The Role of Irrigation System on Ground Water: A Special Study in Selected Areas of Porativupattu, Batticaloa

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Abstract

The demand for water has gradually increased more than past century because of the trends of global population. Intense agricultural activities, industrial activities and domestic uses are caused to the over consumption of groundwater. Irrigation system is one of the major part for contributing the ground water quantity. The main purpose of the study is finding the relationship between irrigation and groundwater. Through this, the changes of water level, influence of irrigation were examined with appropriate data. Irrigation data from the Irrigation Department have used to analyze the groundwater quantity through the correlation analysis. Images were utilized for this study, published reports and statistical records were employed to collect as secondary data. SPSS, GIS software were used for data analysis. As the result, there are five positive impacts and two negative impacts in the selected areas of Porativupattu. The reason for these two negative impacts is these both places located near to the lagoons area. Hence, these both places were not highly influenced by the irrigation. The recommendations of the study are to educate to change consumption and lifestyles, to recycle wastewater, to improve irrigation and agricultural practices, to control the over chemical usages, to develop the traditional agricultural practices, to make the proper irrigation system, to improve mangrove replantation and conservation, to develop the drainage and water supply, legislations and awareness programs. Therefore, the irrigation system is the most important to keep the ground water level in the study area.

Keywords: *Domestic, Irrigation, Water quantity, Agricultural practices, Chemical usages.*

Introduction

Groundwater defined as the water beneath the earth's surface, often between the saturated soil and rock that supplies wells and springs. Many factors are determined the ground water level and nature as topographic, geology, climate conditions, natural vegetation and an important feature is rock.

The demand of water has gradually increased more than past century because of the trends of the global population. Intense agricultural activities, industrial activities and domestic uses are caused to the over consumption of groundwater. When there is not enough potable water for a given population the threat of water problem is realized (Panabokke, 2007).

Irrigation is the artificial application of water to the land or soil. There are many irrigation systems in Sri Lanka. Two major irrigation networks have

found in the study area. They are Navagiri and Thumpenkerny. Besides, 10 small tanks and more than 100 small pools are found here. Even though it is unavoidable, there is dearth of drinking water in more than 15 G.N Divisions during the drought period and condition sour and saline. Moreover, this area has a large extant of land Resources hut people are unfortunate to do even the home gardening (Divisional Secretariat, 2014).

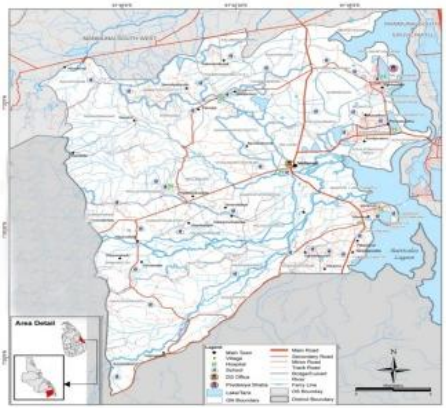
However, the study areas' physical features and climate conditions are indicating the dry zone characteristics. While water protection and conservation differ from country to country, in these area is taken the most suitable.

Study Area

The District of Batticaloa itself consists of several administrative divisions, of these; Porativupattu Divisional Secretariat division has been located in Southwest part of Batticaloa district. It has an extent of 180 sq. m. It consists of 43 Grama Niladhari divisions and 136 villages. Its population is 47,180 and consists of 12,883 families. 22,902 males and 24,278 female live it (Divisional Secretariat Porativupattu, 2014).

OBJECTIVES

- ✓ To identify the water level changes by the domestic wells in Porativupattu
- ✓



(*Source: Retrieved on GIS, 2015*)

- ✓ To find the relationship between irrigation and ground water in Porativupattu
- ✓ To suggest the solution for the ground water sustainability in the study area

Methods And Materials

Primary Data

The sampling of 70 households has been randomly selected for the study form 7 GN Divisions as well as questionnaire survey has been done for 70 households. These 140 households' data were used for the study.

Further, the water level for June, August, October, December in 2014 and February and April 2015 have been measured in order to identify the changes of ground water quantity, of these, the water level measured in the end of these months. Monthly and annual rainfall changes and the trends of evapotranspiration were calculated on the research that depending on rainfall.

Different equipment has been used to measure the water level of each well.

They are measuring tape, bell, rope and cone shape tool by aluminum. Hereby, well depth, well water level, sea level elevation and the changes of season-to-season have been observed.

Secondary Data

Rainfall and temperature data from Department of Meteorology, census report of Sri Lanka, Reports and Documents from Porativupattu Divisional Secretariat, published researches, maps and collections from the web were secondary data of the survey.

Data Analysis

The tool for water level measurement were used to measure the water level of selected wells and observed the seasonal changes, that used the formula :

$$W = (B+G)-L$$

W – Water level from sea level

L – Water level from well top

B – Well height from surface

G – Elevation of particular area.

The groundwater levels of June 2014 were filed in the end of month and depth of wells, water level and sea level elevation were considered on the measurement as well as August, October, December 2014 and February, April 2015 water level were measured. The average consumption of drinking water was calculated from 70 users.

Correlation analysis was also used to analyze the water level a statistical analysis method that statistically measures the extent and the nature of the relationship between two variables. The positive and significant correlation value is below 0.05. Correlation is concerned with describing the strength of the relationship between two variables by measuring the degree of "scatter" of the data values. In this study, the correlation co-efficient analysis is under taken to find out the relationship between the irrigation water and ground water level in selected areas. MS Excel, SPSS, GIS software were used for the study.

Result and Recommendation

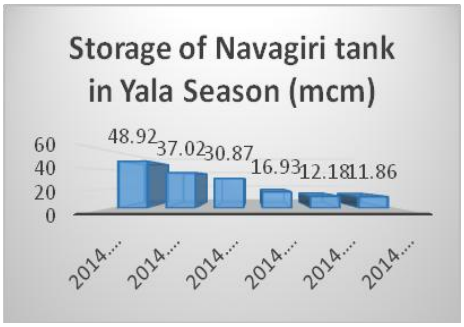
Problems of providing the water from Irrigation tank

Navagiri and Thumpakeny tanks take a huge participation of providing the water for irrigation in the study area. These are of the major irrigation systems in Sri Lanka. The main problem of this tank contains that has not enough the capacity to store much water into them. According to the irrigation officials of Navagiri division, much water went runoff without store or any uses. Because, this has very less capacity in it and if they reconstruct the dam height, this will help to store much water into them.

According to the irrigation engineer of the Navagiri division, if they plan to up the height of the dam, this may cause to the disaster for instance, flooding will often occur in rainy season of every

year. This will affect the people who live around the tank as well as the agriculture activities especially, paddy cultivation. In addition, there are few proper channels to be with them. They could not make more channel to provide the water. The reason for this is the landscape not favorable to make more. Nevertheless, the Porativupattu Divisional Secretariat area is getting the advantage by the landscape to bring the water. They provide the water for the agriculture around 4 -5 ft. per day to the Porativupattu Divisional Secretariat. This is differed in every season. Although, this is not enough for the cultivation and so the people reduce the agriculture activities during the dry season.

Figure 1. Storage of Navagiri tank in Yala season 2014



(Source: Irrigation Department Kalwanchikudy, 2015)

The figure 1 shows the changes of storage in Yala season from April to September, 2014. According to this, the high level of storage had in April and the low level of storage had in September. The water storage level was gradually decreased from April to September, 2014. The major changes occurred in July, August, and September. The reason for this was get the less rainfall from the Northwest monsoon (October to February). While we compare these changes, 37mcm storage of water was reduced in September from April. This is the huge change in this year.

Correlation analysis between Irrigation water and ground water level of selected areas

The significant value is below 0.05 that gives a strong and positive relationship between two variables. The correlation analysis has been done with irrigation water discharge and ground water level for seven GN Divisions.

The table 1 shows the relationship between Irrigation water discharge and Thikkodai water level. From the table it can be observed that there is a Strong positive relationship between Irrigation system and water level. The correlation value is 0.861 and which is significant at the level of 5% because the p value (0.028) is less than the significant level of 0.05.

Table 1. Irrigation and Thikkodai water level

		Irrigation	Thikkodai
Irrigation	Pearson Correlation	1	.861*
	Sig. (2-tailed)		.028
	N	6	6
Thikkodai	Pearson Correlation	.861*	1
	Sig. (2-tailed)	.028	
	N	6	6

*. Correlation is significant at the 0.05 level (2-tailed).

The table 2 shows the relationship between Irrigation water discharge and

Thumpankeny water level. From the table it can be observed that there is a Strong positive relationship between the Irrigation system and water level. The correlation value is 0.852 and which is significant at the level of 5% because the p value (0.031) is less than the significant level of 0.05.

Table 2. Irrigation and Thumpankeny water level

		Irrigation	Thumpankeny
Irrigation	Pearson Correlation	1	.852*
	Sig. (2-tailed)		.031
	N	6	6
Thumpankeny	Pearson Correlation	.852*	1
	Sig. (2-tailed)	.031	
	N	6	6

*. Correlation is significant at the 0.05 level (2-tailed).

The table 3 shows the relationship between Irrigation water discharge and Vellavely water level. From the table it can be observed that there is a Strong negative relationship between irrigation system and water level. The correlation value is 0.871 and which is significant at the level of 5% because the p value (0.024) is less than the significant level of 0.05.

Table 3. Irrigation and Vellavely water level

		Irrigation	Vellavely
Irrigation	Pearson Correlation	1	.871*
	Sig. (2-tailed)		.024
	N	6	6
Vellavely	Pearson Correlation	.871*	1
	Sig. (2-tailed)	.024	
	N	6	6

Table 3. Irrigation and Vellavely water level

		Irrigation	Vellavely
Irrigation	Pearson Correlation	1	.871*
	Sig. (2-tailed)		.024
	N	6	6
Vellavely	Pearson Correlation	.871*	1
	Sig. (2-tailed)	.024	
	N	6	6

*. Correlation is significant at the 0.05 level (2-tailed).

The below table 4 shows the relationship between Irrigation water discharge and Mandur water level. From the table it can be observed that there is a Strong positive relationship between Irrigation system and water level. The correlation value is 0.817 and which is significant at the level of 5% because the p value (0.047) is less than the significant level of 0.05.

Table 4. Irrigation and Mandur water level

		Irrigation	Mandur
Irrigation	Pearson Correlation	1	.817*
	Sig. (2-tailed)		.047
	N	6	6
Mandur	Pearson Correlation	.817*	1
	Sig. (2-tailed)	.047	
	N	6	6

*. Correlation is significant at the 0.05 level (2-tailed).

At 95% confident level, the table 5 illustrates that there is positive correlation between Irrigation system and water level, according to the correlation value of 0.779. The p value

(0.068) is greater than the significant so there is an insignificant relationship between Irrigation system and water level.

Table 5. Irrigation and Palugamam water level

		Irrigation	Palugamam
Irrigation	Pearson Correlation	1	.779
	Sig. (2-tailed)		.068
	N	6	6
Palugamam	Pearson Correlation	.779	1
	Sig. (2-tailed)	.068	
	N	6	6

The table 6 illustrates that there is positive correlation between Irrigation system and water level, according to the correlation value of 0.767. The p value (0.075) is greater than the significant so there is an insignificant relationship between Irrigation system and water level.

Table 6. Irrigation and Periyaporativu water level

		Irrigation	Periyaporativu
Irrigation	Pearson Correlation	1	.767
	Sig. (2-tailed)		.075
	N	6	6
Periyaporativu	Pearson Correlation	.767	1
	Sig. (2-tailed)	.075	
	N	6	6

The table 7 shows the relationship between Irrigation water discharge and Kovilporativu water level. From the table it can be observed that there is a Strong negative relationship between irrigation system and water level. The correlation value is 0.812 and which is significant at the level of 5% because the p value (0.049) is less than the significant level of 0.05.

Table 7. Irrigation and Kovilporativu water level

		Irrigation	Kovilporativu
Irrigation	Pearson Correlation	1	.812*
	Sig. (2-tailed)		.049
	N	6	6
Kovilporativu	Pearson Correlation	.812*	1
	Sig. (2-tailed)	.049	
	N	6	6

*. Correlation is significant at the 0.05 level (2-tailed).

According to, the correlation for Irrigation water helps to test the water level here the significant P value is less than the 0.05 significant levels therefore the alternative or null process can be accepted.

There are five strong positive relationship and two negative relationship between irrigation water discharge and ground water level. According to the analysis, we can understand the causes for the negative correlation of these two areas. These two places are located near to the lagoon therefore they have always been the water into their wells. However, the solution needed to the wells of five areas during the dry seasons for the water shortage.

In order to solve the problems, the following recommendations are suggested from the research. Through this, we can minimize the water and irrigation problems. The ways to eliminate the water shortages are;

- To educate to change the consumption and lifestyles
- To recycle wastewater
- To recharge of the ground water from rainfall
- To develop efficient desalination vegetation
- To control the over chemical usages
- To develop the traditional agricultural practices
- To make the proper irrigation system
- To improve the better sanitation facilities
- To improve mangrove replantation and conservation
- To develop the drainage and water supply
- Legislations and Awareness programs

Conclusion

Ground water is the most precious resource for human beings all over the world. The water level fluctuates in every areas of Sri Lanka. This is depending on the bedrock and soil. The irrigation and the ground water are interrelated with each other in the study area. This was elaborately explained on the study.

The relationship between the irrigation system and the ground water had been thoroughly described. There are five positive impacts and two negative impacts in the selected areas of Porativupattu. The reason for these two negative impacts is these both places located near to the lagoons area. Hence, these places were not highly influenced by the irrigation. But the water shortage occurs occasionally during the dry season because of the rainfall variation. The people who live in these areas are suffering from the insufficient water problem during this short period of the year. Therefore, they have seek an alternate solution to solve this problem. The solutions were given above to reduce this problem in the future.

As the result, we can understand the impact of the irrigation system on ground water level fluctuation. In other times, they cannot get the sufficient water for their needs without irrigation water. Thus, the irrigation system is the most important to keep the ground water level in the study area.

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