

DETERIORATION OF SRI LANKA'S SMALL TANK SYSTEMS VIEWED IN THE CONTEXT OF AN ECONOMICAL-DEVELOPMENT MODEL

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Abstract: This brief paper deals with analysing and suggesting some solutions to the problems faced by the ecosystems related to the small tank systems specially in dry zone through a some what novel approach. In this analysis humans living in these are also considered as a part of the ecosystem.

In this study the concept of "sustainable development model for the ecosystem based on our culture" will be used as the main guideline and data from various literature related to this subject will be analysed in an overall manner based on this concept.

The main objective of this study is to highlight how the prevailing free market based economy and western development model, which we are following today, has contributed in creating the problems in small tank ecosystems. It has been suggested to change this economical system and development model to remedy this situation.

Keywords: Ecosystem, culture, development model.

1. Introduction

Sri Lanka has one of the most glorious histories in the world. This history is deeply connected with its hydraulic civilization. Today this hydraulic system is erroneously named as an irrigation system. Nevertheless according to most of the renowned authorities in this field this was a sustainable water - soil - flora fauna - human ecosystem, which was mainly based on small tanks (Wewa)[4]. The history of this ecosystem leads back to the 4th century B.C. or before. Basawakkulama is identified as the most ancient Wewa sometimes known as "Abhayawewa" done by king Pandukabhaya.

Our ancient kings had built major tanks and village tanks simultaneously for example king Parakramabahu the great, had constructed 165 dams, 3910 canals, 163 major tanks and 2376 village tanks during the last lap of Rajarata [5].

The back born of this ecosystem was its ability to store the rainfall water within the system for the benefit of the whole system. Unlike in modern irrigation systems, which are focused on supplying the crop water requirement for the root-zone, the ancient "hydraulic system" was focused on supplying required water for the whole ecosystem. In achieving this, various types of structures which are very much closer to the nature was constructed such as major

tanks, small tanks, Vetiyas, Amuna, Vila (lake), Wala (Pond) etc. (Figure 1) and inter connecting canals.

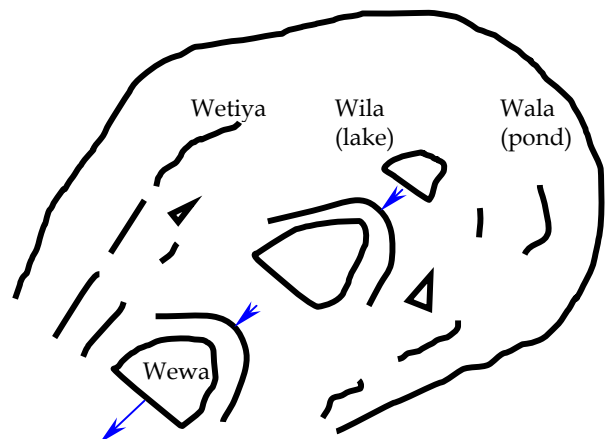


Figure 1 - Rainwater trapping structures

In these constructions our ancient engineers have concentrated on rainfall (nowadays measured in "mm") as well as on intensity of rainfall (nowadays measured in "mm/day").

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Small structures like Vetiya will capture the water to this system from very low intensity rainfall. Small tanks will capture the water from much higher rainfalls and major tanks will capture water from even higher rainfalls [3].

In some areas water from major rivers was conveyed to the major tanks and from there to the small tanks and then to the fields. In some other areas this happened totally other way round, i.e. spilling out water from small-tanks were stored in major tanks below. In almost all these cases small tanks were constructed in cascade system, which facilitated efficient reuse of water. In this manner these structures were used to store water in the ecosystem (i.e. in the soil) in drought periods and was used in flood mitigation in rainy periods. It should be mentioned here that irrigation was only a part of this hydraulic system. Figure 2 shows the essential components of a village tank. Picture of a small ancient wewa is shown in figure 3.

Gasgommana - It is the upstream land strip above the tank bed, accommodating water only when spilling. Large trees such as kumbuk, nabada, maila, damba etc. and climbers such as kaila, elipaththa, kalukeliya, kalawel, bokalawel etc. are found in this area. This vegetation is natural and seeds are floating on water. The gasgommana acts as a wind barrier reducing evaporation from the tank and lowering water temperature. It gets closure to the bund from either side where roots of large trees make water cages creating breeding and living places for some fish species. This strip of tree demarcates the territory between human and wild animals.

Perahana - It is the meadow developed under gasgommana and filters the sediment flow coming from upstream chena lands.

Iswetiya or potawetiya - An upstream soil ridge constructed at either side of the tank bund to prevent entering eroded soil from upper land slopes.

Godawala - A manmade water hole to trap sediment and it provides water to wild animals. This might had been a strategy to evade man-animal conflict.

Kuluwewa - A small tank constructed above relatively large reservoirs only to trap sediment and not for irrigation purpose. It provides water for cattle and wild animals.

Tisbambe - It is a fertile land strip found around the settlement area (gangoda) and does not belong to any body. Tree species such as mee, mango, coconut etc. are grown in scattered manner. Mostly this area was used for

sanitary purposes as the resting place of buffaloes. Buffaloes were used as a protection mechanism from wild animals and malaria.

Kiul ela - This is the old natural stream utilized as the common drainage. Tree species such as karanda, mee, mat grass, ikiri, vetakeya etc. and few rare small fish species are also found in water holes along the kiul ela. Most importantly it removes salts and iron polluted water and improves the drainage condition of the paddy tract.

Kattakaduwa - This is a reserved land below the tank bund. It consists of three micro-climatic environments: water hole; wetland; and dry upland, therefore, diverse vegetation is developed. This land phase prevents entering salts and ferric ions into the paddy field. The water hole referred to as 'yathuruwala' minimizes bund seepage by raising the groundwater table. Villagers plant vetakeya along the toe of the bund to strengthen the bund stability. It appears to be 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, vegetables etc. (Dharmasena, 1995). Specifically they harvest raw materials from this vegetation for cottage industries.

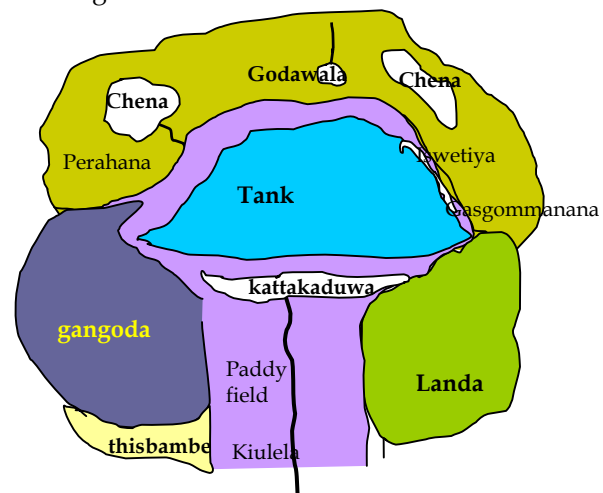


Figure 2- Essential components of a village tank

As mentioned earlier the heart of this ecosystem was the Wewa, which gave the lifeblood for the ecosystem. These systems has sustained for thousands of years. The sustainability of these ecosystems is not only due to there physical structures mentioned earlier. The culture prevailed in these settlements also provided necessary conditions for this sustainability. This culture was not driven by self-interest motivated by greed,

sharing resources equally (even among animals, birds etc.) and the equity of ownership were the most striking features of this culture. The attitude towards the nature was driven by the statement of Arahata Mahinda which states that king is only the guide and protector of nature and not the owner, keeping a Kurulupaluwa (portion of paddy field kept for birds) would have been a direct outcome of this concept. Now this culture with the physical structures like Wewa kept this ecosystem functioning for thousands of years. Actually this culture – ecosystem had in built to it the development model suitable for us. i.e. for our environment & culture. Today we are almost totally blind to this tradition. Today we do not have an idea about our development model and therefore we cannot rehabilitate these ecosystems in a sustainable manner. Anyhow it should be mentioned here that today we cannot get back to the same system but then we should get the spirit of this tradition in planning for today.



Figure 3- Village tank (Wewa) at Puleliya in Anuradhapura district

2. Deterioration of the ecosystems

Even with the invasions occurred in time to time and changing of the kingdom from place to place, most of the ecosystems specially those based on small village tanks, functioned throughout the history. But after the elimination of the Rajakariya in 1829 by British, remarkably the system started deteriorating. This was mainly due to the cessation of structural maintenance. Then with the introduction of market economy to these systems, increasing of needs, introduction of the results (by force!) of green revolution in 1960's to achieve these goals and finally the introduction of free market open economy in 1977, the situation became worse.

2.1 The main reasons for the deterioration of ecosystems

2.1.1 Faults in the hydraulic structures

This is due to lack of maintenance. This includes the siltation of tanks, breakages of dams, spill ways and canals, elimination of ancient water distribution methods such as "Karahana"- a device made by cutting slots with different lengths in a wood log to divide the water flowing in a canal to several canals proportionate to these lengths, degradation of catchment areas, non systematic upland cultivation, cessation of the development process of the ecosystem along the foot steps of the tradition according to the population growth (Schematic diagram of "Karahana" is shown in figure 4 and picture of "Karahana" is shown in figure 5). A study carried out in 1990 showed that three small tanks; Paindikulama, Siwalagala, and Marikaramaga in the Nachchaduwa major watershed have been silted up by 35, 30 and 23 percent respectively of their initial capacity (Dharmasena, 1992). Siltation of tanks not only causes reduction of storage capacity but also leads to alter the tank bed geometry. Subsequent rehabilitation works, where the capacity has been improved by raising the spill and the tank bund would create a shallow water body spreading over a larger surface area.

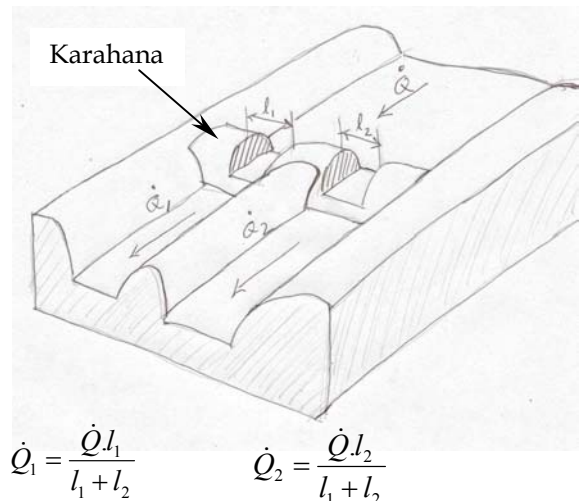


Figure 4- Schematic diagram showing the function of Karahana

This makes the situation more complicated creating several other problems. They are: a) inundation of upstream paddy lands; b) development of salinity conditions in the upper area; c) increase of tank water losses; d) disappearance of the tree strips in the high flood region (Gasgommana) and the grass cover ((Perahana) underneath; and e) disappearance of some indigenous fish species,

which cannot survive in shallow water or do not find a favourable breeding environment.



Figure 5 - Karahana

2.1.2 Poor agro ecological conditions

This is mainly due to poor soil condition and reduction of rainfall, which occurs time to time for eg. in the Maha 2003/04 season there was a reduction in rainfall by 77.5%, 37.0% & 63.3% in Kurunegala, Anuradhapura & Puttalam district respectively [2] any way when long term rainfall data are examined (figure 6) it is clear that these type of droughts are frequent events. Although these draughts are frequent events throughout the history Wewa based ecosystems cannot bare up these as in the history due to their deteriorated physical conditions prevailing at present as stated in 2.1.1

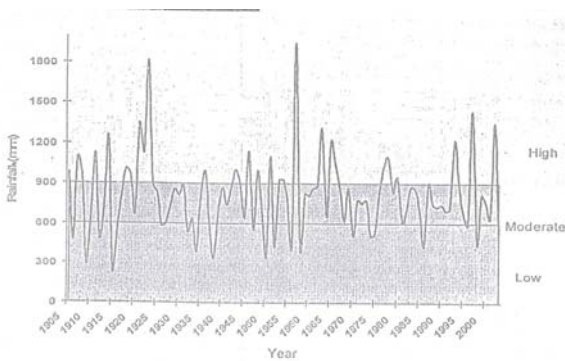


Figure 6 - September - December Rainfall (Mahailuppallama) [2]

2.1.3 Deterioration of cultural values

This includes the disappearance of group concepts, simple, charm life style based on our culture, (described by Wewa, Dagaba, Gama & Pansala) the methods such as "Rajakariya" "Athtama" bethma method of cultivation etc. arose from this culture, and the holistic view upon water (nature), which ultimately prevent water (nature) pollution.

2.1.4 Introduction of free market economy

Free market does not exists in the world. Free market could only be exists among Arahants (Arahant is a 'person' who has got rid of 'thanha' (greed), totally - fully enlighten person). The prevailing market is a one, which is driven by the greed of the people, and govern by a few powerful people in the system. By introducing this market economy, this ecosystem was disturbed by triggering the greediness of people by the illusions of the "free market". Then the almost self-sufficient non-dependent ecosystem was converted to a market dependent society. This non dependency was severely disrupted by the introduction of the results of the green revolution such as weedicide, pesticides, new varieties, mechanization etc. for farmer has to purchase all these from the market which is totally out of control of the farmer in the present economical context. Then the main objective of this society was to earn money not the sustaining of the ecosystem. The sustainability of the system was committed in the process of earning money. Due to relatively high demand in the market paddy, which needs a very high amount of water mainly as a weedicide (about 20 tons of water is required to produce one kg of rice - Wejewardena 2002) was grown 'wherever possible' without considering the sustainability of the ecosystem. This led to severe shortage of water in some ecosystems. This resulted a degraded ecosystem and a socio economically unsatisfied farmer. Sustainability could be achieved by relying on the ecosystem but not by relying on a "free market".

3. Understanding the problem

According to present conditions due to faults in the hydraulic structures and lack of maintenance the effectiveness of irrigation is only 37% and this could be increased up to 45% without much difficulty [2].

According to the studies, if the faults in the structures are corrected to achieve an irrigation effectiveness of 45%, with the prevailing rainfall condition, these ecosystems (table. 1) physically can provide the required food for the nation even up to 2025[1]. But then this to be a success the cultural values and socio economic situation of these systems (settlements) also should be rehabilitated. Today cultural and socio economic condition of the farmers in these ecosystems are pathetic. The prevailing free market economy (actually not free market, but

driven by few “Mudalalies”!) has kept the farmer away from the main stream of the economy. Now farmer is unable to earn money from the market by selling his produce, required to buy his needs from the market (Condition has become worse since the close down of paddy marketing board) according to current prices 2 kg of paddy is needed to purchase a loaf of bread and a piece of soap (Sunday Divaina 18th September 2005). Therefore now this is the most vital basic problem in these ecosystems. Though the ecosystem is able to supply the food requirement physically, the market economy has distorted the picture and when the transactions of these ecosystems are converted to market values (rupees & cents) in the context of income and expenditure the ecosystems become unprofitable or marginally profitable and this marginal profit cannot satisfy the needs of the farmer! In otherworlds the ecosystem, which provides the food self-sufficiency for the nation, are economically unviable. A typical former, who owns a paddy field of one hectare gets a profit of Rs.23,925/ which is for a period of six months until the next harvesting season (Adhikarinayake 2005). Therefore his monthly income is less than Rs.4,000/- . Now if we assume a four member family, according to prevailing market prices of household commodities, this income is not sufficient. Also it should be mentioned here hat 60% of the dry zone village farmers have a land extent between 0.25% to one hectare. In intermediate zone 90% farmers have land extent less that 0.25 and in wet zone 55% have land extent less than 0.25 hectares [1]. This shows the pathetic economical situation of farmers in the current economical context. Now the market prices which determines the farmers expenditure (for land preparation, planting, cultural practices, harvesting etc.) income and his household expenditure are not fixed by ‘god’ these are not like mass of body which cannot be change in Newton mechanics. Therefore it is time to seek the possibility of altering the economical mechanism which govern these prices by considering the total economy of the country instead of the prevailing “Mudhalali” perspective.

Up to now almost all the solutions given to this problem has aimed at reducing the cost of production, increasing the yield etc. and because all these lies within this economical context almost all these solutions have given rise to a vicious cycle leading to more deterioration of the ecosystem. Therefore now it

is time to rethink and find ways and methods to protect the farmer, actually the ecosystem from the so-called free market without continuously trying to degrade the ecosystem to suit the market. This economical system and concepts should be altered in such a way that this ecosystem which provide the food self-sufficiency for the nation and protects the environmental conditions of the country, will get its due share from the prevailing economy. A major part of the solution lies in this protection rather than on physical, chemical, engineering and agronomical sciences; and developing the above said cultural values among farmers and their attitudes towards the nature, life etc. and most importantly a development model based on our culture should be introduced instead of going behind this greed driven western development model.

Table 1 - Rice production scenario [2]

	1990	Projecti on 2025	Proposed scenario for 2025
Population (million)	17.2	24.9	24.9
Rice production (mil.mt)	2.2	3.5	3.5
Rice Yield (t/ha)	3.8	3.8	5
Extent of irrigation farming (mil.ha)	0.58	0.93	0.69
Irrigation water requirement (m ha.m)	0.86	1.38	0.86
Irrigation effectiveness	37%	37%	45%
Cropping intensity	1.3	1.3	1.6

4. Concluding remarks

As a result of the above study and analysis it is clear that the major part of the problem of the small tank based ecosystems lies out side the physical aspects of the system. The “free market” economy, which penetrated the ecosystem without a proper control of the state triggering the greed of the people, degraded the ecosystem physically as well as culturally. This degradation of physical and cultural aspects intern deteriorated the ecosystem putting the system to a vicious cycle. Almost all the

solutions given in this economical context to solve this problem were also ultimately trapped in this vicious cycle. Therefore, now it is time to think about the other aspects of this problem and to address those also i.e. by protecting these ecosystems from the free market, cultivating the above mentioned cultural values, introducing a development model to these ecosystems which is based on the ancient tradition and our culture, described by Wewa, Dagaba, Gama & Pansala.

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