

# Use of GIS Mapping for Environmental Protection in Rajasthan – A Review

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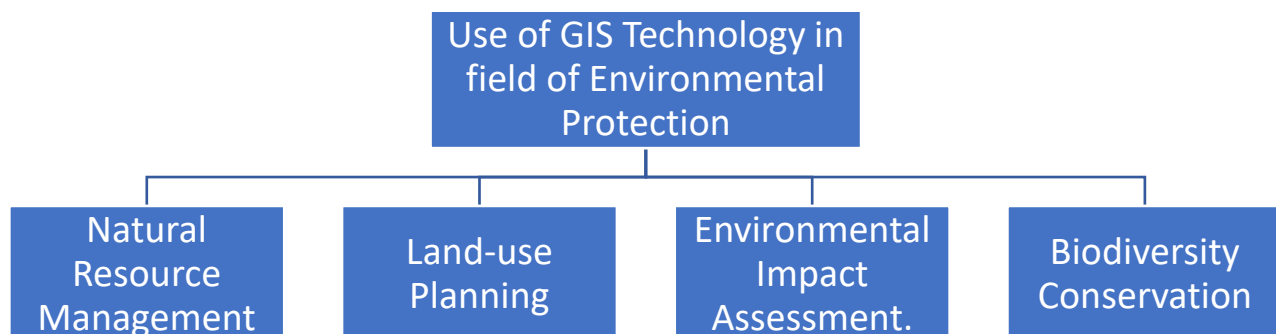
**Abstract:** This review paper examines the use of Geographic Information Systems (GIS) mapping for environmental protection in Rajasthan, India. GIS mapping technology integrates different environmental datasets, enabling the identification of environmental risks and implementation of strategies for sustainable development. The literature review section highlights various environmental protection applications of GIS mapping, such as land-use planning, natural resource management, and climate change mitigation and adaptation. Several case studies from different districts of Rajasthan demonstrate the effectiveness of GIS mapping in environmental protection. These case studies include identification of areas with high levels of air pollution due to thermal power plants, identification of potential sites for rainwater harvesting, support for the conservation of wildlife habitats, groundwater mapping, and support for the development of solar energy. The paper identifies the challenges of GIS mapping, such as data availability and accuracy, which are common issues in environmental mapping. The study concludes that GIS mapping is an effective tool for environmental protection in Rajasthan, providing spatially explicit information that can support decision-making related to sustainable development. This review paper provides valuable insights into the use of GIS technology for researchers and practitioners in the field of environmental protection.

**Keyword:** GIS Mapping, Environment protection, Environmental Impact Assessment

## I. INTRODUCTION

Geographic Information Systems (GIS) have emerged as a useful tool for environmental protection in recent years. GIS allows the integration of different environmental datasets, which can help in the identification of environmental risks and the implementation of strategies for sustainable development[1, 2]. In this review paper, we discuss the use of GIS mapping in environmental protection and its potential for addressing current and future environmental challenges in Rajasthan, India. GIS technology has been used in various environmental protection applications as shown in figure 1. GIS mapping can be used to identify areas with high conservation values, such as endangered species habitats, and develop conservation strategies that take into account the spatial distribution of these areas[3, 4]. Additionally,

GIS mapping can help identify potential environmental risks associated with industrial activities, such as oil spills, and develop emergency response plans to mitigate their impact.



**Figure 1: Application of GIS Technology in the field of environmental protection**

In Maharashtra, the use of GIS mapping has been implemented for monitoring forest cover and wildlife habitats. A study conducted by Dhupal et al. (2018) used GIS mapping to assess the impact of human activities on the forest cover and wildlife habitats in Sindhudurg district of Maharashtra. The study identified areas where forest cover was lost due to various human activities, such as mining and agricultural expansion, and recommended measures to restore degraded forests and protect wildlife habitats[5, 6].

In Kerala, GIS mapping has been used for the conservation of wetlands, which play a crucial role in flood control and groundwater recharge. A study by Nair et al. (2018) used GIS mapping to identify wetland areas in Kollam district of Kerala and assess their ecological value. The study recommended measures to protect and restore degraded wetlands and promote sustainable use of wetland resources[7].

In Uttarakhand, GIS mapping has been used for the conservation of Himalayan biodiversity, which is under threat due to various human activities such as tourism, mining, and infrastructure development. A study by Pandey et al. (2021) used GIS mapping to identify areas of high biodiversity value in Nainital district of Uttarakhand and recommended measures to protect and restore degraded habitats[8].

In Tamil Nadu, GIS mapping has been used for the assessment of coastal erosion, which is a major environmental problem in the state. A study by Nair et al. (2020) used GIS mapping to assess the extent and rate of coastal erosion in Nagapattinam district of Tamil Nadu and recommended measures to mitigate the impacts of coastal erosion[9].

#### **Case Studies of Rajasthan: Use of GIS Technology in field of Environmental Protection**

Several case studies have demonstrated the effectiveness of GIS mapping in environmental protection in Rajasthan, India. For instance, in the Kota district of Rajasthan, GIS mapping was used to identify areas with high levels of air pollution due to the presence of thermal power plants. The study found that several villages located near the power plants had high levels of particulate matter (PM10) in the air, which can cause respiratory problems and other health issues. The use of GIS mapping allowed the researchers to identify the sources of pollution and develop strategies to mitigate their impact. In Jodhpur city of Rajasthan, GIS mapping was used to identify potential sites for rainwater harvesting. The study found that several areas in the city had the potential to harvest rainwater, which could help address water scarcity issues in the region. The use of GIS mapping allowed the researchers to identify suitable locations for rainwater harvesting and develop a plan for their implementation.

In the Udaipur district of Rajasthan, GIS mapping was used to support the conservation of wildlife habitats (Singh et al., 2019). The study found that several areas in the district had high conservation values due to the presence of wildlife species such as leopards and sloth bears. The use of GIS mapping allowed the researchers to identify these areas and develop a conservation plan that takes into account the spatial distribution of these species.

Extensive use of GIS Mapping is also seen in a paper where Ground Water mapping is done using GIS. The author highlights the importance of groundwater mapping and management in arid regions like Udaipur District, where water scarcity is a major problem. The study utilizes GIS mapping techniques to generate various thematic maps, such as groundwater potential zones, depth to water table, and water quality, which can aid in effective management of groundwater resources. The paper also discusses the challenges faced during the study, such as data availability and accuracy, which are common issues in groundwater mapping. Overall, the paper provides valuable insights into the use of GIS technology in groundwater mapping, which can be useful for researchers and practitioners in the field of water management.

In the Jaisalmer district of Rajasthan, GIS mapping was used to support the development of solar energy. The study found that several areas in the district had high potential for solar energy development, and the use of GIS mapping allowed the researchers to identify suitable locations for solar power plants and assess their environmental and social impact.

Rajasthan Ground Water Department (RGWD), Government of Rajasthan (GoR) is the nodal agency for implementing “Aquifer Mapping and Development of GIS based Database for Assessment of Village wise Groundwater Potential and Strategy for Development”. European Union (EU), under its bilateral program provided the financial support for the project. The project is set to be completed in December 2012. This report incorporates the suggestions from the Department on ‘draft of the final project report’ submitted earlier.

Rajasthan being a water scarce State is strategically located in western part of India. Despite this, population of the State is on the rise, part of the land and water resource is affected by salinity and is often brackish in nature. Key objective of the project was to assess the groundwater resources at the level of villages. Per state’s groundwater policy water resources should ideally be managed by the end users, which is a Gram Panchayat. So unless the data at village level is available,

the intended objective of the project cannot be met. A consultative approach was adopted and we engaged the RGWD and EU in all steps of project execution that led to finalization of 15 basins and 2 sub-basins, 19 aquifers (excluding forests and hill areas).

The project being unique in its kind wherein GIS techniques for delineating aquifers in 3 dimensions were to be done while addressing strong hydrogeologic principles. Innovative approach was adopted for defining saturated and unsaturated zones in each well and finally defining such thicknesses per a particular date of water level measurement was designed [10]. This has helped in subsurface aquifer mapping, delineating thickness of aquifer, artificial recharge planning and finally water resources in each unit area which was a 250m X 250m grid cell. The resources so computed were finally summed up for each village and other administrative boundaries, aquifers and basins. In the present exercise, maiden attempt was made to estimate the ground water resources basin wise adopting aquifer as a unit. Further, endeavor was made to evolve Spatially Distributed Recharge Estimation technique using Geo Spatial tools following the lumped water balance and area apportioning to arrive at the village wise resources. The geo-spatial tools inbuilt in to the standard GIS were used for spatial interpolations of parameters and for various computations. Different maps and their attributes were created in GIS platform to facilitate the estimation in line with the GEC recommendations, the methodology adopted is broadly lumped water balance approach based on the water level fluctuation and saturated zone technique.

### CONCLUSION

GIS mapping has emerged as an effective tool for environmental protection in Rajasthan, providing spatially explicit information that can support decision-making related to sustainable development. The use of GIS mapping in environmental protection has been extended to different applications, including land-use planning, natural resource management, biodiversity conservation, and climate change mitigation and adaptation. Case studies in Rajasthan have demonstrated the effectiveness of GIS mapping in supporting environmental protection, including the identification of sources of air pollution, the identification of potential sites for rainwater harvesting, the conservation of wildlife habitats, and the development of solar energy. The case studies discussed in this review paper highlight the potential of GIS mapping in addressing environmental challenges in Rajasthan, such as air pollution, water scarcity, conservation of wildlife habitats, and renewable energy development. The use of GIS mapping can provide decision-makers with spatially explicit information, allowing for the development of effective strategies for sustainable development. However, further research is needed to explore the potential of GIS mapping in addressing current and future environmental challenges in Rajasthan and other regions of the world. Further research is needed to explore the potential of GIS mapping in addressing current and future environmental challenges in Rajasthan.

### REFERENCES

1. Naidu, D.S., Use Of Gis In Hydrological Investigations. Pdf). International Journal of Interdisciplinary Advanced Research Trends. Ii (2), 2015.
2. Ojha, S. and S. Choudhary, Environmentally Sustainable Sand Mining Based on GIS based Sediment Yield Estimation. Engineering and Technology in India, 2017. 8(1-2): p. 49-57.
3. Choudhary, S., et al., Development of Rain Water Harvesting System through National Highway Profiles by Using GIS and Field Survey. Available at SSRN 3348303, 2019.
4. Choudhary, S., et al. GIS Mapping for Distribution of Ground Water Quality in Udaipur. in IOP Conference Series: Earth and Environmental Science. 2022. IOP Publishing.
5. Nagne, A.D., et al., Urban LULC change detection and mapping spatial variations of Aurangabad City using IRS LISS-III. Data Analytics and Learning: Proceedings of DAL, 2018. 369.
6. Choudhary, S. and P. Choudhary, Sediment Yield and Sand Erosion Model through Arc SWAT and SPSS-14 Software for Sand Mine Site in Rajasthan. International Journal of Engineering and Advanced Technology (IJEAT), 2020. 8(6S): p. 138-141.
7. Devi, A.B., et al., Predictive modelling of land use land cover dynamics for a tropical coastal urban city in Kerala, India. Arabian Journal of Geosciences, 2022. 15(5): p. 399.
8. Shekhar, C., et al., Spatio-temporal distribution of broad-leaved *Quercus semecarpifolia* indicates altitudinal shift in northwestern Himalayas. Plant Ecology, 2022. 223(6): p. 671-697.
9. Arunbose, S., et al., Remote sensing, GIS and AHP techniques based investigation of groundwater potential zones in the Karumeniyar river basin, Tamil Nadu, southern India. Groundwater for Sustainable Development, 2021. 14: p. 100586.
10. Choudhary, S. and J. Sharma, Surface Water Quality Trends and Regression Model through SPSS in Udaipur, Rajasthan. International Advanced Research Journal in Science, Engineering and Technology, 2021. 8(10): p. 153-160.