Water Resources of Sri Lanka:
Sources, Uses and Related Issues

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Water Vision 2025

A society that values the sustainable use of its water to achieve the goal of an environment conducive to balanced social and economic development

(Lanka Jalani: Sri Lanka Water Partnership)

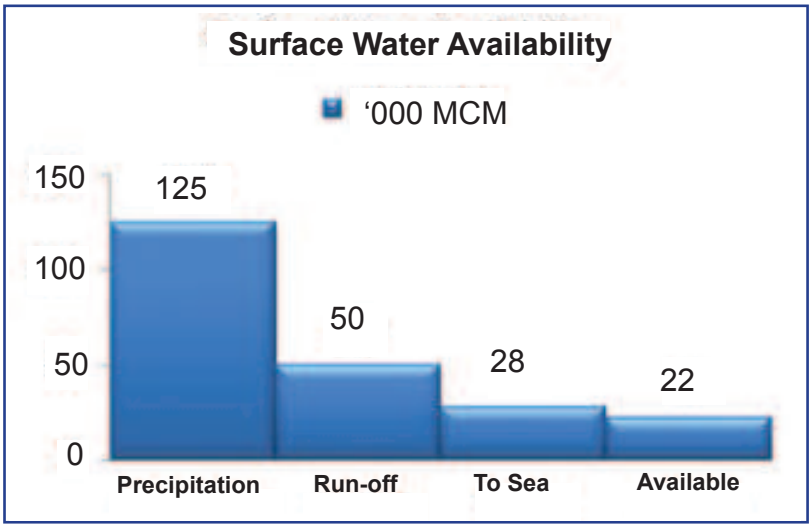
Sources of Water

Ours is an island relatively rich in water resources compared to most countries. We have an average rainfall of around 2000 mm a year. Our drier regions have 900. In contrast, India has 1100 mm, and Australia a mere 455 mm. With a population of 21 million and a land area of only 65,610 sq.km., at first glance Sri Lanka does not appear to be a country where water will be a critical resource in the development process in the coming decades. In reality, the spatial and seasonal variations, caused largely by the monsoon climate and the national geography, are very high and quality issues are significant, and if not addressed and properly managed will clearly result in major issues of scarcity. Added to physical scarcity, the concept of economic scarcity where water withdrawals are not possible due to economic or technological reasons aggravate the issue.

Surface Water Resources

Sri Lanka has 103 river basins radiating from the central mountains to the sea, with Mahaweli basin dominating in size (16% of island's total area or 10,327 sq.km.). Eighteen of the river basins have catchments of over 1,000 sq. km. Around 14 basins are of sizes ranging from 400-950 sq.km. while 45 basins are of size less than 100 sq.km. About 20 are classified as wet-zone rivers which carry about half the surface run-off. These river basins constitute about 90% of the land mass, and it is therefore clear that how we manage the land and water will have a very significant effect on our water resources.

The rainfall amounts to 125,000 MCM (Million Cubic Meters) of precipitation for a year, generating a run-off of 50,000 MCM. Roughly about 57% goes to the sea leaving an available surface water quantity of 22,000 MCM, quite in contrast to what King Maha Parakramabahu said – "not a drop of water should go to the sea, without being made use of". Some recharged ground water is also available estimated to be approximately 7800 MCM per annum.



Groundwater Resources

The available groundwater resources are in quantity much less than the surface water resources and are estimated to have a potential of 7,800 MCM. Based on geological formation characteristics the country can be divided into three hydro-geological formations, namely:

- The North Western and Northern Coastal belt comprising about 10% of the island and consisting of Miocene and quaternary sedimentary formations
- The Eastern, South Western and Western Coastal belts consisting of aquifers in inter granular rocks made up of dune sand, lagoon deposits and alluvial formations. These regions also cover about 10% of the land area.
- Crystalline basement complex, which consists of hard rocks fractured and weathered in some regions. These constitute the remaining 80% of the land area.

Both the quantity and quality issues limit the use of ground water. It is widely used for domestic, small scale irrigation, industrial and other uses. In most rural areas, domestic water supplies are obtained from small diameter shallow wells sitting in the overburden. Groundwater recharge is estimated to be between 7% and 30% of the precipitation. Large diameter shallow wells are being opened up extensively in the dry zone to irrigate upland crops. At present over 12,000 such wells have been constructed and are operational. There is a demand for around 8,000 more wells of this category mainly in the dry zone, although the long-term sustainability of such large numbers of wells has not been confirmed by scientific study.

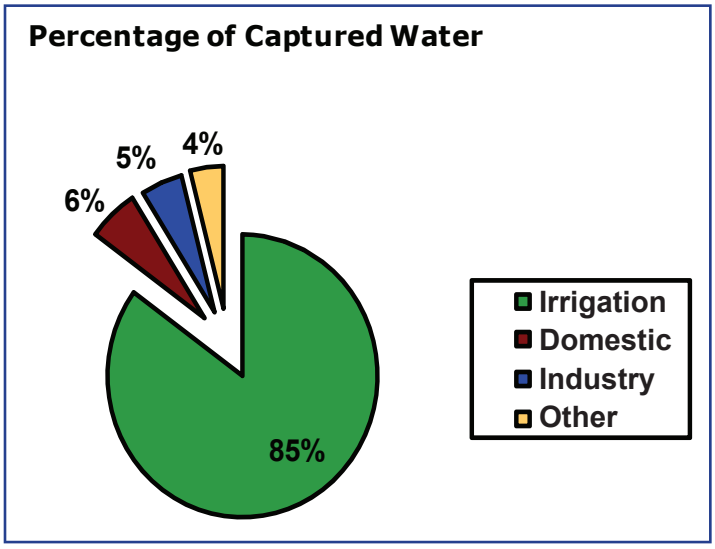
Deep bore holes are used at some locations to provide water for drinking purposes and for industries including the hotel industry. There is a concern of over-exploitation of the resource in certain parts of the country while cases of pollution of groundwater resources have been reported from certain main urban centres. Further studies have to be carried out to assess the safe groundwater abstraction rates in different areas.

Uses of Water

The main sector-wise users of water can be classified as Irrigation, Domestic and Industrial. A fourth classification as 'other' is frequently used which implies uses such as general services, other urban needs, tourism, aesthetic needs etc. Predominant user is

Some Sri Lankan water facts

Annual average rainfall:	1,900 mm
Wet zone	2,424 mm
Dry zone	1,450 mm
Annual rainfall	125,000 MCM
Annual replenishable water	45,000 MCM
Wet zone	22,000 MCM
Mahaweli basin	11,000 MCM
Dry zone – main rivers	5,500 MCM
Dry zone – other rivers	6,500 MCM
Annual GW recharge	7,800 MCM
Discharge to sea	28,000 MCM
Annual Water use	11,000 MCM
Irrigation – 85%	
Domestic - 6%	
Industry - 5%	
Other - 4%	
Land Area Total	65,600 sq.km.
Wet Zone	16,400 sq.km.
Dry zone	49,200 sq.km.



irrigation at around 85%, although estimates vary from 85 to 90%. This is also relative to a world average of 70%. Domestic and industrial users consume relatively low quantities at around 5% each. Use of water for generation of Energy is non-consumptive. However there is another big user, which we tend to ignore frequently – the Environment. The environment needs water to sustain itself which is an essential part of human settlements and their existence.

Water for Food

There are more than 260 major and medium irrigation schemes (serving over 80 hectares each) and nearly 18,000 minor irrigation schemes based on anicut systems and small tanks, of which around 12,000 are presently operational.

The area under irrigation facilities exceeds 560,000 ha which is approximately 27% of the total land area available for agriculture (~2 million ha). The plantation crops of Tea, Rubber and Coconut cover 40% while temporary and permanent crops other than Paddy account for more than 11%. Of Sri Lanka's rice production 80% comes from irrigated land, 21% from minor and 59% from major irrigation schemes.

Studies carried out at the International Water Management Institute (IWMI) show that if the current rate of irrigation efficiency continues in the future, several districts with major rice irrigated areas will have severe water scarcities by 2025. These districts will have to either reduce water demand by increasing irrigation efficiency or by importing food, or transport water from regions in the wet zone where water is abundant..

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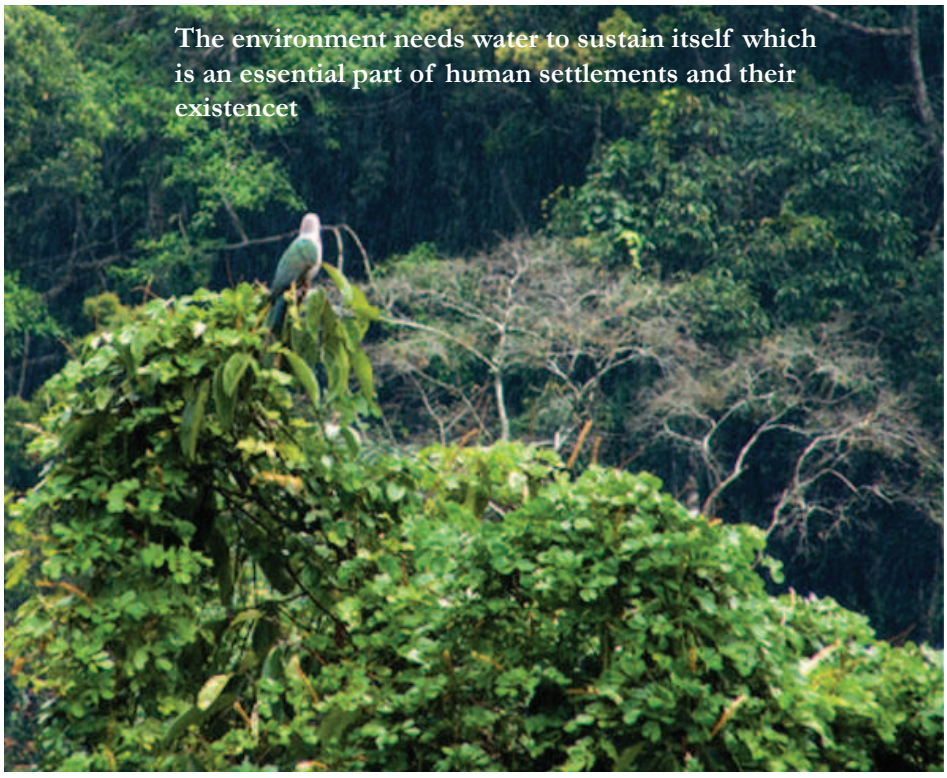

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A scenario with doubled irrigation efficiency however show that the total demand of most water-scarce districts can be reduced by 50 percent and these savings are adequate to meet future demands in the other two sectors. Whether the country has the financial and institutional capability to attain these high irrigation efficiencies is not clear. More importantly another issue to address is the cost/benefit factors of this approach versus importation of food in the long term.

In addition to what the large scale system managers apply, adoption of low-cost water technologies by smallholders also provide an opportunity for significant productivity improvements. Some examples of such technologies are: low-cost small electric and diesel pumps, manual devices such as treadle pumps, low-cost bucket and drip lines, sustainable land management practices such as low or zero-till agriculture, supplemental irrigation, groundwater recharge and water harvesting systems. Analyses suggest that access to water for agriculture through these technologies has a major potential to improve the livelihoods of the poorest farmers. IWMI's evaluation of the impacts of these technologies discovered enormous variety in type, scale, costs, benefits, adoption rates and management approaches, based on each socio-ecological context, making it difficult to work out economics that represent all of them. However, there are studies available of some of these technologies such as low cost drip irrigation and treadle pumps which demonstrate the general cost-benefits involved.

Water and Human Settlements

Sri Lanka has around 500 water supply schemes; of which 330 are urban, serving a population of 5.6M. 75% of the urban population is served with pipe borne water at a service level of 14hrs+, while around 20% has a 24h service level. Only about 15% of rural population is served with pipe borne water, ground water is used by about half of the rest. The rate of usage ranges from 20 l/day to 400 l/day at an average of 180-200 (effective use 100-115). In addition, over 4,000 very small rural piped water supply schemes and around 50 small town water supply schemes are managed

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by Community Based Organizations (CBOs). Water needs of around 4 million people are met by these water supply schemes which use Village tanks, protected / unprotected shallow wells, Deep wells with hand pumps or motorized pumps, and rainwater as water sources.


Mini Hydro is a good solution for increasing energy demand

It is estimated that the water demand will increase from about 3 MCM to about 4.6MCM in 2025. Capital cost of water supply is subsidized with the National Water Supply and Drainage Board charging less than the cost for the first 20 to 25 units, but overall there is better cost recovery now compared to the subsidies given a decade ago. There is scope for looking at more sustainable alternative scenarios with private sector/beneficiary participation.

The table below gives a summary of the water supply situation in 1999; unfortunately holistic current figures are not easily available.

Table 2: Water Supply Situation (1999) in Sri Lanka

Description	Urban	Rural	Total
Population (1999) million	6.0	13.0	19.0
Piped water supply %	75	14	32
Tube wells %	10	11	11
Protected dug wells %	10	40	24
Other means %	5	35	33
Access to safe water	**90%**	**57%**	**67%**

Source: C.H. de Tissera 1999 Urbanisation and Water

The present level of sanitation in the country is low with at least 25% of the households lacking sanitary toilet facilities. Solid and liquid waste disposal too has become a serious problem in many towns.

Water and Energy

Water for hydropower is non-consumptive, but there are trade-offs arising from storage and timing issues impacting on downstream irrigation and drinking water needs. It is however significant to note here that the Mahaweli authority has an institutional mechanism for the allocation of its water optimally between these competing demands. Hydro power potential in the country has been exploited to a large degree and save for one or two schemes no major potential exists. Mini-hydro however is an aspect that is being looked into and is promoted for private sector participation. The generation capacity in the country has not kept pace with the rising demand, and the country has resorted to heavy fossil fuel based generation in the recent past reducing dependency on hydro power.

Hydropower potential in the country has been exploited to a large degree

While hydropower was almost 100% two decades back, it is currently in the region of 40% of the total requirement.

Water and Industry

Although the industrial sector does not consume a large quantity of water, its effluents have a significant effect on the quality of water bodies, negatively impacting on the quantum of available water resources. Regulations and incentives are available to control the discharge standards of industrial effluents, but implementation is ineffective. Industries even if willing, face serious resource issues in improving the situation.

Given that the urban sector is expected to rise from 23% to 60% by 2025, with parallel growth also in industrial activity, it is imperative that the government and the private sector address this issue with innovative approaches. Financing its own water supply and wastewater treatment facilities, or making capital contributions to installations that meet the needs of municipalities and large industry, is an investment close to home for the private sector. Such voluntary action by large corporations in its own interest and very much in the spirit of social responsibility, is frequently much better than waiting for external regulation to impose solutions. This also provides the additional social benefit of freeing public regulatory funds for dealing with other social issues.

Water for Nature

There are extensive marshes connected to rivers or seasonally flooded unconnected areas which serve to store large volumes of water helping to reduce flooding occurrences. They also provide the habitat for a variety of fauna and flora. There is a recent trend of filling up marshy areas for building purposes and this poses a threat as regards flooding in urban areas. Minor flooding has been an annual occurrence in certain parts of the western region while major floods have been experienced at periodic cycles.

Wetlands: There are around 41 wetland sites located in Sri Lanka, selected on the basis of uniqueness in the type of

Sri Lanka has greater bio-diversity per unit area thand any other country in Asia

wetlands, occurrence of rare vulnerable or endangered plant or animal species, and whether the site regularly supported large number of water birds. Most of the important sites are coastal lagoons and mangrove swamps, many of which are threatened by conversion into housing sites, agricultural fields, and salt pans or are affected by drainage, siltation and pollution. The issues associated with management of wetlands include inadequacy of institutional mechanisms, legislative framework and a policy for conservation aspects.

Floodplains associated with rivers: Floodplains associated with rivers are best represented along the Mahaweli Ganga, Kala Oya and Modaragama Aru. The most extensive, the Mahaweli Ganga floodplain, occupies around 50,000 hectares of the eastern lowlands. Much of this floodplain has a natural or semi-natural vegetation cover consisting of a complex array of diverse habitats. These habitat types have intricate inter-relationships between biological and hydrological characteristics. Riverine marshes and adjacent floodplains form natural waterways that convey floodwaters from upstream to downstream locations.

Floodplains and wetlands, as well as deepwater habitats, store floodwater and release it slowly, thereby lowering flood peaks and protecting downstream areas. In urban areas subject to rapid storm water runoff and flooding, wetlands, particularly in the South Western coastal zone, provide especially valuable service as "sponges" able to absorb floodwaters for later slow release. As such they serve as highly effective buffers against property damage.

Biological diversity: Sri Lanka has greater bio-diversity per unit area than any other country in Asia. It is one of eleven areas in the tropics identified by the Committee on Research Priorities in Tropical Biology (NAS, 1980) as demanding special attention because of its high levels of biological diversity, endemism and its vulnerability to habitat destruction. Most of this unique diversity concentrates to an extraordinary degree in the humid South-Western lowlands and central mountains.

Sri Lanka, like other countries around the globe, is depleting many of these resources at rates that have made many of them essentially non-renewable. Among the most significant causes of this growing problem are: forest clearing and burning, shifting cultivation, wetland damming and filling, timber logging, coral reef destruction, cultivation of mono-cultures in crops, over harvesting of plants and animals, careless introduction of exotic species, indiscriminate use of pesticides, and pollution of our aquatic ecosystems.

Water Quality

Major areas to be addressed in relation to water pollution are:

- Water pollution from industrial facilities (Industrial emissions, leakage and atmospheric deposition)
- Sewage and urban runoff pollution
- Water pollution by agricultural activities
- Human settlements/ Domestic waste water

Problems arising from point sources are relatively easy to manage although high in cost, but problems caused by non point sources such as: soil erosion and sediment transport, eutrophication due to presence of high level of nutrients, heavy metal contamination, and toxic and hazardous chemicals contamination etc. are more difficult to manage. Frequently solution entails careful management at the causative level in the first instance.

Discharge of untreated urban waste water to surface water bodies can be a significant issue in the future as these surpass regenerative capacities of the natural water bodies in time to come with the expected increase of urbanisation. The costs of treating these are high, but of the approaches of managing these discharges and directing for specific purposes

such as agriculture may prevent wholesale negative impacts on the water bodies.

The reinforced effluent regulations for industrial discharges have been in effect since 1990, but problems with domestic waste water and urban run-off remain to be resolved and efforts to improve this situation have lagged because of insufficient sewerage treatment systems and related infrastructure in urban areas.

Issues and Challenges

The equation of water related issues is common right across the globe. We have a finite resource on the one hand and an increasing demand on the other, with the populations and the economies growing all the while. A growing population not only means an increased demand for water but also has negative impacts on its availability (resulting from denudation of forests, salinisation etc.) coupled with detrimental effects on quality. Thus depleting the resource. It is not only populations and related economic activity; there is also another user - the environment. The theory that residual water is sufficient for the environment is not acceptable anymore; it must be treated as a user with a rightful demand if our activities are to be made sustainable. In addition, extreme events like floods and droughts appear to be increasing in intensity and the regional and seasonal variations are quite high too.

In short a number of factors impact our use pattern of water and its availability:

- Population Growth
- Economic Growth and Social Development
- Regional and Seasonal Variations
- Climate Change, Extreme Conditions and Disasters
- Increased Pollution / Degradation of Water Quality
- Governance and Institutional Complexity

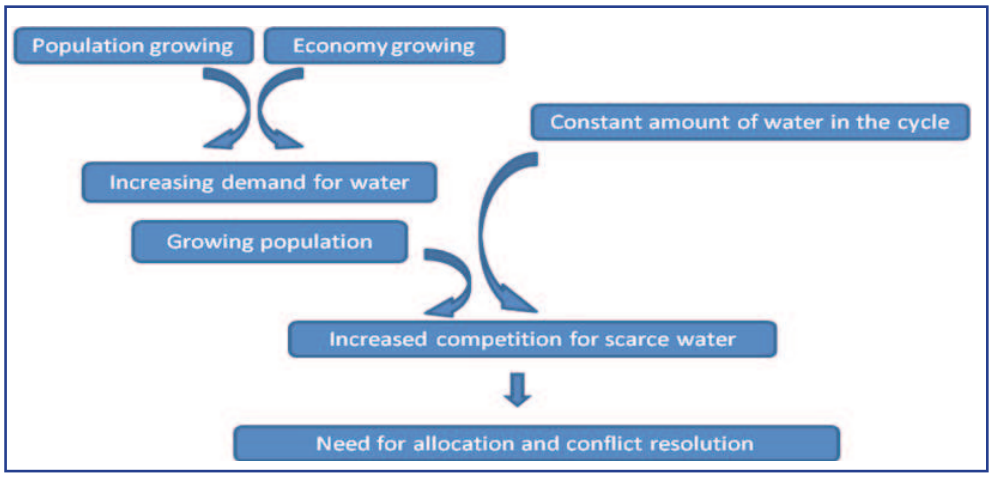
These represent the parameters of a very complex problem needing conscientious and sustained application of our energy if the issue is to be managed well in a sustainable manner.

The challenge, at least in the short to medium term, is not a lack of water in absolute terms, but how to utilize it more efficiently and equitably. In other words, it is a) how water can be made safe and accessible to the unserved for domestic use and sanitation; and b) how it can be used more productively to free the poor from poverty and food insecurity, whilst accommodating the rapidly increasing needs for urban and industrial sectors and without further penalizing the environment.

The Response Needed

With the all pervasive nature of the impacts of water in all aspects of our lives, planning or laying out specifics as a response to the big issues is not quite possible. As highlighted earlier it is a complex problem and a large number of stakeholders in different sectors have to play their role. However, as a stimulant for our thinking process, the key broad areas of action that we need to actively address are summarized below.

- Need for an overarching policy: Our principles, the framework within which



Source: Global Water Partnership

we need to operate and the guidelines need to be embodied in a policy document

- Building a recognition and awareness that water is a scarce resource, amongst the policy makers, professionals, students and the general public.
- Controlling the factors that affect availability and supply
  - Denudation of forests
  - Controlling the degradation and depletion of the resource (farming, industry, overexploitation, urbanization, waste water etc.)
- Improving water productivity in all spheres: agricultural, industrial and domestic
- Sustainable exploitation of GW resources - quantity and quality, avoiding over exploitation and pollution
- Management:
  - Take note of competing demands: people, food, industry, nature
  - Minimise fragmentation of responsibility, and unclear lines of demarcation of responsibility
  - Integrate: sectors, investments, supply, allocation, waste control, pollution and overexploitation
  - Include environmental water requirements in all water management strategies to avoid further degradation of ecosystem services
  - Create effective mitigation strategies to adapt to the impacts of climate change
- Governance
  - Participation of private sector and civil society
  - Policy development taking into account interdependencies between sub sectors: irrigation, hydro power, industry and domestic needs, and environmental consequences and eco-system conservation
  - Enact water resource legislation
  - Establish appropriate institutional structures
- Investment
  - Establish means for private sector investment, as it is unlikely that the full requirements in the coming years can be met with Government funding
  - Address principles of cost recovery - taking into account social equitability, particularly vulnerable groups
- Capacity Building
  - Development of a new generation of water professionals, who do not view water along short-term and narrow sectoral lines, but recognize its inter-sectoral complementarity
  - Investment in institutional strengthening at all levels and in R & D
  - Access to wider sources of knowledge
  - Develop a centralised knowledge base

In short, water scarcity is a real issue in Sri Lanka's case as well, and we need to carefully develop coping strategies. Strategies built around the hard elements of availability and quality alone are not enough. In fact more importantly, it is necessary to build strategies around the softer element of governance - our institutions, how we would manage inter-sectoral power plays, how we would manage scarcities arising from inequities and poverty etc. It is evident that we need to study and analyze these complex set of issues if we are to begin to understand the situation and take appropriate action, rather than just going on with the 'as we are' scenario? A large dose of political will coupled with professional capacity is what we require if we are to map out the right strategy before issues get out of hand compelling us to take 'damage control' measures. And who should do all this, whose business is water. Water is "Everybody's Business", and hence it the responsibility of all of us to act to ensure the wise use of water.

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