

# WATER SECURITY

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## Water Security: An Introduction

Water security can be defined as the regular access to enough safe water for an intended purpose to maintain and enhance the quality of life. Since water is a basic need of life, water security is defined as a human right by international law. In the National Water Resources Policy (approved by the Cabinet in 2000), it is principally accepted that water is a basic need for all living beings. It also includes the provision that the need to ensure access to safe water for the present and future generations is a fundamental right of all citizens. In addition, the draft national policy on drinking water state clearly that the Government of Sri Lanka considers access to safe drinking water as an inalienable right. Further, in section 7.1 of the draft drinking water policy, it is stated that water shall be considered and treated as an economic good, while ensuring basic needs are made accessible to all.

Water security is a rapidly growing issue in many parts of the world including Asia due to inadequate availability of safe water. At the same time, water is a key development ingredient that impacts on a variety of factors that sustain and enhance life. As a critical natural resource, the issues connected with water resources management are inherently diverse and complex. They involve questions of allocation and distribution, equity, conservation, pricing, regulation, education, participation, and

sustainable use. Secure access to safe drinking water is a vital requirement to improve the health and sanitation of societies. The access to water for other sectors such as agriculture, power generation and industries will support the economic development in a country. Water security in the agriculture sector is one of the main factors determining the food security of the nation. Although a healthy biotic environment supports in enhancing the quantity and quality of available water and thereby the quality of life, the environment is considered as the most neglected sector in terms of water allocation. The proper functioning of the environment ensures water allocation in maintaining the minimum environmental flow requirements.

Within the context of this background, it is clear that the issue of water security is of paramount importance to the socio-economic development of the country and sustainability of the environment.

## Water as an essential component of life

Water is an essential component of life. Human, animals and plants need water for their biological functions. There is no substitute for water. Water has multiple uses as well as multiple users. The availability and supply of fresh and clean supply of water determines the health and sanitation of a society.



When considering the distribution of water resources in the world, it is a known fact that 97% of the global water is saline and stored in the oceans. Fresh water availability is only around 3%. About 68.7% of the freshwater is stored in icecaps and glaciers and around 30.1% exists as groundwater, 0.3% remains as surface water while the rest 0.9% contributes to other forms of water. Fresh surface water is available in rivers, lakes, wetlands and other aquatic ecosystems. In view of the above facts, it is apparent that only 1% of the world's water is available for the use of human beings. Out of this 1%, a majority exists as groundwater, while only a small fraction is available in surface water bodies and rivers as surface water.

Distribution of water resources around the world is uneven. Hence, the availability of water also shows a significant variability across the countries, irrespective of the population pressure and economic development. This can be determined by analyzing and comparing the specific water availability for a single period of time for different regions and countries. The specific water availability represents the value of actual per capita renewable water resources. According to UNESCO the greatest water availability of 170,000-180,000 m<sup>3</sup> per capita is in the regions of Canada, Alaska and in Oceania. In densely populated regions of Asia, Central and Southern Europe, and Africa the water availability is within 1200-5000 m<sup>3</sup> per year per capita. In northern Africa and the Arabian Peninsula, this value is around 200- 300 m<sup>3</sup> per year per capita. If the per capita water availability is less than 2000 m<sup>3</sup> per year it is considered to be low, and less than 1000 m<sup>3</sup> per year is considered as catastrophically low. In Sri Lanka, water availability per capita per year is 2500 m<sup>3</sup> and this figure is quickly diminishing. The water availability values indicate that very serious problems exist in terms of fulfilling basic water needs of various sectors such as water supply and sanitation, industry and agricultural development. In addition to the uneven spatial distribution of water resources around the world, availability of water shows a temporal variability too. This is mainly determined by the availability of precipitation and the circulation of water on the earth as represented in

hydrological cycle which includes various processes that take place during the circulation of water in the earth system.

The science that deals with occurrence and circulation of water is called Hydrology which is based on physics, meteorology, oceanography, geography, geology, hydraulics and other related disciplines such as forestry, agriculture and ecology. Water available in the land phase of the hydrological cycle covers the sources of water from rainfall, surface water, groundwater, recycled water, fog interception and salt water purified using osmosis.

### **Multiple uses of water and the water users**

Agriculture is the most dominant water user in the world. Agricultural accounts for nearly 70% of the water used throughout the world, and the majority of this water is used for irrigation. In the United States, 49% of the total freshwater is for agriculture and in Africa and Asia, an estimated 85 -90% of all freshwater use is for agriculture. According to



estimates for the year 2000, agriculture accounted for 67% of the world's total freshwater withdrawal, and 86% of its consumption. With the development of irrigation infrastructure such as dams, river diversions and construction of irrigation canals, the potential arable areas which did not receive adequate rainfall for crop growth started receiving water. In Sri Lanka, the Mahaweli development programme established a series of reservoirs in the upper reaches of the Mahaweli river, and from which water was diverted for agriculture in the drier parts of the country. This led to the improvement of food production while increasing the consumption of freshwater resources in the dry parts of the country.

Many of the world's most important agricultural lands consume groundwater at unsustainable rates. In Sri Lanka, indiscriminate extraction of groundwater takes place in large agro wells in the dry zone of the country, and this leads to the gradual decline of ground water, making it into a non-renewable resource. This can make a significant impact of water security of the nation. In management of drainage, water is used to wash off accumulated salts in soils.

Water is essential for biological functions of all living beings. In addition, humans need water for health and sanitation. As a solute, water washes away dirt and it cleans the environment. Hence water is used for drinking, cleaning and washing purposes. Development of ancient civilizations around the major rivers is the

best example to show the importance of water for human existence.

Water withdrawals in the industrial sector vary with the level of economic development. On average the global industrial water use is around 22% and in high income countries it is approximately about 60% of total water use while in low income countries it is only around 8%. The most significant factor with respect to water use by industries is the discharge of used water, which contributes to pollution of water courses. In developing countries, the industrial wastes are dumped into the water where they pollute the usable water supply.

World energy demand is rapidly increasing as a result of socio-economic development. Hydropower is the most important and widely used renewable source of energy. There are about 45000 large dams developed worldwide for multiple purposes including hydropower development. Though, hydropower provides comparatively clean energy, there are social, economic and environmental issues related to the construction of large dams. In addition thermal and nuclear power production also requires a considerable amount of water.

Ecosystems provides multiple benefits such as habitats for plants and animals, moderation of physical conditions like weather, absorption of energy to reduce temperature, infiltration of water, changes in water flow velocity, moderation of the chemical environment such as reduction of carbon dioxide, production of oxygen, absorption of chemicals, etc. Efficiency of these activities depends on the healthiness of the ecosystems. Hence, ecosystems need water to maintain the multiple benefits it provides to the society.



Water is an important element of cultural practices and religious beliefs. Rivers and other water bodies are associated with many cultural functions. In addition, water has non consumptive uses such as navigation, fishing, recreation, etc. Water users in these various sectors have diverse

objectives in utilizing water. Hence they take maximum effort to fulfill their demands. This demand has created a huge pressure on the water resources around the world.

**What are the factors that affect water security?**

Population growth as well as over exploitation of land and water resources for agriculture and industrial purposes has increased the demand for water during the past three four decades. In addition, these activities have contributed to the deterioration of the freshwater resources around the world too. World freshwater resources are diminishing at an alarming rate as a result of destruction of forests and important ecosystems, disposal of wastes into the water bodies, rivers and streams, human induced soil erosion and landslides, and improper management of water resources. These factors have contributed to the pollution of water and subsequent deterioration of water resources. The quality of water determines its intended use. Water quality standards have been formulated to identify the suitability of water for different purposes such as for drinking, irrigation, recreation, etc. Pollution of water resources adversely affects the water security for all these purposes.

Water pollution has occurred mainly due to point and non point sources. Point sources discharge pollutants from specific known locations so that they are easy to identify, quantify and control. Therefore, most countries in the world have successfully controlled the point sources of pollution. However, in the developing world, this is also a major concern in urban and industrial areas. In contrast, the non point sources are diffused in the environment and hence it is difficult to identify their origins making it difficult to control. Agriculture is considered as one of the important nonpoint pollution sources as the agricultural inputs such as fertilizers, pesticides, heavy metals and sediment generated



from agricultural lands contribute to the pollution of water resources. Eutrophication or excessive growth of algae and aquatic plants in water bodies is the adverse consequences of accumulation of nutrients such as Nitrogen and Phosphorus in water bodies. The algae produces toxic compounds making such water unusable. In addition, aquatic plants block the drainage canals too. Fish cannot survive in eutrophic water due to low dissolved Oxygen levels. In addition, agriculture contributes to the accumulation of salts in soils in areas with high evaporation rates.

Destruction of watershed areas as a result of over exploitation of land for agriculture, urban development and for industrial purposes as well as man made fires are witnessed mainly in the developing world including Asia. Important ecosystems such as forests, mangroves, and wetlands have been degraded as a result of the destruction of watersheds. The health of the watersheds determines the quantity and quality of water they produce. With the degradation of watersheds, poor dry weather flows in the rivers and streams can be seen causing water shortages during dry seasons. In addition, pollution of water increases the water purification costs, which in turn lead to high water tariffs in water supply systems. In addition, water shortages will adversely affect the livelihoods of people such as in fishing.

Large dams are constructed for multiple purposes including drinking water supply, irrigation, hydropower generation, flood protection etc. They will eventually help to improve the water security of different sectors and societies. However, there are many adverse social and environmental impacts of large dams too which negatively contribute to the water availability for humans, animals and the environment. The water rights of the downstream people are adversely affected due to large dams. The downstream

ecosystems and wildlife also suffer with low water and sediment supply adversely affecting livelihoods. The displacement of people due to large dams can reduce the water security of people in their new settlements. River diversions can also positively and negatively contribute to the water security of the people. The water security of the receiving river basins will be improved while the downstream people of donor river basin may suffer due to shortage of water for drinking, agriculture and other livelihood options.

Temporal variations of climatic conditions also contribute to the water shortages. Water may be adequately available in the wet season while water scarcity is experienced during the dry season. Freshwater resources are highly sensitive to variations in weather and climate. The changes in global climate resulting from the accumulation of greenhouse gases in the atmosphere will affect patterns of freshwater availability, and will also alter the frequencies of floods and droughts. Water security of the people can be adversely affected under both situations. Though water is available during floods, the quality becomes an issue in intended use. The benefit of floods is that they help to flush off waste materials and pollutant rich sediments from rivers to purify riverine ecosystems. Under drought conditions, both quality and quantity will deteriorate and water security of people will be adversely affected.

Wastage of water can be seen all over due to leakages of delivery pipes, unattended taps and overuse of water in almost all water use sectors. A very high percentage of non revenue water loss is a serious problem in the water supply systems in most of the developing countries. These wastages also contribute to the water shortages. In addition to the above factors, water security for different uses is determined partly by the management of water resources. In the past, water was considered a commodity to be controlled and supplied. The potential water availability in an area was considered based on the long term average river runoff. Water requirements were calculated for different water supply purposes. Water use efficiency was overestimated and yet the social, economic and ecosystem considerations of water were poor, highly technical and sectoral. However, due to the interdependent nature of the different components in the watersheds and water supply systems, it is important to consider all the sectoral water uses and water users in

formulating water resources management strategies to protect the water rights and water security of all. This is the basis for new approaches formulated for integrated water resources management.

### **Water security of Sri Lanka**

Sri Lanka is rich in water resources. North East and South West monsoons and convective rainfall are the main sources of surface and groundwater. These are supplemented by fog, dew and mist in some areas. At higher elevations, cloud water also contribute to the surface water flow. The mean annual rainfall of Sri Lanka is about 1900 mm which is about two and a half times more than the world annual mean of 750 mm. Depending on the spatial variability of rainfall, Sri Lanka is divided into Dry, Wet and Intermediate Zones. The Wet zone of the southwest and the central hill country receives rainfall of above 1750mm per year while the Dry zone receives around 1250mm of rainfall. The Intermediate zone receives rainfall within the above two figures annually. However, there is a considerable inter annual variability of rainfall experienced in Sri Lanka.

Sri Lanka has 103 major river basins. Severe floods occur in some of these river basins including Kelani, Kalu and Mahaweli, while occasional floods are experienced in many other basins. Cyclones and moonsoon rains can bring severe floods to the Dry zone areas as well. Droughts also occur in almost all parts of the country though the Dry zone is highly vulnerable.

The surface water resources in the country includes rivers, streams, lakes, tanks, man made reservoirs, lagoons and wetlands. Groundwater is also an important resource for the country and the limestone aquifers in the Northern regions are the major water sources in these areas. Shallow groundwater is used for domestic and agricultural purposes in many parts of the country especially in rural areas.

Even though the mean annual rainfall figures are very impressive, different parts of the country face water shortages during dry periods. Even in the Wet zone, settlements located in higher elevations face water scarcity due to deep water tables. Diminishing and deteriorating surface and groundwater resources can be seen in the country as a result of destruction of forest cover in important water source areas, over abstraction

of groundwater, pollution of water resources as a result of intensive agriculture (eg. Kalpitiya, Nuwara Eliya, Jaffna), urbanisation and improper disposal of urban, industrial and agricultural wastes. All these factors have negatively contributed to the water security of various water use sectors in the country.

### **How to enhance water security?**

With the growing population and improved living standards, it is difficult to control the growing demand for water. Within this background, many developing countries face the challenge of providing safe and sufficient water for people due to the degradation of water resources at an alarming rate. However, it is a known fact that most of these countries have rich sources of water. Inadequate measures for law enforcement to protect environmental resources, poor water resources infrastructure, uncoordinated management of land and water resources, lack of government support, lack of political stability and poor community participation have led to a decline in water security in these countries.

Integrated Water Resources Management (IWRM) approach gives consideration to all the water use sectors and the stakeholders in developing strategies for water resources management and has been identified as a highly suitable option for coordinated management of water resources. Within the framework of IWRM, it is important to empower people to value water considering its economical social, cultural and environmental importance. Community participation is needed to control pollution. Risk management should be carried out to provide security from floods, droughts, pollution

and other water related risks. Important ecosystems in the river basins should be protected to improve the water yield and quality. Water supply infrastructure should be properly maintained to minimize leaks and conveyance losses. Rainwater harvesting should be promoted to improve the availability of water for different uses. Groundwater recharge should be improved. It is important to take steps to share water resources to promote peaceful co-operation and develop synergies between different water users at all levels, within and between boundaries and in respect of trans-boundary water resources through sustainable river basin management.

Sri Lanka should also be prepared to face possible climate change impacts on water resources by improving water resource infrastructure, proper land use planning, capacity building in water sector, policy formulation, and imposing strict regulations to protect watersheds, riparian areas, wetlands, etc. In addition, equitable allocation of water resources is also needed to ensure water security of the nation.



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