WATER CRISIS IN NORTH CENTRAL PROVINCE OF SRI LANKA-PAST, PRESENT AND FUTURE PREDICTIONS

C. S. De Silva*

Department of Agricultural and Plantation Engineering, The Open university of Sri Lanka

INTRODUCTION

North central province (NCP) comprising two districts called Pollonnaruwa and Anuradhapura is the largest province in Sri Lanka. It falls under the Low Country Dry Zone of Sri Lanka, covering 16% of total country's land area (7,128km2). NCP is well known as the bread basket of the country as it produces the largest portion of rice. A majority of the farmers in the NCP has been engaged in intensive paddy cultivation since ancient time. According to history the Aryan civilization that emerged in Sri Lanka with migration from Bengal, East India in 543 BC took root in the Dry zone, the rolling plains of North and North Central (Rajarata) and the South Eastern (Ruhunu) of ancient Sri Lanka. Even though the land was excellent for agriculture, the difficulty in diverting enough water for cultivations was the main problem. A majority of the rural population in the NCP depends on agriculture as their main source of income. Rice appears to be the most popular crop among the farmers. Other crops cultivated include maize (*Zea maize*), finger millet (*Eleusine coracana*), soybean (*Glycine max*), brinjal (*Solanum melongena*), hot pepper (*Capsicum frutescens*), banana *(Musa spp*.), okra (*Hibiscus esculentis*), pumpkin (*Cucurbita maxima*), etc. which are usually considered to be drought tolerant species.

Rice, being the staple food and cultivated under flooded conditions, requires an abundant supply of water. Farmers cultivate paddy during both *maha* and *yala* seasons, and very often rainfall satisfy only a fraction of the water requirements for a double-cropped rice harvest and the rice fields of these areas are therefore heavily dependent on supplementary irrigation from tanks and reservoirs. Without artificial storage of water, human existence in the NCP is impossible. The NCP, although apparently flat, is in reality undulating, and the ancient kings took advantage of the nature of the terrain to make strings of tanks in the valleys called the small tank cascade system numbered about 30000. Today Sri Lanka has about 10,000 village tanks irrigating the paddy cultivation. These magnificent irrigation schemes of tank cascade systems were developed as the population was dependent on an agriculture-based economy.

The dry zone in Sri Lanka faces a wide range of environmental management challenges that are tied to its economic development. Among these are the interlinked problems of land and water degradation. Over the past two decades, dozens of studies have been conducted on the large number of kidney patients in Sri Lanka's agro-rich NCP (Nanayakkara, et al, 2012). As many as 400,000 people in the NCP may be suffering from kidney disease and as many as 22,000 people may have died as a result. The affected area covers approximately 17,000 square km, with a population of about 2.5 million, in which more than 95 percent live in rural areas (Bandara *et, al* , 2011). Farm animals including cattle have also been affected with strange disorders including poor vision and frequent abortions. Damage of crops from elephants, mismanagement of the water distribution and finding a reasonable market for their farm products appear to be some crucial problems that farmers faced in the past even at present. Having considered the complex situation in the NCP it will be extremely important to transform the present status of farming to an environmentally sound sustainable system – i.e.ecological agriculture. Water is the major factor for sustainable farming. But climate change also has impacts on the availability of water for NCP. Therefore, this study is designed to analyze the past, present and future predictions on the rainfall pattern and design suitable adaptation measures to ensure sustainable paddy and cash crop cultivation, in

* *Corresponding author: Email -* ***csdes@ou.ac.lk***

addition to providing safe and clean drinking water for the population to avoid serious health problems.

METHODOLOGY

For the past and present situation rainfall data from Meteorological Department, Colombo for the period from 1951 to 2010 was obtained.The climate change predictions for 2050s in Sri Lanka have been studied using climate change projections of HadCM3- a General Circulation Model of Hadley Centre for Climate Prediction and Research, UK. These predictions were then applied to the IPCC-Emission Scenario A2 (Worst case) (De Silva *et al*, 2007). Two districts, namely Anuradhapura and Polonnaruwa in the NCP were used in this study. Results of HadCM3 for 2050s - A2 scenario were compared with baseline data of 1961 to1990 as the World Meteorological Department (WHO) recommended.

RESULTS AND DISCUSSION

Rainfall analysis of past to present decade

The meteorological department data for Polonnaruwa from 1951 to 2010 showed that the rainfall during the *Maha* season (second inter-monsoon and northeast monsoon) had decreased by 230 mm over a period of 55 years at the rate of 4 mm/year (Figure 1). Even though this value is not significant the volume of water reduction over 55 years is to be taken in to consideration. The population has increased over the period and the demand for water also has increased. Similarly the rainfall during yala season (first inter monsoon and southwest monsoon) also has been decreased according to the Meteorological department data (Figure 2). There was a decrease of 150 mm of rainfall over a period of 55 years.

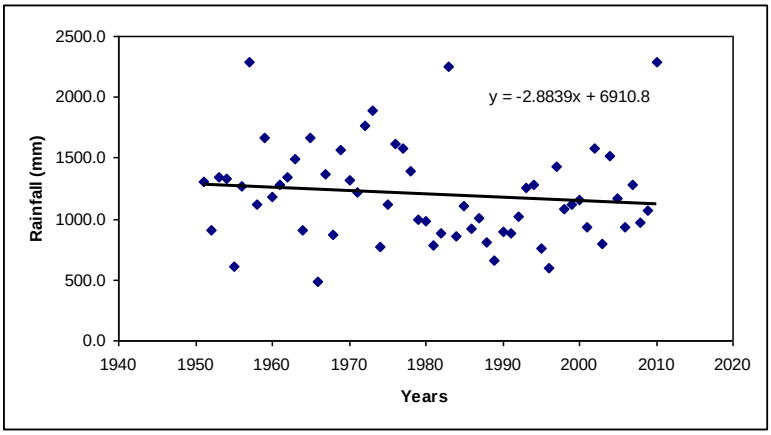

Figure 1. Rainfall variation during the *Maha* season in Polonnaruwa 1951 to 2010

Similarly, in Anuradhapura according to the meteorological department data the rainfall decreased during *Maha* and *yala* seasons approximately at the rate of 2mm/year. Even though this value is not significant statistically and not noticeable, the reduction in the volume of water in the area of the NCP (2 mm x 7,128km^2) has a significant effect on agricultural activities over the past and recent decades. It was reported that in July and September 2012 (Bandara, 2012), drought conditions continued with the lowest rainfall received in May and June, which has devastating effects on agriculture and hydropower generation. The low rainfall has resulted in a drastic drop in water levels in hydro catchments and reservoirs, with severe disruption to hydropower generation, domestic water supply and agriculture. Anuradhapura and Polonnaruwa districts were the worst affected by the drought.

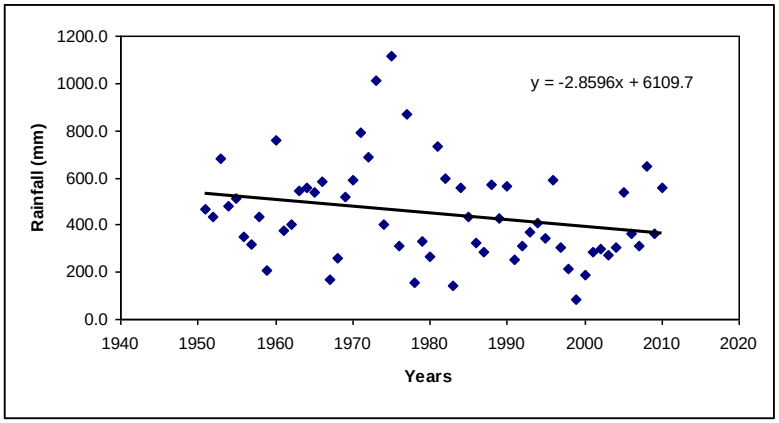

Figure 2. Rainfall variation during the *Yala* season in Polonnaruwa 1951 to 2010

Predictions for Rainfall in 2050

According to the rainfall predicted by HadCM3 for Polonnarruwa there is a drastic decrease in rainfall during the months of January, February and March and slight decrease in April, September and December compared to the base line (1961-1990). A drastic decrease in the northeast monsoon rains in January and February is foreseen and it is predicted to decrease by 37% in 2050 compared to the baseline (Figure 3). This decrease will affect the *Maha* season rains badly on which farmers are heavily depend for their paddy cultivation. Accordingly, the *Maha* season rains (October – February) are predicted to decrease by 12% in 2050 compared to the baseline. Further, the first inter-monsoon (March- April) is predicted to decrease by 84% in 2050 compared to the baseline (1961-1990). This decrease will definitely affect the rains in the *yala* season too. According to the HadCM3 prediction there will be a 10% decrease compared to the baseline during *yala* season (March –September) rainfall in 2050.

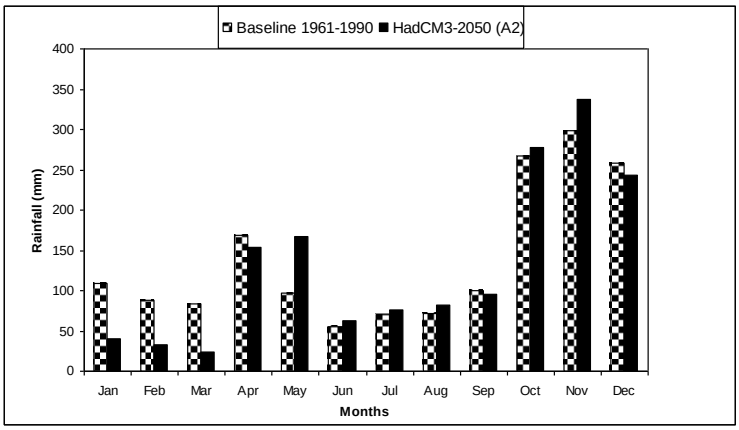

Figure 3. HadCM3 predicted rainfall for 2050 and the basinline (1961-1990) in Polonnaruwa

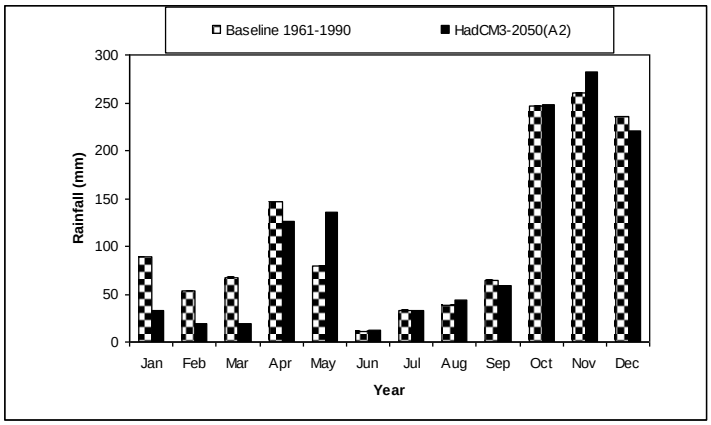

Figure 4. HadCM3 predicted rainfall for 2050 and the baseline (1961-1990) in Anuradhapura

According to the HadCM3 prediction, in Anuradhapura too there will be a drastic decrease in rainfall during January, February and March (Figure 4). There will be a slight decrease in rainfall during April, September and December too. Therefore there will be a 3% and 8% decrease in *yala* and *maha* seasons respectively. Further paddy irrigation requirement is predicted to increase by 18% in 2050 (de Silva *et al*, 2007). Therefore, additional irrigation water is needed for sustainable paddy cultivation.

CONCLUSIONS AND RECOMMENDATIONS

The past , present and future predictions on rainfall indicate that there will be drastic reductions in rain fall during *Maha* and *Yala* seasons and therefore additional irrigation water must be developed for sustainable paddy and other cash crop cultivation in NCP. Reductions in rainfall will pose severe threats to safe and clean water for drinking purposes; therefore treated water supply is mandatory for domestic purposes. Government development programmes should be focused on developing water resources in NCP with special reference to climate change impacts.

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