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Research Paper

Distribution and Data Compilation of Irrigation Tanks to Facilitate their Management Using GIS

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Abstract: *The objectives of this study were to create the conversion equation to convert 1inch: 1mile reference of irrigation tanks to National Coordinate system and create a database using Arc GIS 9.3 software through documentation and to recognize the distribution pattern of irrigation tanks in Vavuniya district, Sri Lanka. Secondary data of 611 tanks of tank command area, catchment area, capacity, bund length, number of sluice, number of farm families and the coordinates of the location of tanks were used. Mapping the irrigation tanks was performed using the converted coordinate system with the help of a created mathematical equation in Arc GIS 9.3. The average tank density of Vavuniya district was one tank per 2.68 km^2. This study initiated the maintenance of a database for the irrigation tanks in Vavuniya district. The distribution pattern indicated the importance of the irrigation tanks in this district. Documentation and mapping would be helpful for planning to provide effective and efficient management. The outcome of this research would be useful especially to the irrigation department and the Department of Agrarian Development. Further, measures should be taken to manage these tanks as they are the only surface water resource of this district.*

Keywords: Arc GIS 9.3, Documentation, Irrigation tanks, Mapping, Tank density.

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1. Introduction

Sri Lanka is richly endowed with fresh water resources, with an estimated three ha of water for every square kilometer of the island (Murray and Little, 2000). Among the freshwater ecosystem irrigation tanks play a vital role serving to store and regulate the flow of water for agricultural use (Anuradha and Ambujam, 2012). Irrigated agriculture has expanded enormously over the past few decades- resulting from the revolution in irrigation development- which has increased from less than 100 million ha in 1950 to more than 275 million ha in 2000 (Hussain and Bhattaria, 2001).

In Sri Lanka, there are 24,199 minor tanks; under this 11257 village tanks and 12942 anicuts, while major tanks are nearly 542; under that 322 reservoir, 112 anicut, 96 drainage, flood protection and salt water exclusion, and 12 are lift irrigation schemes. Total command area under these tanks is 685,625 ha and represents nearly 42% of total land area of Sri Lanka (National Environmental Action Plan, 1988-2001). Being an agricultural country, 32% of the total population employed in the agriculture sector. Furthermore, these were the focal point of the social, economic, cultural, and religious lives of our people (Somasiri, 1991). So it's important to protect this ecologically valuable resource in order to get optimal benefit without exploiting this resource.

In Vavuniya, there are one major, 21 medium tanks and 674 minor irrigation tanks including 26 anicuts. Minor irrigation tanks are those having an irrigated command area of 80 ha or less, as defined by the *Agrarian Services Act No. 58 of 1979* while medium tanks were 80-600 ha and major tanks those having an irrigated area more than 600 ha.

The water resources mainly depend on rainfall as there are no perennial rivers. Out of the 674 Minor Irrigation Schemes 41 abandoned tanks, 64 breached and nearly 208 tanks to be renovated (District statistical handbook of Vavuniya, 2013).

The objectives of this study were to create the conversion equation to convert 1inch: 1mile reference of irrigation tanks to National Coordinate system and create a database using Arc GIS 9.3 software through documentation, to facilitate to recognize the distribution pattern of irrigation tanks and thereby the tank density in Vavuniya district.

2. Materials and Methods

The study was carried out using the data of Vavuniya district which is located in the Northern part of Sri Lanka. It covers an area of about 1967.00 Sq km (District statistical handbook of Vavuniya, 2013). Secondary data of all medium and major tanks were collected from the Department of Central Irrigation and the Department of Provincial Irrigation while minor tank details were collected from the Department of Agrarian Development (DAD).

These data were gathered from the past records, documents and through interviews with the relevant officials. Secondary data of 611 tanks regarding tank command area, catchment area, capacity, bund length, number of sluice, number of farm families and the coordinates of the location of tanks were used in this study.

Available 1inch: 1mile reference of irrigation tanks was converted in to National Coordinate system by using developed mathematical equation and mapping the irrigation tanks was performed in Arc GIS 9.3 to show the tank distribution pattern and the respective tank database.
Tank density was found out using the following equation.

Tank density = Total land extent/Total number of tanks

3. Results and Discussion

All the available data of 611 tanks in Vavuniya district were documented and the database of each tank was created using GIS platform. The locations of both 1inch: 1mile reference of irrigation tanks and national coordinate system after conversion coincides the same location in the respective topo sheet. It ensured the accuracy of the converted mathematical equation. The converted coordinates of mathematical equation was given below.

X coordinates = (200000 - One inch grid reference (Grid E/W Coordinate) *20.1168) + Offset_X given in the table * 1609.344

Y coordinates = (200000 - One inch grid reference (Grid N/S Coordinate) *20.1168) + Offset_Y given in the table *1609.344

Table 1 show that the example of 1inch: 1mile reference of irrigation tanks and national coordinate system after conversion.

Table 1: Example of 1inch: 1mile reference of irrigation tanks and National Coordinate system after the conversion

Coordinates (1inch: 1mile reference)	X_Meters	Y_Meters
C/5(9.70x5.55)	187638.83	429139.2
C/10(0.80x5.60)	173315.67	415057.4
C/25(5.48x0.26)	208819.21	200418.43
C/9(6.90x5.00)	161245.59	414091.84
C/14(3.30x4.15)	155451.95	398561.67
C/20(1.30x0.61)	174120.34	378702.36
C/19(1.65x3.40)	152796.53	383192.43
C/13(7.80x1.20)	140806.92	393814.10
C/23(11.55x8.57)	146841.96	377350.51
C/18(11.30x4.40)	146439.62	384801.78
C/15(8.60x6.15)	185868.55	401780.36

611 irrigation tanks were mapped on the map of Vavuniya district using the following mathematical equation and shown in Figure 1.

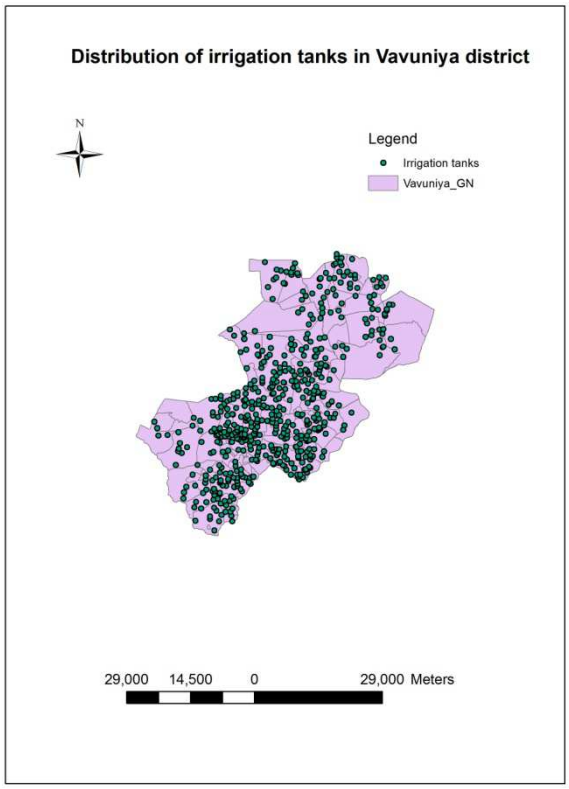

Figure 1: Distribution of irrigation tanks in Vavuniya district

High density of irrigation tanks in Vavuniya district was shown (Figure 1). The average tank density of this district was one tank per 2.68 km^2. Panabokke *et al.*, (2002) reported the average tank density for each Northern Province, North Central and Sabragamuwa Province was one tank per 2.6 km^2 whereas for North Western Province it was one tank per 1.2 km^2.

4. Conclusions

Distribution pattern was identified from the map developed using Arc GIS 9.3 software. The average tank density of Vavuniya district was one tank per 2.68 km^2. The produced equation was helpful to locate an available 1inch: 1mile reference of irrigation tanks into national coordinate system which is a readable format through GIS and other navigation software. Documentation and mapping using Arc GIS 9.3 would be helpful for planning to provide effective and efficient management. Further, this study initiated the maintenance of a database for the irrigation tanks in Vavuniya district. This methodology could be expanded for the data base management of irrigation tanks in other districts of this country.

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