensation nor water issues to cultivate their land. About 14% of total low land extents are under insecure tenure categories as shown in the table 5.7. There were hardly among off-season opportunities for hiring labour. This was a problem for the farmers who owned only 0.5 to 1 ac land extent for any cultivation. About 75% of the total numbers of land parcels in the area are between 0.5 to 1 ac extents. The detailed description of the drawbacks of compensation payment is given in table 5.10

Table 5.10: The Drawbacks of the System of Paying Compensation

Reasons	No. of Responses (N = 46)	Percentage of Responses
No payment for legal tenant farmer	19	41
Lack of activities to be involved during off season	16	35
No drawbacks	9	20
One off payment/lump sum payment	7	15
Non transfer of money to present cultivator ($2^{nd}/3^{rd}$ generation) from the original owner of the land	7	15
Loss of labour hiring out opportunities in the other farmers' fields for extra income	5	11
Delays in payment	2	4
Total	65	130

Source: HARTI Survey Data, 2007

The research also tried to elicit information on problems related to the mechanism adopted for the payment of compensation. Although, about 54 percent of the farmers responded positively, rest of the farmers experienced some difficulties in the mechanism used for fund disbursement (table 5.11). Almost all the farmers who are not satisfied with the disbursement mechanism have complained of the delay in payment. Problems related to land ownership (tenancy arrangements) was another main problem perceived by the farmers regarding the compensation scheme. It is interesting to note that only four farmers have come out with bribery and corruption accusations in the cash transfer.

Table 5.11: Problems in the Mechanism Adopted to Compensation Disbursement

Problems	No. (N = 46)	% of Responses
No problem	25	54
Delays in distribution	20	44
Paper work and cumbersome procedures	4	9
Bribery and corruption	4	9
Land tenancy problems	9	20
Total	62	136

Source: HARTI Survey Data, 2007

5.3.3 Impact of Compensation Mechanism on Household Economy

In addition to the above drawbacks of the compensation scheme and the procedure adopted, there were other factors constrained to this programme such as, financial, cultural, and environmental issues which lead to problems in household food security and household financial management. One of the major problems that emerged from the one-off lump sum payment was managing the money for the entire season to meet the household expenses. Most of the farmers are not used to this kind of financial management. They are used to sell surplus paddy stock in stages whenever the need arises including occasional, seasonal and emergency financial needs through out the year. In addition, cultivation of paddy provided the self-sufficiency in staple food at the household level throughout the year. Table 5.12 indicates the types of marketing strategies adopted by the farmers in selling their paddy stock. The finding clearly shows that only 15 percent of the farmers have handled the lump sum of money without any problem.

Table 5.12: Methods of Marketing Surplus Paddy in KIS

Response	No.	% of Responses
Sell the entire surplus of paddy at the time of harvest	7	15
Store the marketable surplus and sell it gradually depending on financial needs	12	26
Sell a part of the produce at the time of harvesting to cover up the immediate expenses and selling the rest gradually when needed	20	44
Store the full stock until get a good price	4	9
Sell a part of the produce at the time of harvesting to cover up the immediate expenses and keep the rest for home consumption	2	4
Only for domestic consumption	1	2
Total	46	100

Source: HARTI Survey Data, 2007

Another dimension of the problem caused by the lump sum payment at the household level is the shift of the traditional role of fund management from women to men. Table 5.13 describes the pre-project situation of household level fund managers of agricultural income. The finding shows

that over 50 percent of households obtained the services of women for household level financial management. However, the compensation payment was mostly given to the male members or taken over by the male members as a lump sum.

The male farmers of the KIS with lesser experience in financial management in the past have spent most of the money at once and were left with little money at the end of the season. Receipt of a lump sum has prompted them to purchase inessential food items and household consumer durables spending large sums of money. Some farmers have got addicted to alcoholism and gambling squandering much money within a short period of time. The lack of activities and involvement during the off-season also pushed them towards these social evils. As a result, a strong opposition has emerged from female members of the KIS against the programme of compensation in general and more specifically the way it was implemented.

Table 5.13: Management of Household Level Agriculture Income

	No.	% of Responses
Usually men	22	47
Usually women	20	44
Both handle it equally	4	9
Total	46	100

Source: HARTI Survey Data, 2007

The data on the experience of managing one off-payment is listed in table 5.14. 61 percent of the farmers mentioned their inability or difficulties of managing one off payment for household needs for the entire season. Only, 15 percent of the farmers believed that they could manage with one off-payment during the whole season without any problem. This is compatible with the findings of table 5.12, where it is shown that only 15 percent of the farmers sell their entire produce immediately after harvesting and managing the total income.

Table 5.14: Experiences of One Off-payment in Household Financial Management

Responses	No. (N = 46)	% of Responses
Difficult to manage the one off-payment for entire season	28	61
Increased expenses for household consumer durables	7	15
Payment of earlier loan installments	6	13
Loss of place for women in household fund management	2	4
Increased domestic violence	2	4
No problems	7	15
Total	59	128

Source: HARTI Survey Data, 2007

5.3.4 Other Impacts of the Compensation Programme

Paddy cultivation in both seasons has been the way life of the Kalthota farmers from ancient times which has developed prosperity and social harmony in the traditional village. Paddy cultivation was practised through sharing the labour *(attam)* during the peak labour demand periods of planting and harvesting which brought much of the social harmony to the village. Cessation of irrigation issues not only resulted in a lack of involvement and loneliness among the people, but also loss of labour hiring out opportunities. As mentioned earlier, this has provoked the farmers

towards socially unacceptable practises such as addiction to illicit liquor, domestic violence and gambling (Imbulana, 2006).

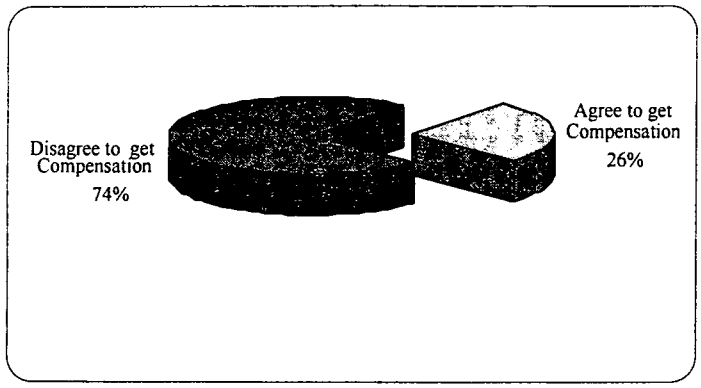
Non-cultivation in the *yala* season in the village raised a chain of effects in the society. Various segments of the society such as wage labourers, agricultural input suppliers, rice millers and suppliers of farm machinery reportedly experienced losses. Moreover, the village level officers in the agricultural sector were without significant work and distanced from farmer community; a condition not so conducive to their status.

The flow of water through irrigated channels supports the ecological environment and the sustainable existence of downstream flora and fauna. The river flow contributes to the recharge of groundwater, cutting off the irrigation supply lead to the localized drying up of wells; also some detrimental effects were observed on livestock for which a source of water and also fodder in the absence of hay production were hard to come by (ibid).

5.3.5 Willingness of Farmers to Accept a Compensation for Irrigation Water in *Yala* Seasons

The farmers' willingness was inquired to reintroduce the compensation scheme of the CEB in lieu of their irrigation water right during *yala* seasons in the context of the current socio-economic condition of paddy farming. The results are illustrated in figure 5.2. Only 26 percent of the farmers are agreeable. The amount of new compensation has to be assessed in consultation with the farmers. However, about 85 percent of the farmers who agree have recommended some alterations to the previous compensation scheme which are reflected in table 5.15. The major request is to provide some quantity of water which is sufficient to cultivate non paddy crops in their low lands, which will make them engage in some activities and pave the way to earn some extra income.

Figure 5.2: Choices of Obtaining Compensation in Future *Yala* Seasons (As perceived by farmers)



Source: HARTI Survey Data, 2007

Table 5.15: Proposed Changes in New Compensation Mechanisms

Proposed Changes	No. (N=12)	Percentage of Responses
Provide limited water to allow OFC cultivation	7	58.3
Compensation eligible for tenant farmers	4	33.3
Payment of compensation on monthly installment basis during the season	1	8.3
The rate of compensation must be increased	1	8.3
Do not propose any changes	2	16.7
Total	15	125

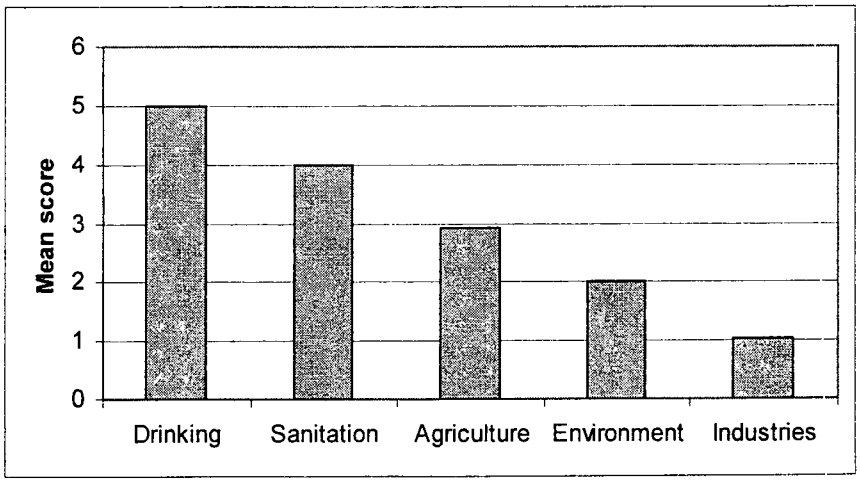
Source: HARTI Survey Data, 2007

5.4 Water Allocation Priorities among the KIS Farmers

The study made an attempt to set the water allocation priority of the KIS farmers during periods of water scarcity. Respondents were asked to prioritize their preference of allocating the limited water available into five different water use categories, namely drinking, sanitation, agriculture, industries and ecological purposes. The order of preference is calculated using a scale 1-5 based on the prioritization of beneficiaries as "least priority" (1) to "highest priority" (5). A score of 5 was the maximum mean value. All the beneficiaries opted for drinking as the first priority followed by sanitation in allocating the limitedly available water as illustrated in figure 5.3. The list of priority order is given below.

1. First priority – drinking needs
2. Second Priority – sanitation
3. Third priority - agriculture
4. Fourth Priority- ecological needs
5. Fifth priority- industries

Figure 5.3: Water Allocation Priority



Source: HARTI Survey Data, 2007

Chapter 6

Allocation of Water between Agriculture and Livestock

6.1 Socio-Economic Features of the Study Area

6.1.1 Demographic Features

The findings are based on the study of 42 livestock farming households randomly selected from the study area. The total population of the sample households is 192, with an average household size of 4.57. About 35 percent of the total population has received education upto G.C.E. (O/L) and above. Illiteracy rate is only 1.5 percent (see table 6.1).

Table 6.1: Level of Education

Level	No.	%
No schooling elders	3	1.5
1 – 5	45	25
6 – 10	69	39
G.C.E. (O/L)	39	22
G.C.E (A/L)	20	11
Graduate	2	1.5
Total	178	100

Source: HARTI Survey Data, 2007

Age profile of the livestock farmers who are undertaking the livestock enterprise as a primary source of income in the area is given in table 6.2, which indicates that, 57 percent of livestock farmers are in the young age category of 25 – 45 years and 6% of farmers are less than 25 years of age.

Table 6.2: Age Profile of Livestock Farmers

Age group	No.	%
15 – 25	2	6
25 – 35	15	43
35 – 45	5	14
45 – 55	9	26
55 – 65	4	11
>65	-	-
Total	35	100

Source: HARTI Survey Data, 2007

6.1.2 Economic Features

74 percent of the respondents have involved in crop cultivation for their livelihood in addition to the livestock enterprise (table 6.3), but rest of the respondents solely depend on livestock enterprises.

The employment pattern in the sample area is given in table 6.4 which indicates that about 40 percent of the population does crop cultivation as primary or secondary source of income, while another 26 percent are linked with agriculture as farmer assistants or farm labourers. About 48

percent of land holdings are lowland and 49 percent of holdings are uplands. The ownership pattern of the lands under different land categories is shown in table 6.5. Paddy was cultivated in 86 and 84 percent of total low land extent during *maha*[5], (2006/07) and *yala*[6], (2007) seasons.

Table 6.3: Status of Respondents

Status	No.	%
Farmer (agriculture & livestock)	29	69.0
Livestock farmer	11	26.2
Farmer leaders cum livestock farmer	2	4.8
Total	42	100.0

Source: HARTI Survey Data, 2007

Table 6.4: Employment Pattern

Type of Employment	Primary		Secondary	
	No	%	No	%
No employment	24	21	51	55
Farmer	16	14	24	26
Farmer assistant/labourer	25	22	4	4
Livestock farmer	35	30	11	12
Employed in government sector	5	4	-	-
Employed in private sector	2	2	-	-
Employed in security forces	3	2	-	-
Skill job	2	2	1	1
Business/self-employment	1	1	2	2
Migrant worker	2	1	-	-
Total	115	100	93	100

Source: HARTI Survey Data, 2007

Table 6.5: Extent of Land under Different Land Ownerships

Type of ownership	Lowland		Highland		Chena	
	Extent (ac)	%	Extent (ac)	%	Extent (ac)	%
Single owner	42.5	54	70.75	90	-	-
Shared owner	4	5	-	-	-	-
Share tenancy	15.5	20	-	-	-	-
Leased in	13	17	0.5	0.5	-	-
Mortgage in	3.5	4	-	-	-	-
Encroached	-	-	7.5	9.5	5	100
Total	78.50	100	78.75	100	5	100

Source: HARTI Survey Data, 2007

93 percent of the livestock farmers receive a monthly income of over Rs.5,000 and 48 percent of them receive an average monthly income of over Rs. 20,000. This is relatively a higher income considering the water scarcity condition of the KOISP. The contribution to the household income from livestock enterprises varies between seasons depending on weather conditions and feed

[5] *Maha* is the wet season or major cultivation season in Sri Lanka extending from October to January and receives monsoonal rains from north-east monsoonal wind.

[6] *Yala* is the minor or dry season in Sri Lanka which receives south-east monsoonal rains. Rainfall mainly prevails during the months from March to June.

availability for livestock. However, over 50 percent of the household income is earned from livestock sector for about 60 percent and 36 percent of the households during *maha,* (2006/07) and *yala* (2007) respectively (table 6.6 and 6.7).

Table 6.6: Range of Monthly Household Income (Rs.)

Income range	No.	Mean income	% of respondents
<5,000	3	4,083	7
5,000-10,000	9	6,667	21.5
10,000- 15,000	3	11,833	7
15,000- 20,000	7	16,686	17
20,000 -25,000	9	21,464	21.5
> 25,000	11	36,982	26
Total	42		100

Source: HARTI Survey Data, 2007

Table 6.7: Level of Contribution of Livestock Income to Household Income

Level of contribution to total hh income (%)	*Maha*	*Yala*
	% of households	% of households
<10	10	9.5
10- 20	7.5	14
20- 30	12.5	21.5
30- 40	5	9.5
40- 50	10	9.5
50- 60	15	5
60- 70	15	7
70- 80	10	-
80- 90	7.5	7
90-100	12.5	17
	100	100

Source: HARTI Survey Data, 2007

6.2 Water Sharing Arrangements under Kirindi Oya Basin

6.2.1 Water Allocation between Old System and New System

The KOISP is an expansion of the old Ellagala irrigation system which consisted of the old Ellegala anicut, the Lunugamwehera reservoir across the Kirindi Oya river and the left bank and the right bank main canals constructed under the new project. The Ellagala anicut system has the Yoda wewa, the Deberawewa, the Tissa wewa, the Weerawila wewa, the Pannagamuwa wewa and the Bandagiriya wewa. The additional lands irrigated by the project are referred to as the "new area".

When the Lunugamwehera reservoir was constructed under the KOISP, there was an issue of sharing water between the farmers under the old system and the new system. As a result, an unwritten agreement was reached between the ID and the old system farmers to provide 70 percent of water to the old system and allow the new settlers to use the balance (CECB, 2004). The water sharing arrangement provided an opportunity to increase the cropping intensity in the old area upto 200 percent (Renault *et al*, 2001), while cropping intensity was 0.75 to 1.25 in the

new area in most of the past years. If we take into account the unauthorized new asweddumization[7] in the old area the cropping intensity would be much higher than 200 percent. This means a much lesser quantity of water to the fields in the new lands that have been rendered irrigable under the KOISP. This is a case of clear inequity of water allocation between the "old" and the "new" areas.

Before the KOISP got under way the people in the new areas received a sufficient quantity of water during the rainy season, which was collected in the village tanks. However, the KOISP dismantled the large number of small tanks in the construction of the reservoir, the dam and the development of new cultivation lands. Since, a fair number of people in the new area are persons, whose lands were fed by small tanks in that area or who were engaged in chena cultivation and livestock farming, and had their lands either inundated by the reservoir or cleared for development under the project, they have virtually a right to cultivate paddy in the new area. Quite obviously, riparian rights should similarly have accrued to the farmers who had the use of the small tanks that are no more or inundated.

6.2.2 Allocation of Water and Land for Livestock Farming

Animal husbandry in the KOISP area before the project, was done in the traditional rearing system with low technology and low input and animals reared under free range system or as stray animals. There were enough grazing land, scrub land and forest land for animal rearing and also ample stubble left behind in the paddy fields after the cultivation season. Livestock enterprise was an important component of the well-integrated, and inter-dependent, complex and environmentally friendly farming system practised in the Kirindi oya area.

However, a couple of appraisals undertaken before the initiation of the KOISP did not recognize the animal husbandry and the basic focus of the project was on settler based irrigated crop production (IIMI, 1995). The project developed about 6,000 ha of forest scrub land traditionally the grazing ground for cattle and buffalo, into agricultural land and another 4,000 ha for other related development activities (Ananda et-al, 1998). Dismantling and leveling of village tanks and ponds by the project created pressure on water resources, especially for drinking and wallowing needs of animals. Lack of attention given to the basic needs of the animals which existed in the area over the years is clearly a social injustice and non-recognition of multiple uses of land and water resources in the region.

6.2.3 Menik Ganga Diversion and Availability of Water for KOISP

In order to solve the problem of water deficit in the Kirindi oya, diversion of the Menik Ganga through a trans basin canal from the newly constructed Weheragala reservoir across the Menik Ganga basin has been in progress at this moment. This diversion project does not intend to open up new lands for irrigated agriculture, but expected to increase the cropping intensity in the new area of the KOISP. The notable aspect of this project is that unlike the previous KOISP, it has recognized and made provision for the allocation of water for ecological needs, downstream drinking water users and minor irrigation schemes in the upper part of the system. However, increased availability of water in the Lunuuganwehera reservoir will increase the cropping intensity and reduce the fallow periods. Therefore, the current problems of rearing livestock are expected to be further aggravated in the area.

[7] The land which is ridged, bunded and prepared for the cultivation of paddy.

6.3 Impacts of KOISP on Livestock Enterprise in the Area

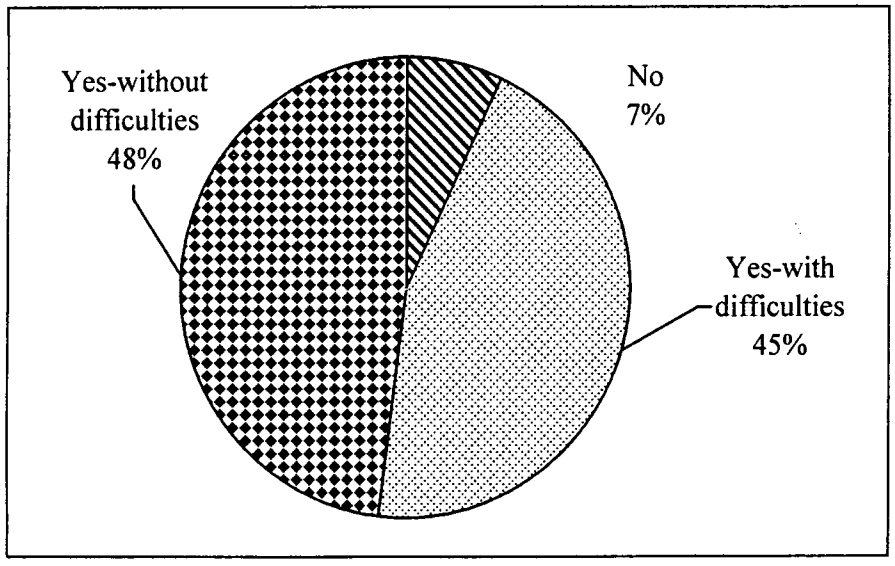
1. Impacts on animal rearing

The KOISP not only converted the grazing lands and reservation land into irrigated farm lands, but also failed to allocate sufficient land areas for the management of livestock herds in the area.

The paddy fields in the area were cultivated once a year before the project and therefore, livestock animals had the opportunity to use the barren paddy fields as their feeding ground in most parts of the year, but increased cropping intensity after the project has limited the grazing grounds for livestock. Double cropping after the project, has brought about a situation of the presence of crops in the field in most parts of the year. Therefore, the rearing of animals under free range system has led to crop damage by the animals and frequent conflicts have been reported between the cultivators and the livestock owners. The use of the tank bund, the channel bund, the road sides, the reservation land and the forest land for grazing purposes has increased after the project.

According to the survey findings, 38 percent of livestock farmers have to walk with their animal herds for a distance of over 10 km in search of pasture land and water during the dry season, after the project, which was a practise for only 5 percent of the farmers before the project. About fifty two percent of the sample farmers expressed that they are unable to meet the livestock water requirements or they are managing the water needs with difficulties as illustrated in figure 6.2. They have to take the livestock herd from one place to another or take them to the neighbouring Monaragala district until availability of feed and water in their home area. As majority of the livestock farmers (about 68%) are youths less than 45 years, they feel that, the current migratory livestock rearing system has led to the under utilization of their productive labour time mainly due to lack of grazing land in the KOISP area.

Figure 6.2: Fulfilling of Livestock Water Requirement



Source: HARTI Survey Data, 2007

Land and water scarcity for animal rearing in the Kirindi oya area was intensified by the KOISP in multiple ways as described in table 6.8. Demolition of village small tanks by the project, development of reservation lands which were used as grazing land earlier for cultivation, development of abandoned land for cultivation and demolition or obstruction of small natural water ways are the main reasons for the scarcity of grazing land and water.

Table 6.8: Impacts of KOISP on Land and Water Availability for Livestock

Causes for Scarcity	No. of responses (N=41)	% of responses
Destruction of village tanks by the project	33	79
Development of reservations land for cultivation	19	24
Development of abandoned land for cultivation	13	31
Obstruction/diversion of small water ways in the village	6	14
Reduced opportunity for grazing due to double cropping	1	2

Source: HARTI Survey Data, 2007

2. Impacts on livestock production and productivity

About 98 percent of the sample livestock farmers believed that the KOISP had a negative impact on the livestock industry. The adverse effects of the project are that, the farmers have to spend more time or need to migrate to the neighbouring district to look for suitable grazing land and water. Lack of water for drinking, and for wallowing (buffalo), paucity of grazing land, restrictions for free range animal rearing and loss of land and water resources at village level are the major unfavourable trends of the project on the livestock industry. Table 6.9 shows the effect of the shortage of land and water on the livestock enterprise which tended to reduce the herd size, milk production and productivity, diminish the health and sanitation of animals and increase the theft of animals due to the movement of animals along the road side for grazing. Development of the road infrastructure and improved transport services also contributed to the increasing cattle thefts.

Table 6.9: Effects of KOISP on Production and Productivity of Animals

	No. of responses	% of responses
	No. N=41	
Spending more time in rearing animals	31	73.8
Affect the milk yield	36	85.7
Affect the normal sanitary condition of animals and animals shed	1	2.4
Affect the animals health	13	31.0
Theft of animals	24	57.1
Number of animals in rearing was limited	3	7.1
The place rearing animals, has to be moved often	1	2.4

Source: HARTI Survey Data, 2007

*Due to multiple answers given by respondents, percentage sums to more than 100.

3. Other impacts of KOISP on livelihoods of livestock farmers

The KOISP has made both positive and negative impacts on the livelihood of the livestock farmers. Although the project has generated no advantage so far as the livestock industry is concerned the farmers have increased their agricultural (crop) income after the project. With the ownership of developed land and availability of irrigation water, access to credit has increased. The project has made tremendous efforts in developing physical and social infrastructure in the area compared with that of the pre-project situation. The detailed description of some of the other main impacts of the KOISP on livestock farmers is given in table 6.10 and 6.11.

Table 6.10: Impacts of KOISP on the Livelihood of Livestock Farmers

Type of impacts	No. of responses (N=41)	% of responses
Reduced income from livestock enterprise	37	88
Warrant more time and effort for livestock management	34	81
Increased theft of animals	24	57
Increased income from agriculture	24	57
Conflict between livestock farmers and agriculture farmers on sharing water	9	21
Conflict between farmers on sharing grazing/common land	18	43
Increased access to credit	3	7
Improved physical and social infrastructure	2	5

Source: HARTI Survey Data, 2007

*Due to multiple answers given by respondents, percentage sums to more than 100.

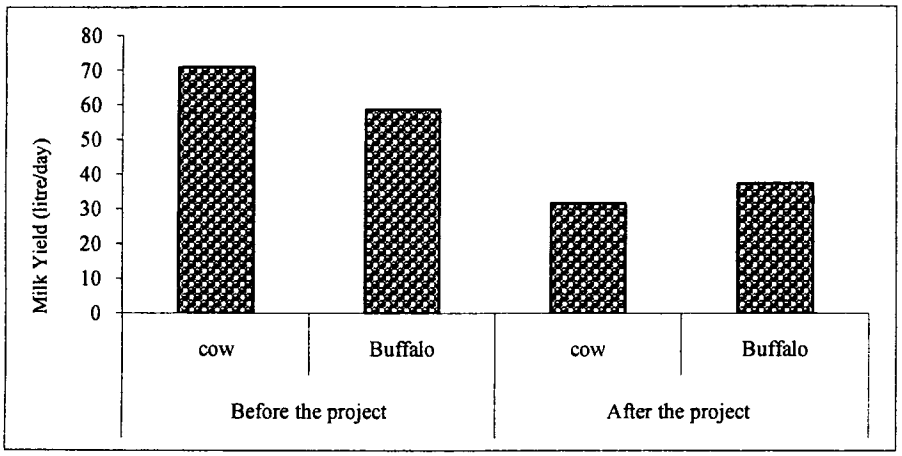
Table 6.11: Effects of Land and Water Scarcity on Livestock Production

Type of impacts	No. of responses (N=41)	% of responses
Reduced milk yield	36	86
Required more labour time for livestock rearing	31	74
Increased theft of animals	24	57
Reduced animal health and sanitation	14	33
Reduced herd size	3	7

Source: HARTI Survey Data, 2007

Figure 6.3 illustrates the situation of livestock enterprise before vs after the project. The finding clearly describes the setback of the industry both in terms of number of animals and productivity. The milk productivity per animal has dropped by 48 and 45 percent for cattle and buffalo respectively. Poor feeding has resulted in the loss of animal weight and drop of milk yield to less than half a litre per day (IIMI, 1995)

Figure 6.3: Overview of Livestock Industry in Dry Season (before vs after project)



Source: HARTI Survey Data, 2007

The farmers have proposed following suggestions to minimize the problem of land and water scarcity in the area.

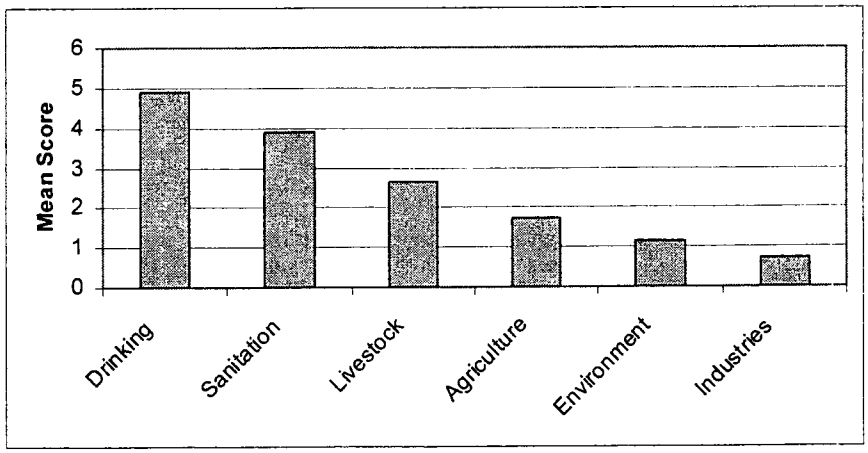
1. Renovation of abandoned tanks or make new tanks at feasible locations.
2. Seasonal allocation of water for village tanks from the KOISP.
3. Develop new tanks/ponds/pits to harvest run off rainwater.
4. Develop the proposed pasture lands and establish assured water supply for the proposed areas.
5. Develop alternative water sources such as agro-wells, tube wells and fill irrigation systems.
6. Create awareness and provide technology among the farmers to develop the livestock enterprise under intensive rearing systems with high-bred animals.
7. Evacuate the encroachers in the reservation areas of the Pannegamuwa and the Weeravila tanks to allow the area for grazing.

6.4 Water Allocation Priorities in the Area

The study made an attempt to assess the water allocation priority of the livestock farmers during water scarce periods. The beneficiaries were inquired of the priority order of their preference in allocating the limitedly available water between different needs such as water for drinking, agriculture, livestock, ecological needs and for industrial requirements of the area. The beneficiaries priority order was put into a scale of 0 – 5 in which the lowest priority was assigned a score of (0) and the highest priority was given a score of (5). A score of 5 was the maximum mean value of the score. The results are illustrated in figure 6.4.

The water allocation priority in the area is listed below
1. First priority – Drinking needs
2. Second priority - Sanitation
3. Third priority - Livestock water requirement
4. Fourth priority - Agriculture
5. Fifth priority - Ecological needs
6. Sixth priority - Industrial needs

Figure 6.4: Water Allocation Priority in the Area



Source: HARTI Survey Data, 2007

Chapter 7

Conclusion and Recommendations

7.1 Major Findings:

7.1.1 Findings from Water Policies of Selected Countries

India adopted a national water policy in 2002, replacing its earlier 1987 policy. Considering the increasing scarcity of water, the planning and management of this resource and its optimal, economical and equitable use have become a matter of utmost urgency. It clearly lays down national water allocation priorities which may be modified by state governments. Sri Lanka can draw an invaluable lesson from the Indian experience to enact a law, stipulating the water allocation priorities in times of stress. Currently, in Sri Lanka there is no policy on water allocation from major water bodies or streams for diverse purposes. The government decides on allocation for various purposes on a case by case basis or when a dispute occurs. There are no accepted principles on allocation resulting in ad-hoc decision making.

Secondly, India has a clear arrangement for adjudication of water disputes. When a request is received by the state government and the centre is of the view that the dispute cannot be settled by negotiations, the central government can constitute a water disputes tribunal nominated by the Chief Justice. The decision of the tribunal shall be final and binding on the parties. In contrast, a serious limitation in Sri Lanka is the absence of an institutional arrangement for conflict resolution in this sphere.

The Chilean experience shows how the allocation of water through markets in tradable water rights has increased the insecurity of the collective, indigenous systems. The Murray-Darling initiative provides useful insights into a situation where a resource as scarce as water in Australia can be allocated in highly water stressed circumstances. Moreover, rights are clearly established for water allocation in Australia which establishes the priority of domestic and livestock uses over industrial purposes. In contrast, the Sri Lankan situation presents a scenario of a "free for all" in water abstraction, with clear advantages to the powerful vested interests at the expense of the rural farmer whose rights have not been secured through a clearly enunciated water policy. Murray Darling Basin commission is a positive initiative to learn from to address the problems of bulk water allocation which is a crucial need for Sri Lanka.

The Tennessee Valley Authority as the forerunner of the Sri Lanka Mahaweli Authority continues to offer valuable perspectives into multi-purpose development in a river basin context. Yet the MASL, a consumptive user, in contrast acts as a water allocation authority by establishing a water panel which meets before each cultivation season to determine the water allocations with the operational agencies such as the Irrigation Department, the NWSDB and the CEB.

7.1.2 Findings from Thuruwila and Anuradhapura

The supply of safe drinking water for Anuradhapura was a long felt need, but delayed due to lack of raw water and conflicts in sharing the existing water resource. After a series of consultations, a consensus has been reached between the line agencies to abstract water from the Thuruwila irrigation tank under the agreement given by the MASL to provide supplementary water to Thuruwila to compensate for the extraction for drinking purpose.

Although a consensus was reached among the line agencies, the farming communities of Thuruwila were exploited by some interested parties and a political group against the project. Lack of correct information on and awareness of the true situation of the project and its outcome

triggered this situation. The failure to accommodate the farmers at the initial project planning and implementation stage, and the absence of transparency of the project activities at initial stage hindered its smooth implementation. This is a classic example to illustrate that the line agencies generally think of creating awareness and having stakeholder consultation only after the community protests begin to raise issues.

The final judgment on water allocation was given by the Supreme Court, which confirmed the importance of arriving at a decision acceptable to all types of water users' concerns. Though the process took a longer time due to the conflicts in reaching consensus between the line agencies (ID and NWSDB) and between the farmers and the agencies, it has legalized the water allocation for drinking water users as well as ensured a fair water share for the farmers. The controversy and the suspicions harboured about the project and the resultant delays could have been minimized, if the authorities mustered up sufficient participation from the local communities and the water users in taking management decisions at the initial stage of the project formulation. The participatory approach adopted by the NWSDB at the later stage has benefited both NWSDB in the smooth implementation of the project and the farmers in incorporating their concerns in project implementation and also receiving additional economic and social gains from the project.

The impact of drinking water supply project on the people of Anuradhapura was manifold. The project has improved the household water security and sanitary conditions. The labour time spent for fetching water has dropped tremendously after the project, which has helped the beneficiaries to increase the household income level and empowered the people, more specifically women and children. The project was immensely instrumental in enhancing the health and well-being of the people, and their social status and had also accounted for increased land values in the area helping to promote peace and harmony at household level.

The impact of water abstraction from the Thuruwila tank to the farming community shows no significant effect on the cropping pattern, cropping intensity and risk of crop failure. Farmers have learned to adopt rotational water issues and water use efficiency has increased. Improvements made to the irrigation infrastructure witnessed an improvement in irrigation efficiency. The project positively impacted the Thuruwila village with improved rural infrastructure, benefits of access to safe drinking water, increased capacities of the rural societies and the CBOs and increased linkages between external organizations.

The order of water allocation priorities in Thuruwila during water scarce dry periods, in descending order is drinking, sanitation, agricultural activities, ecological needs and industrial requirements respectively. The priorities at Anuradhapura are a little different where the third priority is water for ecological needs and water for farming needs received fourth place.

7.1.3 Findings from Kalthota Irrigation Scheme (KIS)

Construction of the Samanalawewa reservoir has imposed a restriction in the freedom of water use for Kalthota farmers. The farmers had to depend on water releases from the Samanalawewa reservoir, though they had free flow of water almost all through the years before the project. Therefore, the ID, the farmers and the Ceylon Electricity Board (CEB) had to make an agreement on sharing of water. However, allocation of water for agriculture has prevented the CEB from the full utilization of the installed hydropower capacity, especially during dry (*yala*) seasons. In the meantime, water duty of KIS is about 10-13 ac.ft, which is more than double of other well performing systems in the country. The high level of inefficiency in agricultural water use is attributed to the inherent problems of the KIS - alluvial type of soil in the area and the irregular practises of the use of water by the farmers. Water management in the Kalthota anicut system is complex and there has to be a system in place for proper water management considering the soil type, the dam leakage and the hydropower need during dry periods. The actual reason for high water use has not been adequately studied. The agencies should have paid more attention to this

during the last 15-20 years. Based on the prices of 2007, the value of one cubic meters of water used for hydro power generation is 2.77 times higher than the return earned for one cubic meter of water pumped to paddy cultivation. Therefore, the saving of water in irrigation has more benefits to the society in terms of economic and welfare gains.

In order to increase the hydropower generation, the CEB introduced a compensation payment scheme for farmers' water right during the *yala* seasons of 1997 and 1998 which had failed after two seasons due to the objection raised by the farmers. Although the farmers with no effort on their part got a higher financial benefit than their farm income, by way of compensation from the CEB, problems related to compensation mechanism, and to the management of one-off lump sum payment at households and socio-cultural considerations of abandoning paddy cultivation led to the failure of the system. The case is a clear example to show that, financial and economic gain alone is not sufficient in making policy decisions, but it warrants the vital importance of taking into account the social and cultural values.

Findings transpire that almost half of the sample farmers perceive that some of the farmers are really interested in saving water at field level and claim that they do not get their fair share of water. The striking feature is that, even after 15 years of implementation of the Samanalawewa project along with the development of competition for water within the river basin, agricultural water use efficiency has not improved considerably. At the same time, it is also vital for the CEB to reduce the transmission losses of electricity generated form water resources which has a competing demand and high opportunity cost. Conveyance losses of electricity generated in Sri Lanka was around 15.67% in 2007, and it was 16.58% in 2006 (Weerasinghe, L. Personal communication, CEB)

The most important impact of the water sharing arrangement adopted in the agricultural activities is that the farmers have to follow a rotational water issue and a cropping calendar instead of continuous water supply they enjoyed before the project, but they receive sufficient water to cultivate water intensive paddy crop in full extent during both seasons.

About 50 percent of the farmers are in agreement with the compensation programme implemented in lieu of their irrigation water rights, although there are some practical problems in the mechanism adopted. Lack of activities for the farmers during the non-cultivation season, non payment of compensation for legal tenant farmers, household finical management problems due to one off payment, loss of labour hiring out opportunities for small extent cultivators and non transfer of the compensation money to the current cultivators (2^{nd} / 3^{rd} generation) from the original registered owner are some of the important issues that impeded the compensation payment programme. Lump sum payment has caused conflicts at household level and has prompted some of the farmers to take to alcoholism and gambling.

Findings on farmer perception on the willingness to reintroduce the compensation scheme in lieu of water at the current economic situation record unwillingness on the part of 75 percent of the farmers.

The water allocation priorities among different sectors of Kalthota farmers during water scarcity are almost same as other case study areas of the study. The order of priority of allocating water in descending order is drinking, sanitation, agriculture, ecological needs and industries.

7.1.4 Findings from KOISP (Livestock farmers)

Water sharing arrangement practised in the KOISP between the "old system farmers" and the "new system farmers" is a case of clear inequity, where the old system farmers are provided with 70 percent of water and the balance for the new system users. During the period of development of the KOISP, a large number of small tanks used by the farmers in the new system area for their

livelihood activities were demolished and ideally the new system farmers also should have riparian water rights, but it did not materialize in the project.

Livestock rearing, especially cattle and buffaloes was one of the important components of the farming system practised by the Kirindi oya farmers before the KOISP. However, non-recognition of the livestock enterprise in the project appraisal of the KOISP has led to increase the pressure on livestock enterprise in view of the increased competition for water and food. This is clearly a social injustice and complete disregard of the multiple uses of land and water resources in the area. The on-going Menik Ganga diversion project to augment the KOISP is expected to provide some solution for the water deficit experienced by the new system area farmers, but it will further aggravate the problem of livestock rearing due to increased cropping intensity and non availability of grazing lands. The most important development of the Menik Ganga diversion project in relation to water allocation is that, it has made provision for the allocation of water for ecological needs, downstream drinking water requirements and water needs of the upstream minor tank systems.

The KOISP has resulted in a number of negative impacts on livestock rearing in the area. Shortage of grazing land and water sources for animal rearing has led to lower production and productivity. Free range animal rearing practised in the area has caused frequent conflicts between the livestock farmers and the crop growers. Numbers of animals and herd size have reduced and the farmers have to migrate with animals during dry seasons to the neighbouring districts in search of feed and water. This practise has caused the breeders to spend more time in animal rearing and has increased the incidences of animal theft.

The process adopted in sharing water in the Kirindi oya basin is a failed attempt, which has caused inequality in sharing water among the farmers and also between crop cultivation and livestock rearing. Water allocation priority order as perceived by the livestock farmers during water scarcity period is drinking, sanitation, livestock rearing, agricultural activities, ecological needs and industrial water requirements respectively.

7.2 Policy Implications

In the past, a notion of abundant supply and a low demand for water contributed to only minor concerns on water rights and allocation. Yet, in the post-independence era with water demand and user conflicts occurring increasingly, the mechanisms for water allocation and recognition of water rights have become a challenge. The process of water allocation amongst competing users is currently mediated through *ad hoc* administrative arrangements subjected to political pressure.

What are the lessons of experience that we can derive from the case studies of water disputes presented in chapter 3? First, is the need for a national water resource policy. While there are sectoral water policies, such as major and minor irrigation policies, urban – rural and community water supply policies, there is no clearly defined policy for the overall water resources sector. We can draw a lesson from India, which has a national water policy, while most of the state governments have their own state water policies. What is significant is the fact that section 5 of the National Water Policy of India prescribes the water allocation priorities amongst the competing sectors as follows:

1. Drinking water
2. Irrigation
3. Hydropower
4. Ecology
5. Agro-industries and non agricultural industries
6. Navigation and other uses

Similarly, in the driest continent on earth, Australia, a bulk water allocation policy has been established on a river basin; the basis for the Murray-Darling Basin. This policy is applicable to the state governments of New South Wales, Victoria, South Australia, Queensland and the Australian Capital Territory.

The national water resources policy should not only cover surface water allocation but also the ground water resource. Should uncontrolled private extraction of groundwater, a scare resource, be permitted to continue? Over and above a groundwater extraction policy, currently a doctrine of territorial sovereignty is applied. This means "what is beneath our feet is ours to use". Such extraction should be limited to a reasonable use such as drawing water from a bucket from a well.

Ownership of the overlying land should not allow the occupier to pump underground water through mechanical means. Guidelines should be issued prescribing the spacing norms for pumps and wells. There is ample evidence in the country to prove the effects of bulk extraction of groundwater on the small-scale and domestic level users.

Doctrine of equitable apportionment requires that the allocation and retention of water rights are contingent upon putting them to a beneficial use. But this should not permit the first person who acquires an early right, to be given seniority of user rights against later users. For instance, in paddy cultivation, excess water is used to flood the paddies to abate weeds. The early user in this instance should not be considered to have acquired a vested right to that same quantity of water against a new user. A case in point is the Kirindi Oya Irrigation and Settlement Project where old system farmers were allowed to increase their cropping intensity and are allocated water to cultivate paddy in both seasons depriving the basic rights of the new system farmers. Thus Ellegala (old area) farmers were given priority of water during droughts even if it meant that the new areas did not get any. This is an indicator of the prevalence of a prior appropriation right over an equitable user right.

Findings of all three case studies indicate that, re-allocation of existing water shares is socially, culturally, economically and politically very sensitive. Any intervention should be made in the participatory bottom up approach and proper inter-agency co-ordination from the initial stages of the project with the participation of all relevant stakeholders is a vital aspect to achieve the expected goals. Thuruwila experience is a living example to illustrate the critical importance of adopting a people centered approach, where success was achieved in the later part of the project through the shift of approach in development to obtain all the stakeholders' participation from the lessons learned from the initial stage of the project.

Although the involvement of civil society as the 'watchdog' in some instances has granted untold benefits to the society, this phenomenon has burdened and inconvenienced the economy hindering or delaying the efforts of improving the welfare of the people. The basic reason for the protest and hindrances is lack of correct information on and awareness of the true situation of the projects and its outcome. Thuruwila water abstraction project is one such example. One of the clear messages of the project is the need of transparency in project implementation in order to avoid the public suspect about the project.

The case studies are clear examples to show the importance of basin level integrated water resource management planning considering all different users. All the concerned stakeholders must be consulted in water management to minimize the inherent difficulty to switch to IWRM. Lack of integrated and multi-objective planning of available water resource seriously affects the fair and equitable access to water for different users and leads to conflicts and other side-effects in the allocation of water. Non-compliance with this approach was one of the reasons for the conflicts of land and water between the old system farmers and the new system farmers and between crop cultivators and livestock farmers. The KOISP never recognized the livestock farmers in their project appraisal and seldom took any significant measures to solve their problems.

The expected water scarcity in irrigated agriculture resultant on the abstraction of water for drinking purpose has been substantially reduced in the past by the improvement of irrigation infrastructure, adoption of water saving management practises such as rotational water issue and implementing cropping calendar and the attitudinal changes of the farmers from habitual water usage.

Experience gained through compensation payment for the farmers in lieu of their irrigation rights in the Kalthota irrigation scheme is a clear example to show the influence of social and cultural values in a peasant society which surpass the realized economic gains. Therefore, any economic model should in corporate the socio, cultural and environmental aspects in water resources planning in addition to the economic perspectives to obtain a sustainable outcome.

Findings of the Kalthota irrigated agricultural scheme show that water duty in the scheme is 2-3 times higher than that of most of other irrigation schemes. However, the attention given in the past to improve the irrigation efficiency by introducing water saving technologies, renovation of irrigation structures and channels, development of alluvial soil through promoting organic manures and changing the attitudes of farmers to use water in an efficient manner is very minimal, though there is a critical need of water within the river basin for much needed electricity generation at the Samanalawewa hydropower station. Even after 15 years of development of the Samanalawewa hydropower station, the irrigation performance in the KIS has not improved to a satisfactory level.

The first water allocation priority during water scarce dry period is provision of water for drinking purpose and followed by sanitary requirements in all case study areas. However, conflicts are experienced in many places in drinking water supply projects including Thuruwila, when the extracted water is pumped to outside the area of the original water source without benefiting the area covered by the raw water source. At least at a later stage, the Anuradhapura water supply project has included the Thuruwila farming community for the drinking water supply project under the reasonable argument forwarded on water security problem in Thuruwila area which is similar to that of the Anuradhapura city area. This phenomenon was the reason for the success in sharing of water between drinking water issues and irrigation issues in Kaudulla and failure/resistance at Kantale (drinking water from Kantale reservoirs to the Trincomalee town) and Muruthawela (drinking water from Muruthawela tank to the Walasmulla town).

Provision of safe water supply has significantly improved the household water security, which has direct benefits on the beneficiary community in improving household income, health, well being, women and child welfare, social status, dignity and peace and harmony.

Considering the role of livestock industry in the KOISP area, authorities should take actions to allocate sufficient grazing grounds for livestock rearing. But, what is more significant is the fact that the farmers and the pastoral groups linked to Kirindi oya have different perceptions on water rights. While animals grazing on fallow fields and the commons, can help cultivation by providing manure, cattle can also damage crops and lands in passing through the lands in search of water. The Cattle Owners' Farmer Organization in Kirindi oya had been included in the Project Management Committee only to address cattle damage to the crops but water rights of pastoralists were never an issue discussed. Ruth Meinzen – Dick and Bakker (2001) observed the fact that customary cattle watering places were not recognized in the development of the Kirindi Oya system; it was an indicator of the relatively weak water rights for livestock. Evidently, the water use of the rights of livestock has not been recognized. Promotion of intensive methods of livestock rearing through conducting training and awareness programmes and supply of hybrid animals to the beneficiaries can reduce tension between the livestock farmers and the crop cultivators. Intensive method of livestock rearing becomes inevitable with the augmentation of the KOISP under the Menik Ganga diversion project, which is expected to create more competition for land and water.

The three case studies show that issues in water allocation among different water user groups can be best resolved if stakeholder consultation is considered as an important strategy. Allocation rules imposed by a state agency are less effective than an agreed set of rules reached after negotiation with all of the water user groups, as their competing demands can only be settled by consensus.

7.3 Recommendations

1. Water allocation priorities during scarcities should be established in consultation with all water user groups and the agreed priorities should be set up and legalized as in many other countries in the region.
2. Water resources legislation should be enacted to integrate the existing piecemeal legislations.
3. An apex body is recommended for inter-sectoral coordination and decision making in the water sector. The experiences gained from the Mahaweli water panel could be used to institutionalize the gap in the current institutional framework.
4. Measures are necessary to improve the irrigation efficiency, reduce the water losses in drinking water supply schemes (unaccounted water) and losses in hydropower generation (transmission losses).
5. Water resources planning should be undertaken in an integrated approach at basin level considering the multiple uses of water in order to achieve the fair and equitable access of water and to avoid the conflicts between different competitive users.
6. Re- allocation of current bulk water uses should be put into practise in a more transparent manner and accomplished using a people centered approach with the participation of all relevant stakeholders to achieve success with minimum conflicts and delays.
7. Water sharing arrangements must consider the social, economic and environmental implications of proposed new measures in addition to the expected economic gains of the new provisions.

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