REVIEW ARTICLE

RAINFALL MAP PREPARATION AND ESTIMATION OF IRRIGATION REQUIREMENTS USING Arc GIS

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ARTICLE INFO	ABSTRACT
	In this work, a rainfall map of the area under study was prepared and from the map thus prepared, irrigation requirements of a particular crop was analysed. Average rainfall intensity over the last 5 years was collected and linked with GIS to obtain the required map. As GIS can easily handle, store, analyze, manipulate and retrieve spatial data, map preparation can be easily implemented using GIS environment. The work was executed using ArcGIS 10.2

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1. INTRODUCTION

Geographic Information System is an organized collection of computer hardware, software, geographic data and personnel required to efficiently capture, store, manipulate, update, analyse and display all forms of geographically referenced data. ArcGIS is one of the platforms that facilitate spatial analysis using GIS. Preparation of a rainfall map is very useful taking into view that it gives the intensity of rainfall in a particular area and with this information supplemented by the water requirement for a particular crop, the irrigation requirement that needs to be done at a particular area can be obtained. These data can be used for preparation of irrigation maps for different crops showing irrigation requirements of different crops in different areas. In this work, India was taken as the study area and crop citrus was used for finding the irrigation requirement.

2. MATERIALS AND METHODS

The methodology of the work can be broadly divided into two phases. The first one is the preparation of rainfall map for the study area and the second part is analyzing the irrigation requirement for citrus at any part of the study area and map preparation of the irrigation water required.

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2.1 Preparation of Rainfall map

The first step in the methodology was collection of rainfall data of various points of India. District wise rainfall data was available for the past five years from the official website of the Indian Meteorological department. These data were collected for all districts and the average value was given as the rainfall value during map preparation. This was followed by digitizing the political map of India for shape file creation using ArcGIS. All the districts were digitized and the shape file was completed. All these steps were done using Universal Transverse Mercator projection system. Next the collected data were transferred to the ArcGIS environment as attribute data. Now by using different colour combinations, a rainfall map was prepared in which rainfall within a particular range was shown by a particular colour and so on. The final editing of the map was done and legends, scale etc were added to the map. The final map prepared is shown in Figure 2.1.

2.2 Calculation of Irrigation water Requirement

The next step was to analyse the irrigation requirement in any area for a particular crop. The crop we selected for study Citrus. It had a growing period of 365 days. The water requirement during the entire growing period for citrus was calculated.

Water requirement = Growing period * Water requirement of crop per unit time

Water requirement of crop per unit time was obtained by multiplying crop factor with reference crop evapo-transpiration per unit time. Crop factor for citrus is around 0.7. The reference crop evapo-transpiration values were obtained from the Figure 2.2.

Knowing the growing period of the crop and the water requirement per unit time, in different climatic zones, the water requirement for the same crop in different climatic zones were calculated. From the rainfall map prepared, the rainfall intensities at these climatic zones are known. The difference between the water requirement and rainfall intensities will give the irrigation water that needs to be supplied to that area per year.
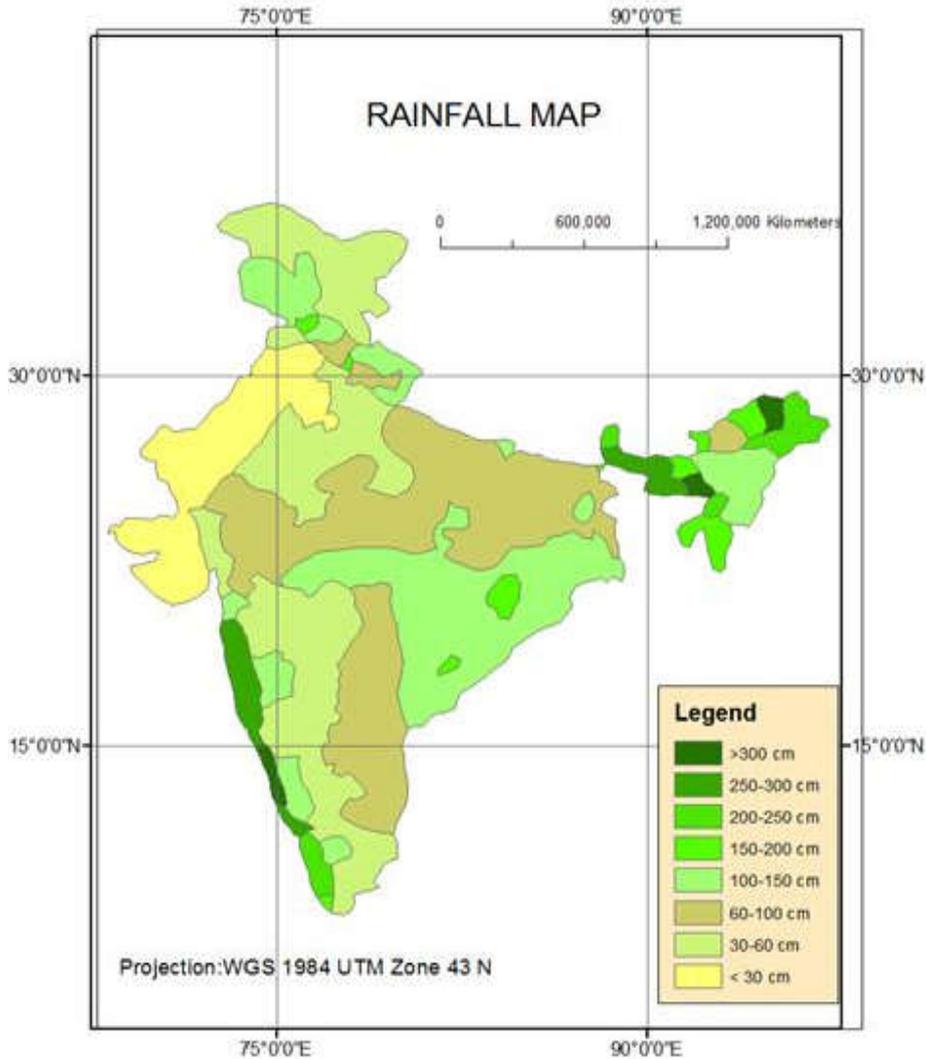

Fig 2.1. Final output map from Arc GIS

Climatic zone	Mean daily temperature		
	15°	15-25°C	25°
Desert/arid	4-6	7-8	9-10
Semi-arid	4-5	6-7	8-9
Sub-humid	3-4	5-6	7-8
Humid	1-2	3-4	5-6

Fig 2.2. Reference Evapo-transpiration values

Legend

-43.250000 - 250.000000

250.000001 - 500.000000

500.000001 - 750.000000

750.000001 - 1000.000000
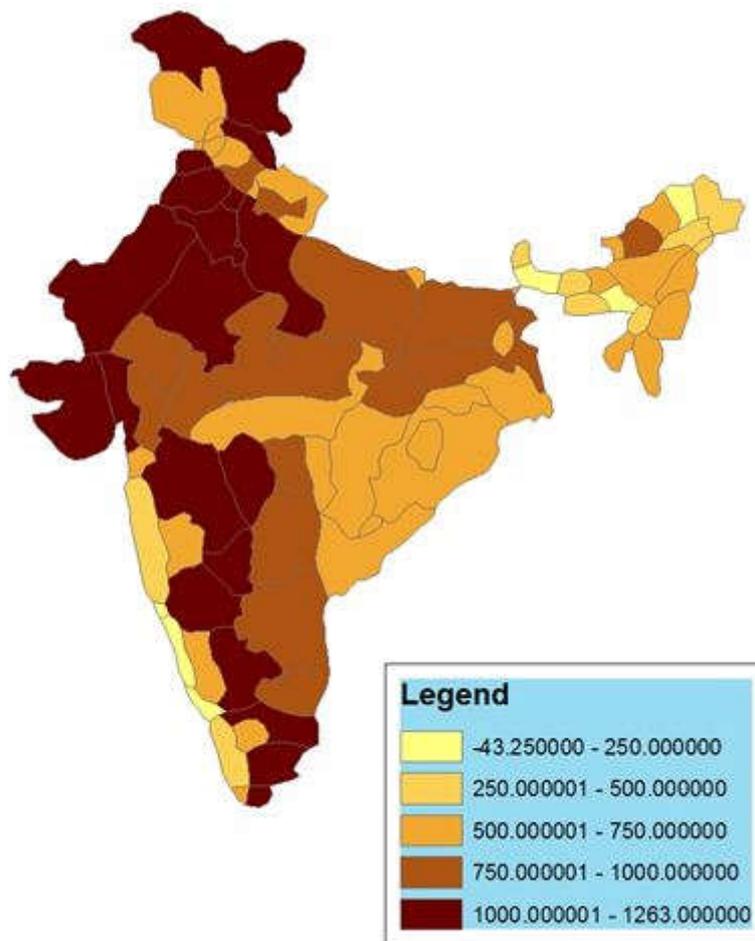
1000.000001 - 1263.000000

Fig 2.3. Irrigation water requirement for different climatic zones

These irrigation requirement values were mapped in GIS to prepare a map showing intensities of irrigation required at different parts of study area. The map showing irrigation water requirement for the cropcitrus in different parts of the study area is shown in Figure 2.3.

From the Irrigation requirement map, it can be seen that certain areas doesn't require much irrigation while some other areas require huge quantities of irrigation water. Thus mapping of irrigation water requirement across different parts of the study area helps in proper planning of the irrigation water distribution systems and other water supply schemes.

3. Conclusion

Arc GIS can be used as a powerful tool in mapping the spatial distribution of attribute data. Rainfall map preparation helps to identify the spatial variation of rainfall across different parts of the study area and to identify areas of high and low rainfall. This knowledge about rainfall intensities can be used in the design of storm water drainage systems, calculation of irrigation water requirements and design of irrigation water supply systems etc. GIS acts as a powerful tool in modeling these spatial variations into an easily interpretable form which can be put into use for other related purposes.

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