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Preparation of River Atlas for Rajasthan, excluding the Ganga Basin

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Abstract: Water is a scarce natural resource, and is fundamental to life, livelihood, and food security. India has many rivers, some of which are the mightiest in the world. Indian rivers have great significance in the socio-culture and religious ethos. Almost all the major cities of India are located along the rivers. River basin planning plays a vital role in the planning and implementation of water resources projects nearby the rivers. They provide economically cost-effective and ecologically sound solutions for the development. An attempt is made to prepare a river atlas for Rajasthan excluding the Ganga basin. This will provide us data which will help in development, in conjunction with, other natural resources and anthropogenic information such as distribution of rainfall and other climatic data, other water bodies, forest cover, elevation, soil type, other physiographic information, land use, tourist and pilgrimage centres, and infrastructure including roads and highways.

Keywords: River Atlas, Image processing tools, Google Earth, ArcGIS, DEM (Digital Elevation Model).

1. Introduction

The state of Rajasthan is one of the driest states in the country. Thar Deserts, Aravalli Ranges, Lakes, and heritage infrastructure are the main features known for the uniqueness of Rajasthan. The total surface water resources in Rajasthan are only 1% of the country. The Geographical area lies between 23.3 to 30.12 North latitude and 69.30 to 78.17 East longitude. The Aravalli Range runs across the state from the southwest peak of Guru Shikhar (Mount Abu), which is 1,722 meters (5,650 ft) in height, to Khetri in the northeast. Aravalli range divides the Rajasthan state into 59% in the northwest of the range and 41% in the southeast.

Rivers are a blessing for the people of India. They provide water to the people. Water resource management is a multidisciplinary approach combining a collection of technical tools and expertise along. This water is used for various purposes such as hydroelectric power generation, irrigation, forestry, fishery, etc. Major crops grown in Rajasthan are Wheat, Jau, Jwar, Maize, and Pulses. Approximate 50 percent of food is grown near the bank of the rivers. But due to not having, an assessment of the watersheds for a very long time, the maintenance work of lower-order rivers can't be done, and this creates problems in determining and fulfilling the water requirements for the people in Rajasthan. So, to solve the same problem an attempt has been made to prepare the river atlas for Rajasthan excluding Ganga Basin. Major two basins which we have considered are Chambal and Luni.

This project is the first attempt to map the river network of Rajasthan in as fine a detail as possible. Chambal is the perennial river among all the rivers, and all other rivers are non-perennial rivers in the state. Luni is the second largest river after Chambal in the state. Preparation of the river atlas will help in the economical and overall development and the best utilization of water resources available in Rajasthan.

To control the flow of water, dams are constructed on the rivers. Where dams are constructed, the hydropower generation plant is also established for the generation of electrical energy. Gandhi Sagar, Rana Pratap Sagar, and Jawahar Sagar dams are constructed on the Chambal river and these are fulfilling irrigation demand on an approximate 5700 square kilometers area in Rajasthan. Rhyolite and granite are also very helpful in groundwater recharge.

Gandhi Sagar dam alone have five electricity generating units each of 23 MW. The water which is released from the hydroelectric plant is used for irrigation. The Jawahar Sagar dam has storage capacity of 1600 MCM, which can be used during any natural disaster. The average annual rainfall varies from 500 mm to 750 mm in Rajasthan.

2. Literature Review:

Atlases show the geographic features and topography of the land area as well as political boundaries. They are also helpful in understanding the climatic, so.cial and economic statistics of an area. Protection of rivers and wetlands will directly help in human health and conserving species and habitats across watershed. It's very clear that with the passage of time there occur changes in the geographical features of the natural resources. So drawing the river

network of the watershed basin will be helpful in identifying the fresh natural water resources available.

In Rajasthan, there are five main revers excluding the Ganga basin. These rives are named Chambal, Luni, Mahi, and Ghaggar. Chambal river of Rajasthan provides water the twelve months. Others are dependent on the Chambal River. Due to the great scarcity of water, it becomes very essential to study all the available water resources and make the best utilization out of them for general use as well as for development purposes.

As there is a great scarcity of water in Rajasthan. So, sustainable water resource management is the need of the Rajasthan, especially in western deserts. There are found many types of stones in Rajasthan. Rhyolites and Granites are very highlighted among all the stones as they have a great water-retaining capacity. These stones are helpful in groundwater recharge from rainfall. On the same topic Sen Hemant et al. (2011), presented their research concluding groundwater augmented structures should be constructed from Rhyolites and Granites to collect the rain-water.

Calcium and Magnesium are the two important nutrients in water for irrigation. When there is an excess of salts in the water, it can damage the crop. Generally, the water of rivers is salty, so it is harmful to crops. To solve this problem of the effect of saline water on plant growth, Rainer Haul et al. (2015), completed a study on the same topic. They found that the saline water affects only the upper two to three centimetres of the surface but within a depth of thirty to forty centimetres there is no such effect of saline water i.e. there is no availability of salts to damage or harm the plant growth and irrigation fields at a depth of forty to sixty centimetres and lateral roots can be germinated at this depth. They further suggested that to use the sandy soil to solve this problem as the sandy soil can absorb the water. So, the salts will drain inside, and there will be good plant growth. It is also found in research that sandy soil offers good plant growth in desert areas.

Calcium is very helpful in stimulating photosynthesis as well as in increasing NH_4^+ and K^+ nutrients for plant growth. When the sufficient amount of calcium is available in water it makes efficient use of nitrogen which helps in economical production of crops.

Taking into consideration the importance of a fresh reassessment of the availability of water resources in the country, a project titled "Assessment of National Water Resources using Space Inputs" was initiated by National Remote Sensing Centre, ISRO (et.al. December 2011), with the use of geographical information system and remote sensing. The groundwater resources play an important role (NRSC, 2011) in agriculture, hydropower generation, livestock production, forestry, recreational activities, etc. Potential changes of global climate change on water resources include enhanced evaporation due to warming, and geographical change in the precipitation intensity, duration, and frequency together affecting the hydrological parameters (CWC, 2011).

Catchment basins may be characterized by varying natures and results for adopting the conventional methodology. Greening in catchment basin management includes agriculture, dryland agriculture, horticulture, tree culture farm forestry, social forestry afforestation, and forestry. Jat (2012) did a research on the topic "Greening through Watershed Management- A case study of Bhandarej Watershed in Dausa, Rajasthan". It was found that watershed is adopted as a natural unit of the ecosystem, planning, and sustainable development by many scientific researchers. It was also iterated that holistic biomass resource management is a good way to solve the problems through catchment basin management. Telling the importance of participatory natural resource management will enthuse the people to come forward for active participation in suitable natural resources management to produce the profusion for our growing population without damaging the resource base.

Sinha (2021) did research on "Availability of water in the endangered fields of rivers to improve the situations". It was seen that water in Rajasthan was at 60 to 65 feet into the ground in the year 2000 and now the water level is around hundred feet down into the ground. By the year two thousand fifty, there only fifty percent of food production can be done due to not having the sufficient amount of water in comparison to 2021.

The problems of large irrigation projects are usually presented by waterlogging and soil salinity B.M. et al. (1982). In this study, it was shown that availability of salts, calcium and magnesium will be harmful for irrigation as well as drinking. Availability of salts in water can damage the roots of the plants and can decrease the amount of production. It was concluded that satellite imagery information would be helpful to identify such problems by using the multistage approach for interpretation.

Forest cover in the state is identified as 16,639 square km which is approximate 5% of the geographical area as shown by IRS RESOURCECAT-2 LISS-III, (2019).

3. Brief Description of Software used:

- Google Earth
- ArcGIS

3.1 Google Earth:

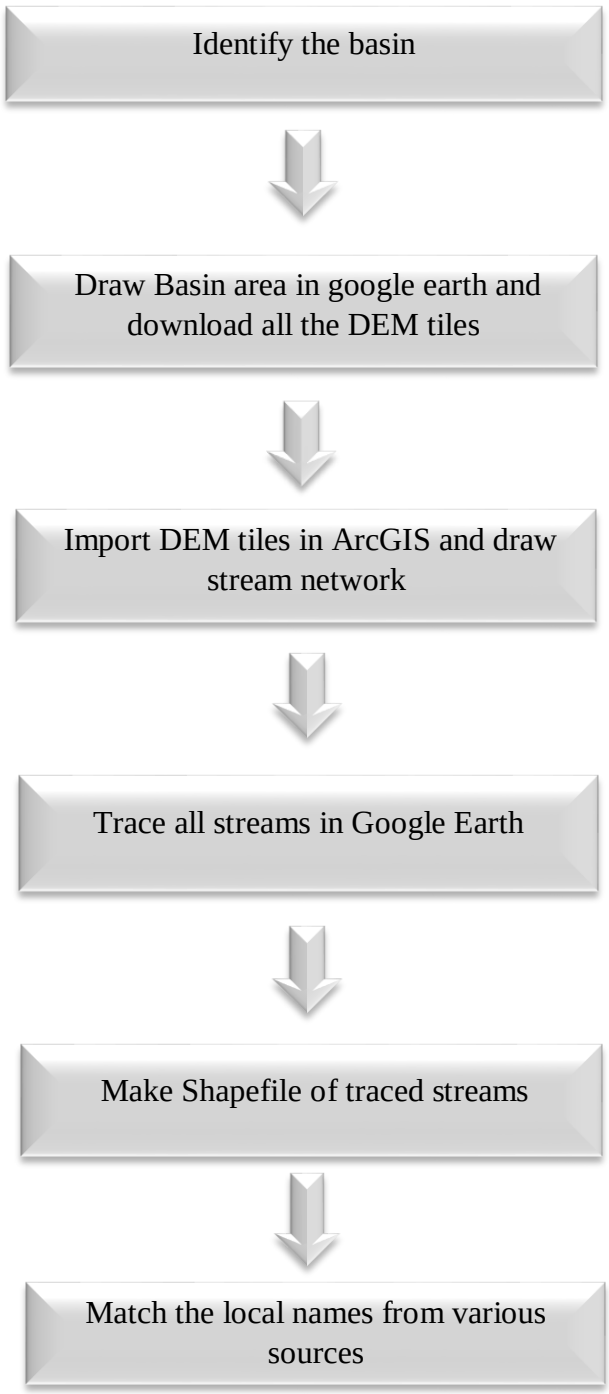
Google Earth is a computer program which maps the earth digitally by superimposing satellite images, Aerial Photography, and Geographical Information System data. It is an image processing tool that was developed in the late 1990s. The technology used was developed on Intrinsic Graphics. Google Earth provides a digital globe by

zooming into which we can navigate the earth by sitting in one place. It completes the whole process in real-time. Despite Earth navigation, this software provides some extra features such as a distance measuring tool. Other features like viewing the images by just clicking on the place make this software unique. Accuracy of up to 30 meters is possible making viewing physical features such as lakes, hills, rivers, etc. possible.

3.2 ArcGIS

ArcGIS refers to Aeronautical Reconnaissance Coverage Geographic Information System. ArcGIS is a club of many software including client software, server software, and online geographic information system which are provided and maintained by ESRI. ArcGIS, a command line-based data manipulating system, was launched by ESRI in 1999. In the present version of ArcGIS commands like line, point and polygon are used to manipulate the data. The latest version of ArcMap is ArcMap 10.8.

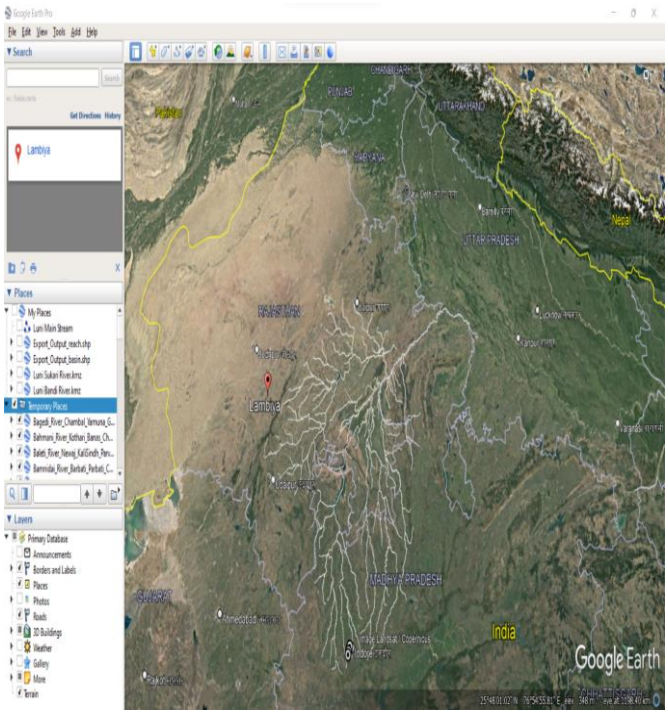
4. Methodology:



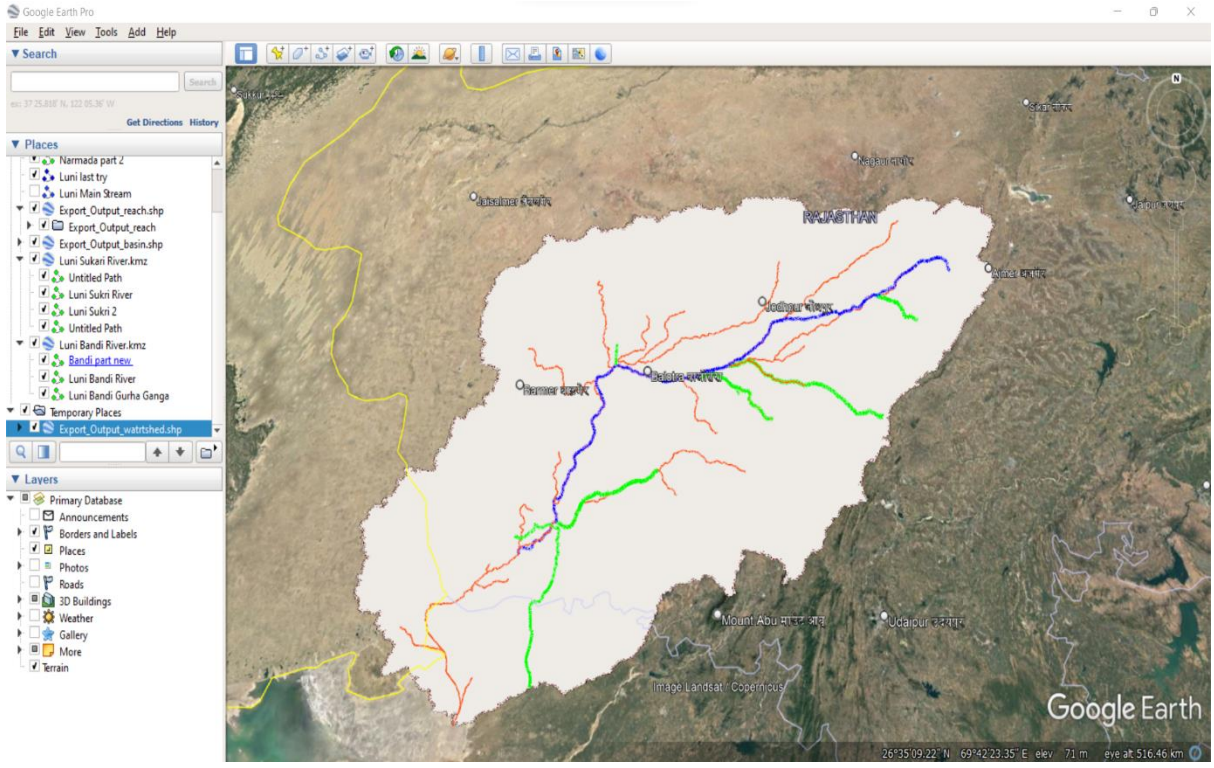
5. Result

At the end as the result of this project, we got the final river network of Chambal and Luni basins in Rajasthan with a precision of 30 meters. The screenshots of the result are attached below

5.1 Chambal Basin



5.2 Luni Basin



6. Conclusion

1- With the usage of Software tools like Google Earth Pro and ArcGIS, it is possible to conveniently present the river outlets of the basin.

2- Information related to the coordinate system of the basin can be easily accessed through USGS Earth Explorer, which plays a vital role in presenting water delineation in the river atlas.

3- These studies play a crucial role in river management as rivers provide water for irrigation, domestic supply, power generation, and industry as well as a range of other ecosystem services and intrinsic and biodiversity values.

4- These studies play their part in deciding trade routes and developing commerce which affects the economy. As river water is extensively used in irrigation and in developing hydroelectricity.

5- These studies play part in strategic benefits like Regional Security, Poverty reduction, Climate Resilience, and Secure livelihoods (crops, livestock, fish.)

7. References

1. "Assessment of Water Resources at Basin Scale using Space Inputs A Pilot Study" by National Remote Sensing Centre, ISRO, Hyderabad and Central Water Commission (CWC) India.

2. "Greening through Watershed Management- A Case study of Bhandarej Watershed Distt. -Dausa Rajasthan" by Dr. B.C. Jat, Lecturer in Govt. P.G. College, Neemkathana, Rajasthan India.

3. "Hydro-Geology Groundwater Resources and Analysis of Potential Aquifers in Malani Igneous Suite - A Case Study of Sirohi District of Rajasthan" by Sen Hemant and Nagori M.L.

4. "Water Resource Management and Development in Rajasthan" by Dr. B.C. Jat, Lecturer in Govt. P.G. College, Neemkathana, Rajasthan.

5. "River Systems and River Science in India- Major Drivers and Challenges" by Rijiv Sinha et al. (2021).

6. "Effect of Saline Water on Plant Growth" by Rainer Haul et al. (2015).