

Development of Geo-Visualized Information System for states of India based on rainfall using ArcGIS

Dr. Priya R. Swaminarayan
Professor & Head,
MCA, ISTAR, V. V. Nagar, Anand,
Gujarat, India
swaminarayan.priya@yahoo.com

Ms. Subodhini Gupta
Assistant Professor,
MCA, ISTAR, V. V. Nagar, Anand,
Gujarat, India
subodhinig@gmail.com

Abstract- In India, rain is as significant as God, as it is the source of livelihood and bread, especially for the farmers and agriculture is the main occupation of the common man in India. As per estimates released by the Central Statistics Office (CSO) the share of agricultural products/Agriculture and Allied Sectors in Gross Domestic Product (GDP) of the country is 13.7 per cent in 2012-13, Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socioeconomic fabric of India.

In This paper, we have developed Geo-Visualized Information System for states of India based on rainfall using ArcGIS. The system provides the facility for analyzing the rainfall information. In many of the states of India, there is the uneven distribution of rainfall and divergence between water obtainability and demand. The results of this implemented system help the Indian Government for taking a decision that in which states of India large storage reservoirs are required to redistribute the natural flow in accord with the requirements of specific regions, so it will help to improve the role of agriculture in GDP of India.

Keywords- Rainfall, ArcGIS, ArcMAP, Shape file, ESRI

I. INTRODUCTION

A GIS(Geographic Information System) is a computer-base system which stores geographically referenced data. Geographical reference data can also link with non-graphic attributes which permits manipulation, modeling and analysis. A GIS offers map display and map production [1]. Nowadays, Geographical Information System (GIS) becomes very popular and several organizations, researchers and Government use it for various purposes. GIS is computer software that links geographic information(where things are) with descriptive information (what things are) [2].

ArcGIS is the world's prominent platform for building Geographic Information System (GIS) through which user can put geographic knowledge to work in various domains such as academic, business, science, government, Agriculture and many more. It also supports reusability because it allows to publish geographic information, and it can be accessed by anyone from anywhere. The system can be used by anyone using web browsers, desktop computers and smart phones.

ArcGIS also supports implementation of the data model for file systems as well as DBMS [3]. ArcGIS is developed by ESRI and it is a PC window based program. As given in Wikipedia, about 70% of current GIS users make use of ESRI product (ArcGIS). ArcGIS Desktop 10 is the latest version. ArcGIS desktop consists of a set of integrated applications and following are the components of ArcGIS Desktop 10.2.1:

1. ArcMap: It allows you to create maps, set attribute tables, query attributes, analyze spatial relationships and layout final projects.
2. ArcCatalog: It manages spatial data available in your computer and other locations and it also allows you to

preview, search and add data to ArcMap. It also helps in managing metadata and setup address locator services.

3. ArcToolbox: This application is not directly accessible from the Start menu but it can be accessed and used within ArcMap and ArcCatalog. ArcToolbox contains tools for Geo-processing, coordinate systems, projections.

II. INTRODUCTION TO SHAPE FILE

A shapefile stores non-topological geometry and attribute information for the spatial features in a data set. The geometry of a feature is stored as a shape comprising a set of vector coordinates. Because shapefiles do not have the processing overhead of a topological data structure, they have advantages over other data sources such as faster drawing speed and edit ability. Shapefiles handle single features that overlap or that is noncontiguous. They also typically require less disk space and are easier to read and write. Shapefiles can support point, line, and area features. Area features are represented as a closed loop, double-digitized polygons. Attributes are held in a dBASE format file. Each attribute record has a one-to-one relationship with the associated shape record.

To create Shapefiles following four methods can be used [4].

1. Export - In this method Shapefiles can be created by exporting any data source to a Shapefile. For this purpose ARC/INFO, PC ARC/INFO, Spatial Database Engine (SDE), ArcView GIS software can be used.
2. Digitize - In this method Shapefiles can be created directly by Digitizing shapes using ArcView GIS feature creation tool.
3. Programming using Avenue - In this method Shapefile can be created within the program itself. For this purpose ArcView GIS, ARC/INFO, Simple Macro Language or PC ARC/INFO software can be used.

4. Writing directly to the Shapefile specifications by creating a Program - Some software like SDE, ARC/INFO, PC ARC/INFO, Data Automation Kit, Arc-CAD allows shape-to-coverage data translation and ARC/INFO also provide a coverage-to-shape translation.

III. IMPACT OF RAINFALL IN INDIA

The non-irrigated areas of the country are largely impacted by the amount of rainfall in a region. Agriculture is demographically the broadest economic sector and plays a significant role in the overall socioeconomic fabric of India.

India has very inconsistent climate and the amount of rainfall during the Monsoon season is highly variable ranging from 160-1800 mm per year. In India rainfall has a great impact on Meteorological, Agricultural, Hydrological and Socioeconomic sectors. Agricultural sector of India is extremely dependent on the timely availability of sufficient amount of water.

Rainfall has a major impact on the health of the Indian economy. Because India is Agriculture and Agro-based country, it's 60% population is involved in Agricultural activities. Good monsoon means a booming economy weak or failed monsoon (droughts) result in extensive Agricultural losses and significantly hinder overall economic growth [5].

Plants need water to survive and rain is the only effective means of watering. For healthy plants a regular rain pattern is vital. Excessive rainfall causes the risk of flooding and crop breakdown. Droughts can kill crops and extremely wet weather can cause dangerous fungus growth.

Being one of the largest country having a diverse climate and two third area is rain dependent is very unfortunate. In India rain is so significant that it has a God called Indradev for rain. Agriculture is the main occupation and the source of livelihood and the bread of the common man in India [6].

IV. IMPLEMENTATION OF GEO-VISUALIZED SYSTEM

In this paper, we have used ArcMAP 10.2 which is the main component of an Esri's ArcGIS suite of geospatial processing program for analyzing geospatial data. We have implemented symbolize features based on rainfall during 1951 to 2000 in India. Here we have used vector Map of India, which is shown in figure – 1 Map of India with State Name showing name of all the states with their respective position in the Map of India.

As given in ENCYCLO, Online Encyclopedia, the Vector Map (VMAP), also known as a Vector Smart Map, is a vector-based collection of Geographic information system (GIS) data about Earth at various levels of detail. Level 0 (low resolution) coverage is global and entirely in the public domain. Level 1 (global coverage at medium resolution) is only partly in the public domain.

For the development of Geo-visualized Information System

for states of India based on rainfall during 1951 to 2000, we have taken data from www.data.gov.in which is the Open Government Data Platform published by Government of India. This Data Portal is a platform for single-point access to datasets and applications published by Ministries or Departments or Organizations of the Government of India. It supports the best features of India's India. Gov. in and the US government's data. Gov project.

We have taken data from the Indian Ministry of Earth Sciences, the data set provides details of climatological normal of district wise rainfall calculated with the data for the period of 50 years. With the help of these district wise rainfall, we have calculated state wise average rainfall for the period of 1951 to 2000, that is used as input for Geo-Visualized System of rainfall.

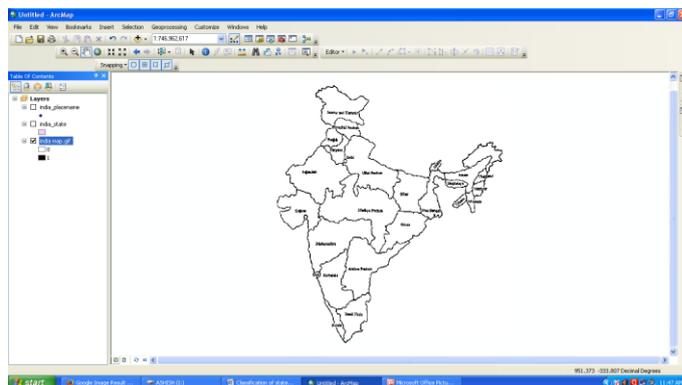


Figure 1: Vector Map of India with State Name

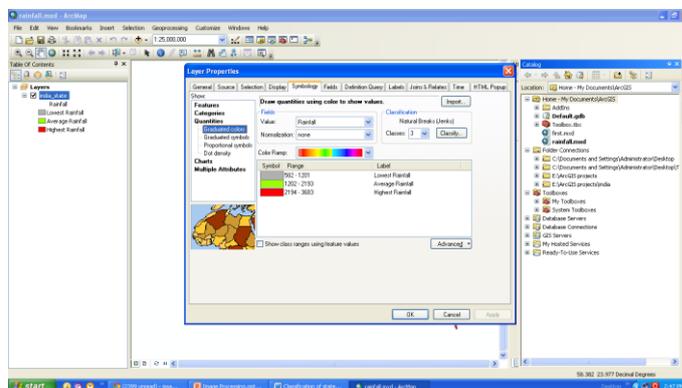


Figure 2: Class Distribution based on Rain Fall/Applying classification Rules

Here, figure 2 shows the classification rule formation, we have discretized the rain fall of different states in three classes and applied color ramp to give a clear visualization. We set lowest rainfall range from 582-1201 mm, average Rainfall from 1202-2193mm and highest rainfall of 2194-3683 mm.

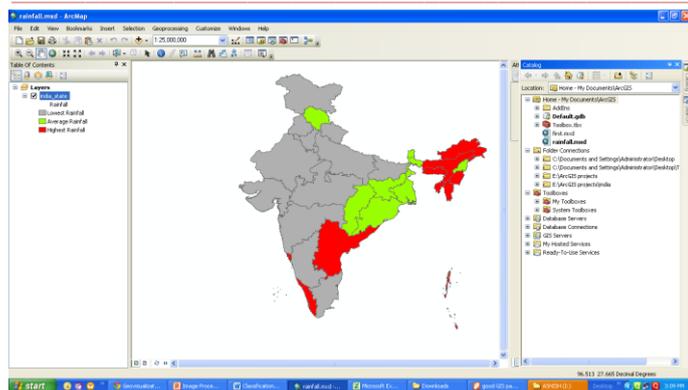


Figure – 3: Geo-Visualization of rainfall in different states/ Result of Implemented system using ArcMAP 10.2

The above figure shows the result of Implemented system using ArcMAP 10.2. Here all the states are categorized into three categories by using three different colors. The red color states come under the category of heavy rainfall and green color states show lowest rainfall and remaining states come under the category of low rainfall.

As shown in figure-3, gray color states of India indicate that, here it is advisable to implement an Irrigation facility for farming due to lack of rainfall as farmers of these 11 states are suffering due to low rainfall.

V. CONCLUSION

In This paper, we have developed Geo-Visualized Information System for states of India based on rainfall using ArcGIS. The system provides the facility for analyzing the rainfall information. The results of this implemented system help the Indian Government for taking a decision that in which states of India large storage reservoirs are required to redistribute the natural flow in accord with the requirements of specific regions. Also the government has ready reference to plan the watershed layouts and other rain Water Harvesting Program in any specific geographic region of the country. In many of the states of India, there is the uneven distribution of rainfall and divergence between water obtainability and demand, so this system can be helpful for the same.

REFERENCES

- [1] <http://www.lib.umd.edu/binaries/content/assets/public/gov-info-gis/research-and-instruction/introduction-to-gis-workbook.pdf>
- [2] "What is GIS?", esri retrieved from <http://www.esri.com/library/bestpractices/what-is-gis.pdf>
- [3] <http://resources.arcgis.com/en/help/getting-started/articles/026n00000014000000.htm>
- [4] "ESRI Shapefile Technical Description", An ESRI White Paper—July 1998 retrieved from <http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf> on 10th February 2014
- [5] MishitaMehra, ET Bureau, How normal monsoon could impact agriculture, inflation, income & storage retrieved from http://articles.economicstimes.indiatimes.com/2012-05-06/news/31588216_1_normal-rainfall-monsoons-food-grain-production
- [6] Trail Blazers, retrieved from <http://kvgktrailblazers.weebly.com/home.html>