Water Management Issues In Sri Lanka; Lessons From The History

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ABSTRACT: Historical evolution of the water resources development in Sri Lanka is reviewed in the backdrop of present status and current issues in water resources management.

1. INTRODUCTION

1. 1 Geographical Setting

Sri Lanka is a pear shaped tropical island in the Indian Ocean with a total area of 65525 sq.km. It lies between Latitudes 5^0 and 10^0 N and Longitudes 79^0 and 82^0 E. The maximum length of the country is 432 km and the maximum width is 224 km. The island consists of a vast coastal plain and central mountainous region, rising to an elevation of 2524 metres. The inland waters cover 2905 sq.km. As the island is situated in the equatorial belt; temperature, precipitation and humidity are generally high and their seasonal variations are low. The mean annual temperature in the coastal lowlands is 27^0C and is 15^0C in the central hill country. The annual average rainfall varies from a minimum of 960 mm to a maximum of over 5000mm in the central hills. Rivers radiate from the central highland in all the directions. Sri Lanka is mainly an agricultural country.

1.2 Water Resources & Hydrology

1.2.1 Surface Water

Sri Lanka can be divided into 103 distinct catchments (Figure: 3) where the sizes vary from 10 sq. km to a maximum of 10,600 sq.km. The largest river, Mahaweli Ganga (Ganga means river) is 335 km long which has the largest catchment area (10,600 sq .km). Other large rivers are Aruvi Aru (164 km,3284 sq.km), Kelani Ganga (145 km, 2292 sq.km), Deduru Oya (142 km, 2647sqkm), Walawe Ganga(138Km, 2471sq.km), Kalu Ganga(129Km, 2719 sq.km), Maha Oya(134 km, 1528sq.km) etc.

The average annual rainfall over the entire island is estimated to be 141 km^3 (2160 mm) and the annual runoff from all the rivers has been estimated at 50 km^3. Rain fall is of 3 types: 1) Monsoonal, 2) Convectional, 3) Depressional.

Monsoon rains occur during the south – west monsoon period from May to September, as well as during the north – east monsoon period from December to February. Convectional rains occur during the inter – monsoon periods, from October to November and from March to April. Depressional rains occur during the inter- monsoon period (October to November) and sometimes during the south- west monsoon.

Sri Lanka has been traditionally divided into three zones, namely (a) the Wet zone (b) the Intermediate Zone and (c) the Dry Zone. The Wet Zone receives a mean annual rainfall of over 2500mm and comprises the south-west quadrant of the island whereas the Dry Zone receives a mean annual rainfall of less than 1750mm and comprises mainly the northern and eastern sectors of the island. The Intermediate Zone receives a mean annual rainfall between 1750mm and 2500mm (Ministry of Forestry & Environment, 2000).

The irrigation requirement principally for rice is small in the Wet Zone. The region is well developed with crops such as Tea, Rubber, Coconut, Cocoa and Cinnamon. However the coastal lowlands in this region are subject to retarded drainage, water logging, salt water intrusion or periodical flooding and paddy cultivation in these areas has been in the decline.

The Dry Zone receives rainfall only during the period October to February. The annual runoff from the Dry Zone is about 23 Km^3 of which 19.3 Km^3occurs during October – February. Large extents of undeveloped lands with soils capable of supporting irrigated agriculture are available in this area. Due to the long period with little or no rainfall, large storage works are required in this region for the storage of water available during the raining season.(Manamperi, 1973).

The evapo-transpiration in the wet-zone is estimated at 1450 – 1550 mm/year. In the higher mountain

areas of south central Sri Lanka, with grater cloudness and low solar radiation, the values tend to decline to around 1000 mm. In the Dry Zone evepo-transpiration rates vary from about 1000 to 1400 mm/year as the water availability is limited. Evaporation rates from Dry Zone tanks (reservoirs) are estimated to reach upto 2134 mm. (Madduma Bandara , 2000.)

1.2.2 Ground Water

A relatively thick sedimentary deposit extending upto depths over 150 m, occurs in the north-western littoral belt and substantial quantities of ground water of suitable quality for irrigating low water consuming crops and domestic use are available. Jaffna penninsula in the north has an underlying limestone layer which forms a large ground water aquifer . This is the source of domestic and irrigation water in the area .This area is cultivated with irrigated crops such as chilles, onions, tobacco and vegetables (Manamperi, 1973).

2. HISTORICAL ASPECTS OF WATER RESOURCES DEVELOPMENT AND MANAGEMENT

2.1 Hydraulic Civilization

The ancient human civilizations were originated in the river valleys as an agricultural society due to accessibility to water and the fertility of soil. The development and management of water resources were also gradually set in to serve the needs of the society. Sri Lanka has a proud history of a hydraulic civilization dating back to pre Christian era .

The construction of storage reservoirs for irrigation and domestic supply had been practiced in Sri Lanka from as early as 500 BC. Several reservoirs varying in size from few million cu metres to over a hundred million cu. metres are found in the Dry Zone areas. Besides, a large number of stream diversion works on perinnial streams are found among the ancient works. (Manamperi , 1973).

The cascades of village tank (small reservoir) systems were a salient feature of the water and soil management system of the ancient Sri Lanka (Fig. 1 & 4).

Large reservoir systems were also in existence in the ancient Sri Lanka which were inter connected with man made or natural channels . The channels which were generally built along a contour , diverted water from perinial rivers and also collected intercepted runoff from the upper catchment. The ancient water resources developments were mainly aimed at irrigation purposes.

It has recently been established that many of these so called small tanks in the basin of the Mau Ara , a major tributary of the Walawe ganga in the southern area (Fig. 4) were not storage reservoirs, because their earth embankments were not equipped with sluice gates. They are in fact stream diversion structures made of earth , with their ends curved in the downstream direction. These structures are what a traditional farmer calls a vetiya. These earth structures had been built at corresponding elevations on the small tributaries , and had been joined together by channels. The function of a vetiya is to raise the water flowing in the tributary stream in both monsoon seasons, above the stream bed, which is less permeable than the valley sides. Some of the raised water soaks into the permeable soils of the valley sides to facilitate cultivation of non – rice other field crop, while the excess passes around the ends of the vetiya and back into the steam bed beyond for cultivation of rice in the impermeable low humic gray soils in the valley bottoms (Mendis, 1997 & 2001)

The ancient irrigation works in Sri Lanka are well known as one of the wonders of the ancient world. They had been built continuously over a period of about the 17 centuries from about the 5^{th} century BC to about 12^{th} century AD , after which they suffered a decline (Mendis, 1997) due to collapse of the ancient hydraulic civilization due to internal conflicts, foreign invasions etc. The ancient water resources development works were executed with meticulous regard for environmental concerns, and showed that the concept of sustainable development was consciously practiced over two millennia ago with much success. (Weeramantry, 2000).

After the collapse of the ancient hydraulic civilization in the dry zone, population moved mostly to the hill country and coastal areas of the wet zone and the intricate irrigation systems of the dry zone were abandoned. However, after a spell of about 6 centuries renovations of some of the ancient irrigation works were initiated during the British rule.

Restoration of ancient irrigation reservoirs and trans basin diversion canals in the north central Province were continued with much vigor after the independence in 1947. However the same attention was not paid for restoration of small village tanks and diversion structures especially in the south and south east part

of the dry zone. Instead, two large reservoirs, namely, Uda Walawe & Lunuganvehera were constructed submerging many abandoned small tanks for which criticism has been leveled at (Mendis, 1997, 2001).

3. RECENT TRENDS IN WATER RESOURCES DEVELOPMENT & ISSUES

The trend after the independence has been to construct large multipurpose reservoirs (eg. Senanayake Samudraya in Gal Oya Scheme, Uda Walawe Project, Mahaweli Diversion Scheme) by constructing dams across major rivers. The surface water resources of major rivers and reservoirs now a days function multiple purposes such as

1. Irrigation
2. Water supply (for industrial & domestic use)
3. Hydro power
4. Transport
5. Recreation
6. Sustenance of aquatic eco systems
7. For flood discharge and mitigation
8. Sediment transport
9. Pollutant transport etc.

Therefore, the need for proper water management to safeguard this increasingly scarce resource is vital. The multiple use of the water resources and river regimes has created many issues .They are

1. The problem of allocation of water for all the requirements such as irrigation , hydro power generation, domestic & industrial water supply, etc.
2. The problem of allocation of water within each sector such as distribution among the farmers.
3. Pollution of water resources due to effluent discharge into water ways and nutrient discharge from agricultural land.
4. Environmental problems created due to changes in the river regime.
5. Salinity intrusion due to sand mining in river beds and also due to reduced discharge.

4. LESSONS FROM THE HISTORY

4.1 The restoration of ancient cascaded system of small tanks and diversion structures (vettiya) will help to retard the stream flows enhance the soil moisture and distribute surface water more effectively thus reestablishing soil nutrient conservation eco systems concept.

4.2 Community participation for decision making for distribution of water for cultivation is a much talked subject for some time. This is being done by setting up of farmer organizations. In ancient times also such a system was said to have been in existence. However the society in that era would have been more disciplined, religious and obeyed the king. Punishments for wrong doing were also more severe than at present. Therefore, decision making as well as implementation of decisions made would have been much easier. Disciplined orderly society is a key factor for the success of participatory approach.

4.3 Lessons can be learnt from the history for location of reservoirs and trans basin diversion canals at appropriate places so that water resources management can be optimized.

4 4 The ancient irrigation systems dating back to pre Christian era are still functioning effectively after renovation which amply demonstrates the sustainability of the ancient development work. More in depth studies will be useful to acquire further knowledge on this subject .

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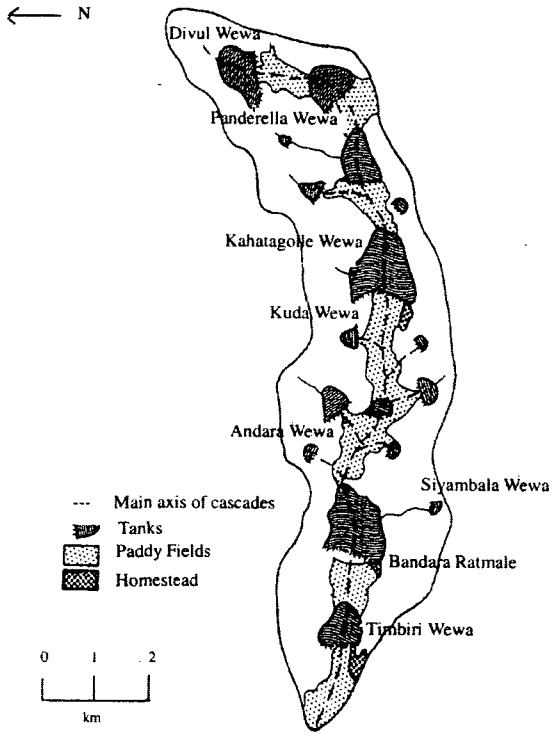

Figure 1. Cascades of Village Tanks
(Source: Madduma Bandara, 2000)

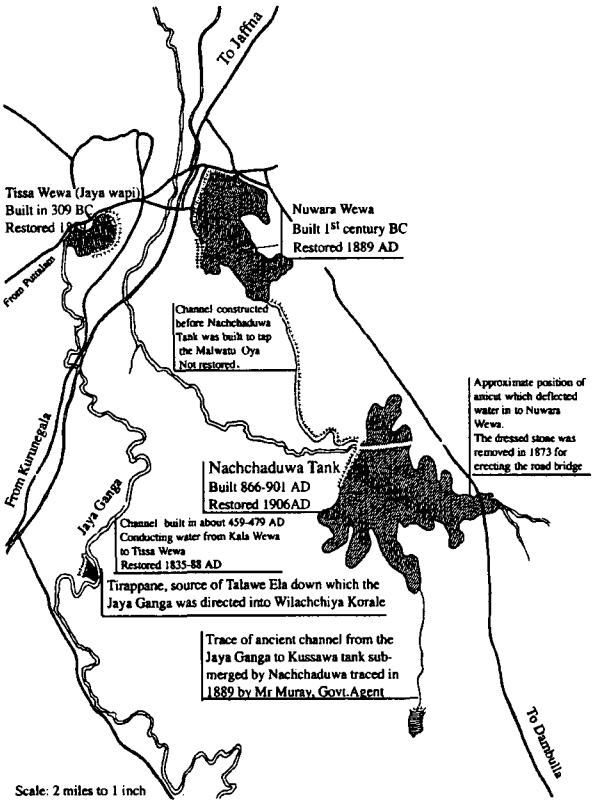

Figure 2. The Ancient Canal System
(Source: Brohier, 1934)

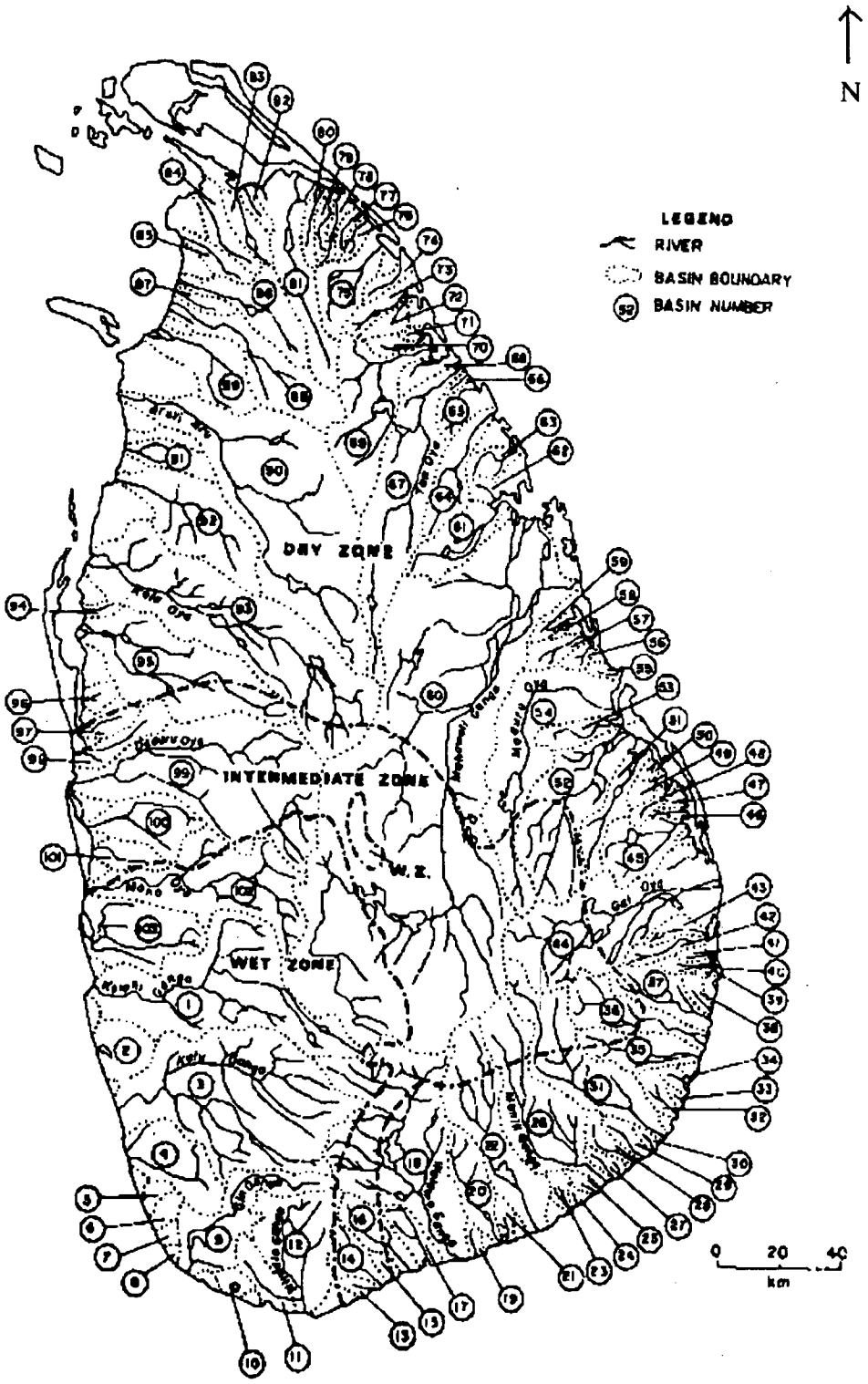

Figure 3. River Basins of Sri Lanka

(Source: Hydrology Division, Irrigation Department of Sri Lanka)

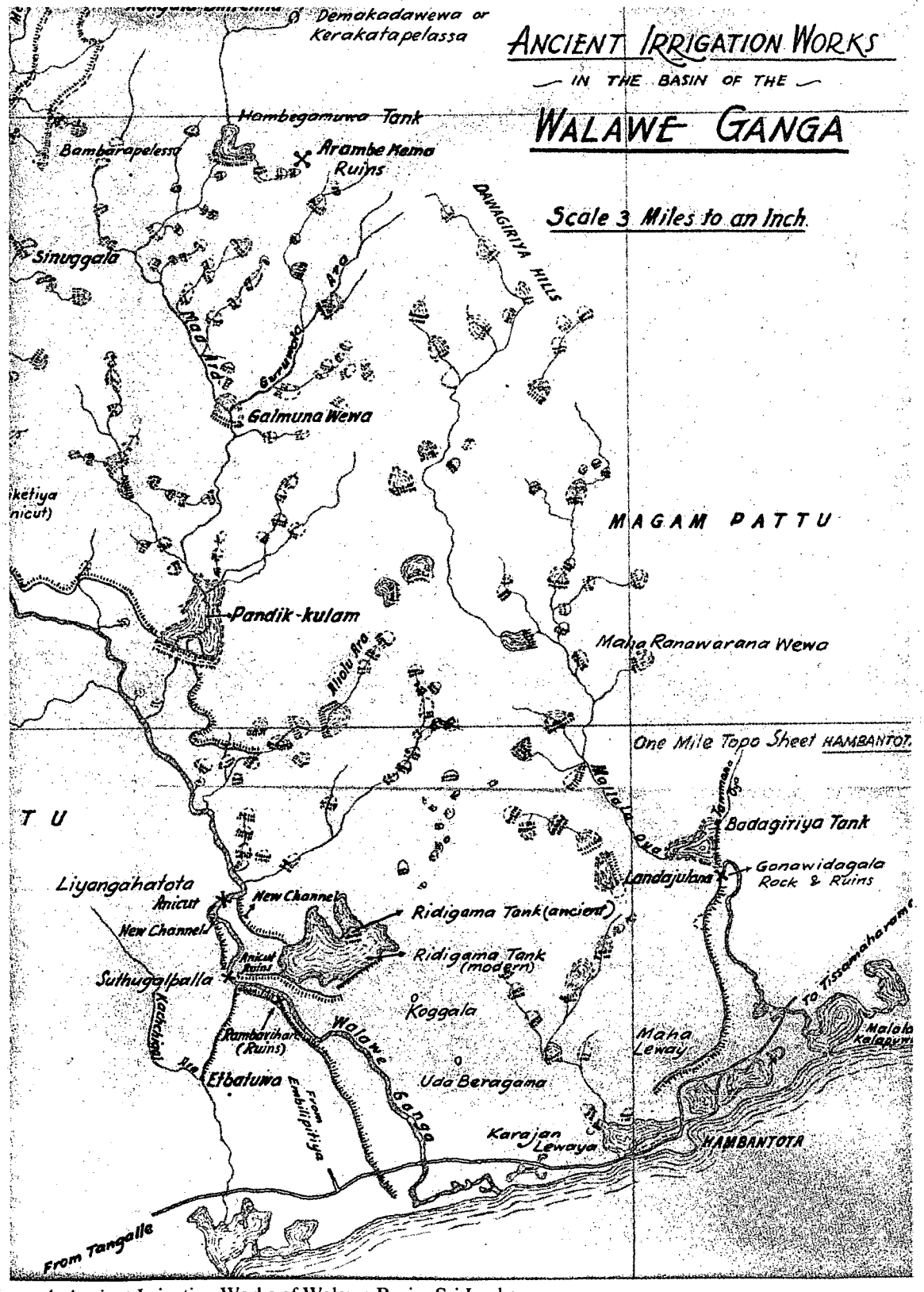

Figure 4. Ancient Irrigation Works of Walawe Basin, Sri Lanka

(Source: Brohier,1934)