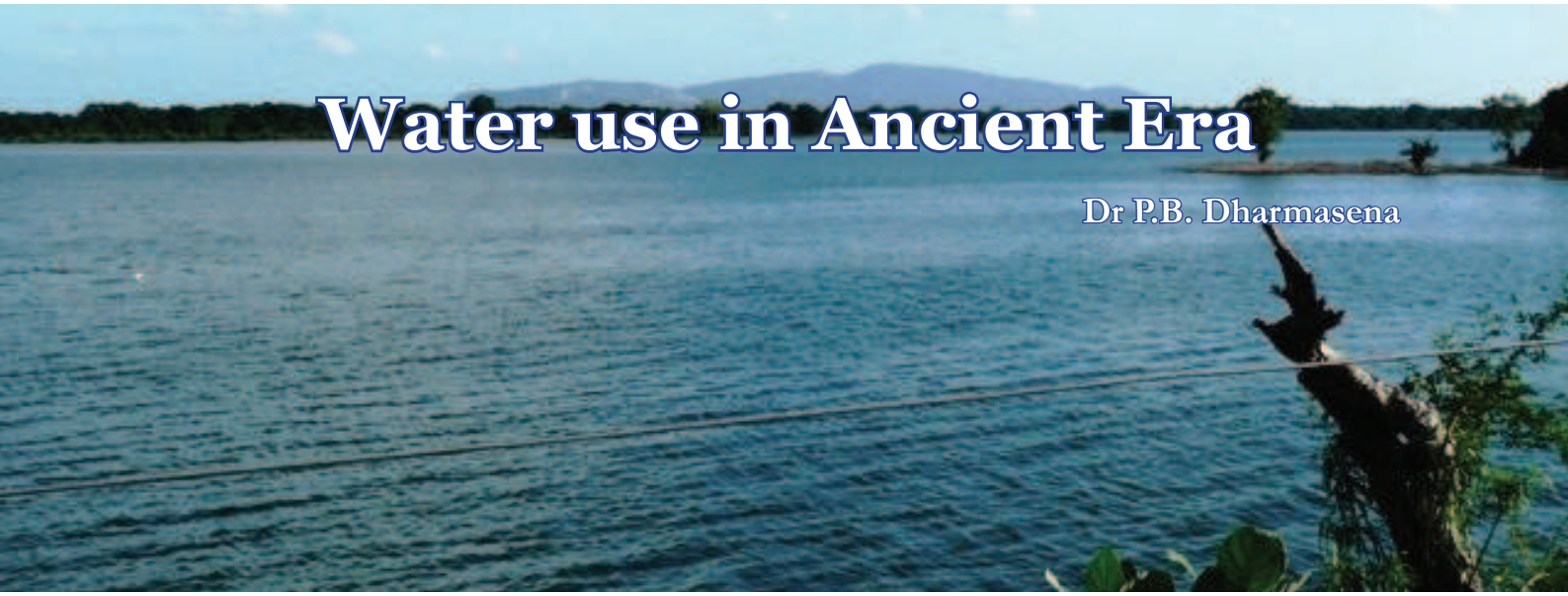

Water use in Ancient Era

Dr P.B. Dharmasena

We are proud of being Sri Lankans for many reasons, one of which that we had a glorious past of water resources management. Generally it is referred to as 'Hydraulic Civilization', said to be unique to Sri Lanka. The culture and lifestyle that evolved over the course of history during this era, were intricately tied to nature and the local landscapes. Interference of social, political and economic dimensions of neighbouring countries affected significantly the entire process of this evolution. The known history of Sri Lankan civilization records two main discontinuities due to external invasions that had taken place in 3,000 BC and 1,200 AD. This evolutionary process of the ancient hydraulic civilization of Sri Lanka, led to the formation of an administrative concept based on water movement, which is less known even to the Sri Lankans.

Evolution of a great civilization in the north central part of Sri Lanka was principally driven by the process of collecting water from rainfall for people and agriculture.It is somewhat a sacrifice made to form societies around small sources of water in a water scarce area and not moving to water rich areas found in the central highlands of the island. This is debatable and difficult to understand unless one deeply probes the interactive process of historic evolution. One might conclude that although the apparent problem in this area was water,the historic fate of the country nonetheless had enabled the development of a civilization through skillful management of the available water resource giving due regard to the national landscape features of the region.

Three main factors were responsible for the evolution of water resources management systems in the dry zone. They are the morphology of the landscape, the amount and distribution of the rainfall, and the nature of the substratum (in terms of pedology and geology).

This civilization evolved through millennia as a result of trying to find solutions to basic needs (food,water, and protection) and basic concerns of drought, floods, cyclones, epidemics, and invasions. It is difficult to trace especifically the timing of the special strategies adopted to mitigate such disasters or to what degree these approaches were indigenous or influenced

by invading/ migrating foreigners.

Administrative Division	River Basin/s
1. Rakungiri (Ritigala)	Malwathu Oya
2. Upulwangiri (Dambulu)	Kala Oya
3. Kawasthalabha	Yan Oya
4. Neelagiri	Modaragan Aru
5. Kevesastha (Uththara)	20 river basins in the North
6. Chalaka (Thambapanni)	Mi Oya
7. Dhumakakaddeera	Deduru Oya
8. Mahagiri (Samanala)	Kelani, Kalu, Walawe, Mahaweli
9. Agni (South Eastern region)	Kumbukkan Oya, Menik Ganga, Kirindi Oya
10. Indra (Western region)	Maduru Oya, Mundeni Aru, Gal oya

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The system of dry zone civilization might have first emerged around natural lakes (*vil*) and streams (*oya*) in varying sizes. Subsequently, human beings developed rainwater-harvesting methods to make living possible in other areas of the dry zone. Intrinsic networks of minor tanks and streams evolved with the formation of organized communities. More logical water-use systems evolved when farming societies developed. Culture, customs, agriculture, traditions, and all sorts of life styles evolved on this landscape through the influence of migration and invasion from the northern side of the island. These external factors might have accelerated or sometimes disrupted this evolutionary process of civilization. Two main types of supportive factors of the evolutionary process of this ancient civilization can be identified, namely, need based inventions and problem solving strategies. Basic needs were water, food, fibre, shelter, and protection. Problem-based driving forces of the evolutionary process of our human community include strategies to address natural disasters such as droughts, epidemics, floods, cyclones, and external invasions. Strategies adopted to face these challenges infiltrated to the social systems in the form of their lifestyle and as accepted facts in their traditions. The pre-historic evolution that took place in both Sri Lanka and India show great similarities due to continuous interaction between the two countries.

With the progressive acceleration of cognitive abilities and technology in the later pre-historic period (30,000–1,000 BC), the stage was set for a radical transformation in the interactive balance between man and environment. People steadily proceeded to dominate nature and transform it through collective effort. The advent of iron technology to Sri Lanka around 1,000 BC saw the ascendance of man. Excavations in the citadel of Anuradhapura have produced important evidence of iron technology, breeding of horses and cattle, and paddy cultivation, from cultural horizons nearly ten metres below the present ground surface. There is incidental evidence (faunal, sedimentological) for water management associated with paddy cultivation. Agriculture would undoubtedly have been dominated by paddy cultivation, which can only be intensified in the Sri Lanka dry zone, by the adoption of water management measures to control supplies from seasonal rainfall, streams, and perennial rivers.

The history and cultural heritage of Sri Lanka extends over a period of more than 5,000 years. The great King Ravana ruled the land of Lanka, which then covered also a part of India

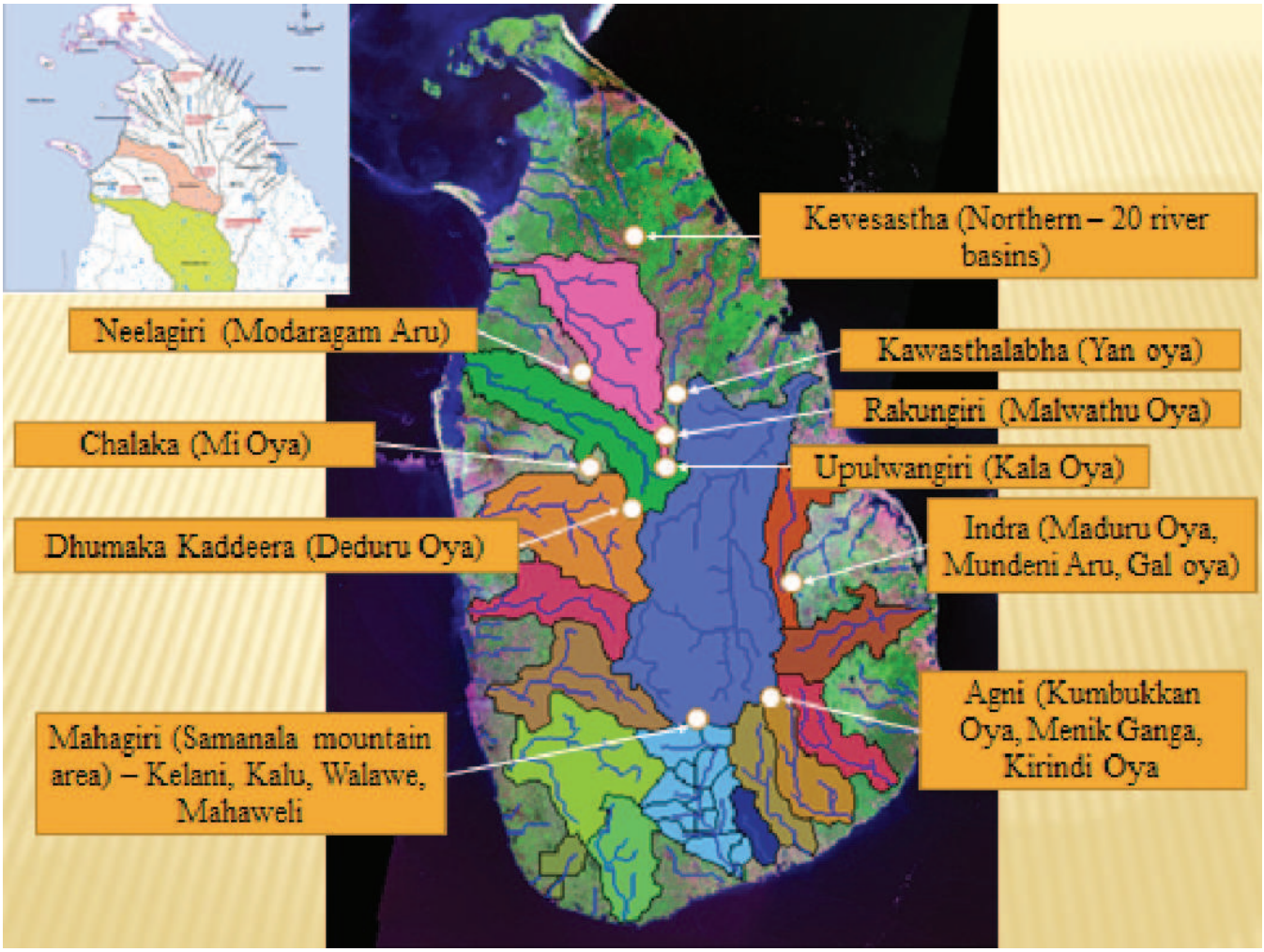

Figure 1 Ancient 10 administrative divisions based on water (3,000 BC)

around 3,000 BC, as mentioned in the popular Indian epic *'Ramayana'* (The Epic of Lord Rama) thought to have been written in 500 BC. The capital of the *Asura* King Ravana is said in the epic Ramayana to be situated in Anuradhapura. The invasion by Vijaya through the Princess Kuweni (Princess of land) occurred in 600 BC. The Princess Kuweni ruled the area 'Chalaka' (western region), which was one of the ten divisions at that time. Cities of these local kings were said to be on mountains and administrative zones had been based on river basins (Figure 1). These ten ancient administrative divisions and the pertinent river basins are given below.

Inadequacy of rainfall especially the poor distribution, higher evaporation, and transpiration rates with respect to precipitation, occurrence of droughts, and resulting agricultural failures led the ancient rulers to construct reservoirs of varying sizes to create a favourable environment for human life. The legendary story of civilization in Sri Lanka begins when the island was inhabited by people of the original tribes *Yakka, Raksa,* and *Naga*. These early people gradually developed systems of sedentary agriculture based on irrigation, and folklore maintains that the *Yakka* built some ancient irrigation tanks. By the time of the arrival of Vijaya around 500 BC, small scale irrigation systems were already operational.

The first extensive Sinhalese settlements were along rivers in the dry northern zone of the island. Because of early agricultural activity, primarily

the cultivation of wet rice which was dependent on unreliable monsoon rains, the Sinhalese constructed canals, channels, water-storage tanks, and reservoirs to provide an elaborate irrigation system to counter the risks posed by periodic droughts. Such early engineering attempts reveal the brilliant understanding these ancient people had of hydraulic principles and trigonometry. The discovery of the principle of the valve tower, or valve pit (*bisokotuwa*), for regulating the escape of water is credited to Sinhalese ingenuity more than 2,000 years ago. By the first century AD, several large-scale irrigation works had been completed.

Water was managed by sharing between river basins through diversion or feeder canals to avoid excess or shortage. Some examples are the Dambulu Oya–Malwathu Oya diversion canal (860 AD), the Malwathu Oya–Kanadara Oya diversion canal (860 AD), and the Yoda Ela–Nachchduwa feeder canal (540 AD). Within some river basins, water flow had been also regulated through link canals to avoid imbalance of water. Examples are the feeder canals of Kalawewa–Thisawewa, YodhaEla (470 AD), Nachchaduwa–Nuwarawewa (290 AD), Balaluwewa–Siyambalangamuwa feeder canal (290 AD), and Basawakkulama–MahaVilachchiya (470 AD).

The western invasion of the country began with the Portuguese in 1505 followed by the Dutch in 1656 and subsequently by the British in 1798. The hydraulic civilization evolved as a network of streams and tanks in varying sizes spread

Chena (Shifting cultivation) evolved through interaction of man with the environment

over the dry zone of Sri Lanka forming tank clusters referred to as tank cascade systems. Prof. Madduma Bandara defined it as 'a connected series of tanks organized within micro-catchments of the dry zone landscape, storing, conveying and utilizing water from ephemeral rivulets'.

Medieval villages developed in association with small tank cascade systems in the dry zone of Sri Lanka. The centre of the village is the tank, and houses are grouped on one or both sides of the tank on the relatively higher elevation around the tank bund (embankment). The wells for domestic water tap the shallow phreatic groundwater table. The irrigable area below the tank bund is located along the main axis of the inland valley. Rain-fed upland crops are grown on the unirrigable slopes of the upland under a system of shifting or chena cultivation. Tank water is conserved with tree belts (*gas gommana* and *kattakaduwa*) around the tank, upstream bunds (*iswetiya*) and water holes (*godawala*) above the tank bed. This is known as the traditional tank-village system typical to Sri Lanka (Fig. 2).

After King Pandukabhaya (437–367 BC) founder of the Anuradhapura city, 122 kings reigned for 1477 years up to 1040 AD, until the kingdom was moved to Polonnnaruwa (80 km to the west). The establishment of forests and construction of ponds, reservoirs and irrigation systems were considered great meritorious acts in accordance with Buddhism, the faith of the leaders and of the large majority of the people.Sri Lanka history is full of achievements of kings who contributed to the development of water resources. Since the first century AD, kings such as Vasabha (67–111 AD), Mahasena (276–303 AD), Dhatusena (455–473 AD), Agbo II (575–608 AD), and Parakrambahu (1153–1186 AD) built numerous reservoirs and irrigation systems that fed vast expanses of paddy field in the dry zone. Construction and upkeep of these irrigation systems became massive undertakings. An indigenous expertise developed over the centuries, which appears to have been utilized by other countries of South Asia.

Indigenous agriculture is mostly based on in-born principles. People observed natural phenomena operating around them and studied how they could be manipulated for their needs. This included management of the forest by observing its anatomy, association of coexistent species, regeneration after fire, spatial variations and so on. The farming system, which includes chena (shifting cultivation), paddy and home garden cultivation, evolved through interaction of man with the environment

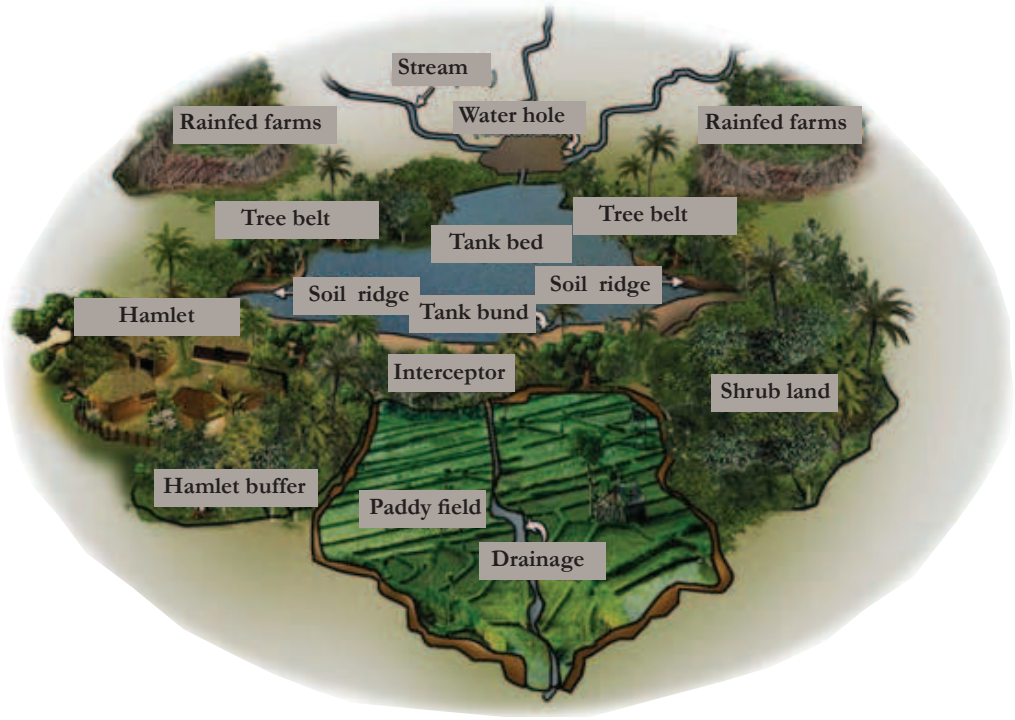

Figure 2 Features of an ancient village

and emerged in harmony with the natural landscape. Their experience and observations of rainfall pattern, wind, temperature, humidity, and landscape have been used to adjust their cultivation activities.

To reduce the risks of natural disasters they developed the tank-village community system that spread all over the dry zone. When they found that some of the disasters they faced in farming were beyond their control, they appealed to the support of religious, spiritual and cosmic influences. The most important fact they realized was that sustainability of their food sources was not possible without giving due respect to the resources used in farming. Paddy cultivation under rain-fed conditions or with supplementary irrigation water from reservoirs of varying sizes evolved to become a sustainable farming practice in the dry and intermediate zones of Sri Lanka. Basic problems faced by farmers were shortage of water in less rainy seasons, development of salinity in certain parts of the field, and damage from wild animals, pest, and diseases. The strategies that emerged to address these problems are not specific to a certain problem, but collective. The following strategies can be traced:

a. '*Bethma*' practice—It is a practice that temporarily redistributes plots of land among shareholders (paddy land owners) in part of the command area (territory) of a tank (reservoir) during drought periods.
b. '*Pangu*' method—The tank had to be maintained properly to avoid breaches, leaks, and excess seepage. Repair and desiltation of tanks and cleaning of canals during dry periods are shared tasks assigned to each farmer in proportion to land ownership.
c. '*Kekulama*'—Farmers advance the cultivation time using early seasonal rains whenever they feel that tanks would not get enough water to cultivate the command area. They have the experience that if September (2nd inter-monsoonal) rains are high, the total seasonal rainfall is not adequate to fill the tank.
d. '*Karahana*'—This is a water distribution device fixed across the canal made up of log with two weir-shape cuts. The size and bottom level of these cuts are made according to flow requirements of the two canals below, and the

Ancient communities were able to mitigate effects of floods, cyclones etc. by managing properly their landscape

karahana is fixed by the village head ('*Gamarala*').

e. Village commons—micro-landscapes are utilized to reduce tank water losses, mitigate salinity effects, prevent tank sedimentation and so on.

The traditional communities addressed and continue to address all issues as a systematic and holistic concern rather than as an individual event. In addition to rain-fed farming (chena) area, the hamlet and paddy fields, they take care of the commons (their territory) surrounding them. It is vital to understand why these commons have been maintained purposefully. These communities had the wisdom to mitigate the effects of droughts, floods, cyclones, and epidemics by managing properly their natural landscape and conserving natural resources. Descriptions and importance of the commons are discussed below (Fig. 2).

Upstream tree belt ('*Gasgommana*') – This is the naturally grown vegetation in the upstream land strip above the tank bed, flooded only when spilling occurs from the reservoir. Large trees and climbers are found in this area. The *gasgommana* acts as a wind barrier reducing adverse effects of strong winds, minimizing evaporation from the tank, and lowering water temperature. It extends up to the bund (embankments) where roots of large trees create watery conditions suitable for breeding and living places for some fish species. This strip of trees demarcates the territory separating somewhat the human and wild animal domains.

Upstream meadow ('*Perahana*') - This meadow developed below the *gasgommana* filters out the sediment flowing from upstream chena lands. This helps in maintaining the tank capacity, reducing the threats of floods and droughts.

Upstream soil ridge ('*Iswetiya*' or '*potawetiya*') – This is an upstream bund constructed to prevent entering of eroded soil from upper land slopes.

Upstream water hole ('*Godawala*') – A man made water hole to trap sediment. It also provides water to wild animals.

Hamlet buffer ('*Tis-bambe*') – A fertile land strip found around the settlement area (*gangoda*) that is not privately owned. Tree species such as Madukalongifolia, mango, coconut are grown in a scattered manner. This area was mostly used for sanitary purposes and as the resting place of buffaloes. Buffaloes were used as a protection mechanism from wild animals and malaria.

Downstream drainage ('*Kiul-ela*') – This is the old natural stream utilized as the common drainage. Tree species, which could absorb salts, and a few rare species of small fish are also found in water holes along the *kiul-ela*. Most importantly it filters salts and iron polluted water, and improves the drainage condition of the paddy tract.

Interceptor ('*Kattakaduwa*') – This is a reserved area of land below the tank bund. Its micro-landscape consists of three micro-climatic environments: waterhole, wetland, and dry upland, which facilitate development of diverse vegetation. This land prevents soluble salt sand ferrous iron entering the paddy field. The waterhole referred to as '*yathuruwala*' minimizes bund seepage by raising the groundwater table. Villagers plant *Vetakeya* (Pandanuskaida) along the toe of the bund to strengthen the bund stability. It appears to be a village garden, where people utilize various parts of the vegetation for purposes such as fuel wood, medicine, timber, fencing materials, household and farm implements, food, fruits, and vegetables. Specifically they harvest raw materials from this vegetation for cottage industries.

Dr P.B. Dharmasena
Freelance Consultant (Agriculture, Hygrology, and Soil Science)
0777 613234