International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

# Tourism-Induced Environmental, Ecological and Socio-Economic Changes in Jaisamand Lake and Its Surrounding Region

**Mr. Yogesh**

Ph.D Scholar, Geography Department,
Jayoti Vidyapeeth Women's University Jaipur, Rajasthan

**ABSTRACT**

Tourism is an important driver of regional economic development, employment generation and infrastructure growth. Tourism is extremely important when it comes to creation of job opportunities, infrastructure development, and improved socio-economic conditions of the population. In case it is used in a sustainable manner, tourism helps to develop the economy of an area as well as conserve the environment, which makes the lives of people better. Therefore, tourism has become increasingly more important in sustainable development of environmentally sensitive regions.

However, this development of tourism results in increased stress on sensitive ecosystems, particularly on protected areas and wetlands. The Jaisamand Lake, one of the biggest artificial freshwater lakes of India, which is the heart of the Jaisamand Wildlife Sanctuary has become a leading nature and heritage tourism site in south Rajasthan.

The present study is an attempt to assess the environmental, ecological and socio-economic impact of the tourism development in Jaisamand lake region based on field observation, discussion with the stakeholders, secondary data and the geospatial analysis. The results point to the diversification of livelihoods, creation of employment and infrastructure development as outcomes of tourism. At the same time, the growing amount of visitors has led to problems such as waste management, minimal water pollution, habitat degradation, shoreline modification and wildlife disturbance.

The study shows how essential sustainable tourism planning is, in which the community is engaged in planning, implementation of ecotourism projects and activities, habitats conservation, habitat monitoring using the GIS and carrying capacity assessment. With proper management Jaisamand Lake can be served as a case study for sustainable wetland tourism in a semi-arid area.

**Keywords**: Ecotourism, Wetland Tourism, Jaisamand lake, Biodiversity conservation, Sustainable development.

## INTRODUCTION

Tourism is one of the most important and fast expanding industries in the world and important for job creation, infrastructure development and regional development. In recent years, due to the growing popularity of the tourism sector in nature, areas such as wetlands, nature reserves and others, which are ecologically sensitive, have started to receive more attention. Tourism offers an economic chance, but also

at the same time environmental pressures which can have an impact on the sustainability of the environment.

Wetlands offer a variety of services to the ecosystem, such as water purification, controlling floods, recharging groundwater, carbon sequestration, fisheries production and biodiversity conservation. Although wetlands are important ecologically, more and more threats to wetlands are the result of land-use change, pollution and human activities.

## STUDY AREA

Jaisamand Lake, created in the year 1691 by damming the river Gomati, is one of the important lakes of freshwater in Rajasthan. Apart from its irrigation and fisheries functions, the lake and the adjoining Jaisamand Wildlife sanctuary is home to diverse flora and fauna along with its drinking water supply function.

The development of the access, recreational opportunities and the rising interest into natural and heritage tourism has promoted the tourism growth in the region. Boating, birdwatching, wildlife spotting and photography have been added to the local economy. However, with increasing numbers of visitors there has been concern on habitat disturbance, water quality and conservation of biodiversity.

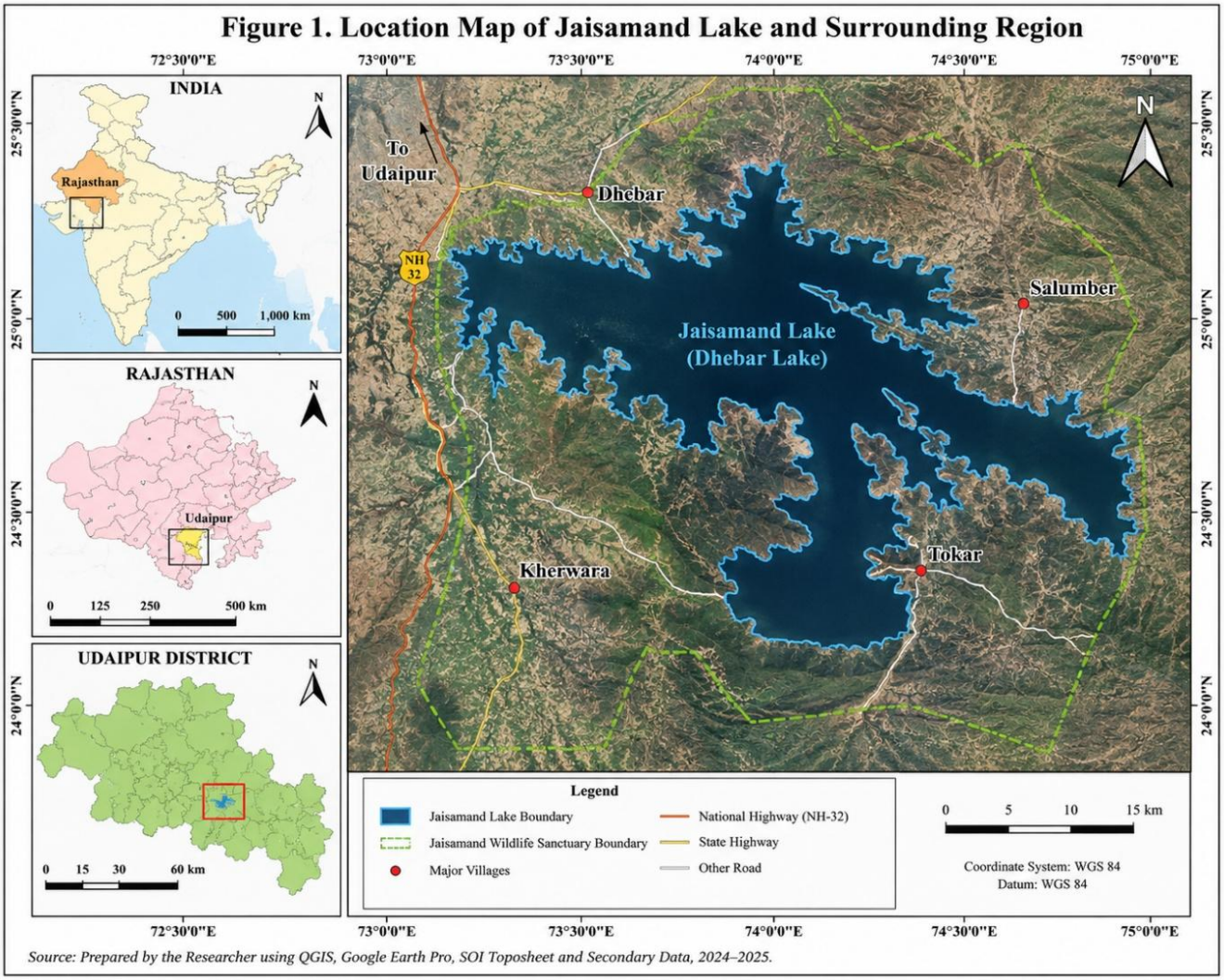



**Figure 1: Location Map of Jaisamand Lake.**

In the present study the environmental, ecological and socio-economic impacts of tourism development in Jaisamand lake area have been discussed and the possibilities of achieving tourism development without compromising the ecological integrity of the lake have been suggested.

## LITERATURE REVIEW

The themes of tourism and environmental conservation are closely interrelated themes in Geography and Sustainability research. Tourism offers economic benefits in terms of jobs, income and infrastructure development, but overdevelopment of tourism in an ecologically fragile region is associated with environmental issues.

A Tourism Area Life Cycle model proposed by Butler (1980) was adapted and it is likely that the rapid development of tourism is detrimental to the environment. This is particularly relevant when it comes to the quality of the wetlands and the health of the system, as an excessive number of visitors to the wetlands could affect this.

Wetlands are one of the most productive ecosystems and have numerous functions such as biodiversity protection, nutrient cycling, water control, carbon sequestration and water purification (Mitsch & Gosselink, 2015). Yet, globally there have been substantial losses in the wetlands due to land use change, infrastructure expansion and pollution (Davidson, 2014).

Tourism has been shown to cause habitat fragmentation, disturbance of wildlife, and degradation and stress of vegetation in protected areas (Buckley, 2011). Wetlands in India play an important role in biodiversity and livelihoods but are facing threats due to urbanisation, tourism and land use change (Gopal, 2007).

Most studies related to Jaisamand lake have been related to biodiversity, fisheries, water quality and wildlife conservation. While these studies highlight the importance of the lake for its environment and its ecology, there are still not many studies that enter into the lake's environmental, ecological and socio-economic impacts arising from tourism.

GIS and Remote Sensing advances have contributed to the monitoring of land-use change, habitat fragmentation, pressure zones of tourism and biodiversity hotspots (Lillesand et al., 2015). These tools offer good support in sustainable tourism planning and conservation management.

The literature examined provided examples of the economic benefits of tourism, and the likely ecological pressures on jaisamand lake. The studies conducted in Jaisamand region are very few and short, need more detailed geographical study with the linkage of tourism development and sustainable management of Jaisamand as one of the wetlands of the world.

## SCOPE AND METHODOLOGY

### Research Design

The study adopts an interdisciplinary geographical approach to assess the environmental, ecological and socio-economic impacts of tourism in the Jaisamand Lake region. Given the close linkages between the different tourism activities and wetlands, it was decided to gather qualitative and quantitative information to gain a general understanding of the impacts of tourism in the study area. The study consists of two parts, Field Observation and Ecological Assessment, and Spatial Analysis for assessing the levels of correlation between the environment sustainability and tourism development.

**Sources of Data - In the investigation the primary and secondary source of information was used.**

**Primary Data**

In-depth field survey towards main sites of tourism around Jaisamand lake was carried out to collect primary data. Direct observations were used to assess the impacts of tourism activities, environmental conditions, habitat disturbances and tourism related infrastructure. Informal discussion with the local people, tour operators and forest department officials to gather the inputs on the trend of tourism, dependency of livelihoods with tourism and challenges in tourism management. In addition a key visitor site mapping was conducted using GPS to identify key visitor sites, recreation areas and environmentally sensitive areas.

**Secondary Data**

The secondary data collection included data from Government publications, Tourism statistics, Biodiversity surveys, Scientific publications, conservation reports, Census reports and policy documents. The existing literature pertaining to Biodiversity, Wetland ecology & conservation available in the Rajasthan Tourism Department and the Rajasthan Forest Department on numbers of visitors, tourism facilities, protected areas management etc. was surveyed, satellite imagery was also conducted and geospatial data was used to provide an Ecological context to the area.

**Analytical Framework**

A Driver – Pressure – State – Impact – Response (DPSIR) approach has been used to analyse the relationship between the development of tourism and environmental change. The development of tourism is seen here as affecting the ecological and socio-economic systems. The stresses to natural resources and ecological habitats such as growing visitation and development of infrastructure and recreational facilities. They are subjected to stresses that alter their habitat, shoreline alterations and/or a decrease in water quality.

The impact of these changes on the life of the communities, ecological and socio-economic impact on the biodiversity and its ecosystem stability. Conservation measures, sustainable tourism management and environmental regulations and community involvement are all response measures designed to minimize impacts and promote sustainability.

**Application of GIS and spatial analysis.**

Geospatial was applied to recognise the spatiality of the tourism development and change in environment of Jaisamand. GIS and Remote Sensing techniques were used to find the areas where tourism was concentrated, sensitive habitat areas and areas where the development pressure is increasing. Spatial analysis has been done and mapping of the tourism hotspots, land-use/land-cover change assessment, and habitat fragmentation and potential areas for ecotourism have been conducted. Satellite imagery (multi-temporal) was used to give insights to landscape transformation related to the development of tourism. The use of Geospatial techniques was helpful to gain a more systematic knowledge of the distribution of tourism activities on the landscape and of the relationship between tourism activities and biodiversity rich habitats and wetland ecosystems.

All these field observations, socio-economic information, ecological assessment and spatial analysis, provided a holistic approach to assess the impact of tourism and to suggest the recommendations towards a sustainable management of the Jaisamand lake region.

## RESULTS AND DISCUSSION

In the last two decades, the tourism in the Jaisamand has been on the rise and was subsequently made an important tourist destination in the southern part of Rajasthan for nature based tourism and heritage tourism. The calm lake, historical background of the dam of Jaisamand, wildlife and recreational opportunities are the reasons for its popularity.

Boating, birding, wildlife, nature photography, recreational and educational tours are the tourism theme for the area. The area is also home to Jaisamand Wildlife sanctuary, giving the area even more appeal due to the various habitats and wildlife it can enjoy in a protected area.

The more visitors the more the infrastructure has been developed in tourism. The better transport connectivity, the accommodation and recreational services are increasing the economy and providing new livelihoods opportunities due to tourism. The tourism activities however, are focused in some areas, also causing local environmental pressures.

**Table 1 - Interesting places to see in Jaisamand Region are some of the following:**

| Attraction | Tourism Significance |
|---|---|
| Jaisamand Lake | Scenic attraction |
| Marble Dam | Heritage tourism |
| Islands | Recreational tourism |
| Wildlife Sanctuary | Ecotourism |
| Bird Habitats | Bird watching |
| Aravali Landscape | Nature tourism |

With the tourism trend on the rise, it's definitely made for a more popular area and it has definitely helped the economy. Concurrently, the lake has experienced an increasing popularity, which has raised the issues of sustainability of the lake's natural resources and of lake-based tourism.

## ENVIRONMENTAL INFLUENCES OF TOURISM:

This tourism activity, around Jaisamand lake has caused different impacts irregularly. One of the elements that influence the economic growth and visibility of a region is tourism and, as the number of tourists increased, tourism started to have an impact on the environmental conditions of some parts of the lake ecosystem. The most obvious impacts are deposition of wastes, the localized water pollution, the change to site shoreline and the impacts on natural resources.

### 1. Water Pollution

Water quality of the wetland is a very important consideration in the health of the wetland ecosystem. There is some local degradation of water quality associated with tourism activities particularly boating points, recreational areas and at shoreline areas of high use as observed in the field. In these "hotspots", the amount of plastic waste that has now built up is now visible, as is the amount of food package waste and other littering.

Low level fuel and oil pollution from boats and nutrient pollution from wastewater from the tourism facilities (if not managed properly) can also be taken into consideration. The impacts are currently small,

but in the future, as tourists grow in number, and nothing is done to adequately protect the lake environment the impacts can become a greater stressor to the aquatic environment of the lake.

**Table 2. Problems to be tackled due to tourism are:**

| Activity | Environmental Impact |
|---|---|
| Boating | Fuel contamination |
| Picnicking | Solid waste generation |
| Resorts | Increased water consumption |
| Tourist traffic | Dust and emissions |
| Shoreline recreation | Habitat disturbance |

The results have demonstrated that, the present level of the tourism associated pollution is not a problem but it could be a bigger problem with the growing number of tourists.

**2. Shoreline Modification**

Ecological values of shoreline ecosystems are sediment stabilization, shoreline vegetation support and aquatic and terrestrial species habitat. Only one shoreline modification has been displayed when it aids the tourism development process. Pathways, parking/recreation facilities and visitor facilities are all displayed.

The changes can lead to loss of ecological buffers that are provided by shoreline habitat and may result in more vulnerable shoreline habitat to loss or erosion by shoreline. At the shoreline modification, including for example modification of vegetation and sediment regimes, may also have impact on aquatic habitat. Depending on ecology and in the way they are developed, they can be long-term or have a long term effect on the organism.

**3. Solid Waste Generation**

Solid waste is definitely one of the most evident impacts of the environmental pressures due to tourism. Plastic bottles, food wrap, disposable utensils and plastic packaging materials were typical products in the areas near recreational activities and visitor gathering areas. Landscape, wildlife and aquatic habitat can be adversely affected by improperly disposing of waste.

The plastic wastes can be released in wetland, and may stay in wetland for a long time, affecting the ecological activities. There is a need for waste management due to the persistence of the non-biodegradable waste; and a need to control the behaviour of visitors in the environment-sensitive areas.

The majority of the ecological effects reported in Jaisamand lake are representative of the problems that generally occur in tourist villages of wetlands. This degradation isn't extremely high, but if it continues to degrade and more and more people visit it, it can have an impact on the health of the ecosystem.

## THE IMPACTS OF TOURISM ON THE ENVIRONMENT:

Tourism impacts not only the environment, but also the processes and biological patterns of the landscape of Jaisamand. Ecological values of this area include proximity to riparian habitat and wetland areas that support a very diverse flora and fauna, largely found in forest, grassland and scrub habitat. These ecosystems are impacted by tourism activities directly and/or indirectly.

**1. Impacts on Wildlife**

The response of wildlife species to the presence of people varies by species and their tolerance for disturbance. Human presence can modify behaviour of species particularly if present in the tourist season, and where the public are involved in recreation, near walking trails.

Observations in the field indicate that disturbance (including frequent movement/vehicles and noises from people) may have a negative impact on wildlife feeding, resting and movement patterns. An increase in niche exclusion (due to permanent human habitation) may lead to habitat use and distribution reductions in some species. These behavioural responses may not have an immediate impact on population size but are able to impact habitat suitability in the long term.

Not to mention indirect effects that are significant. As tourism develops, there may be degradation of habitat, resulting in a decrease of food resources, shelter and breeding areas. With time, these changes can then impact on wildlife populations and wildlife interactions in the sanctuary.

**2. Avifaunal Disturbance**

The bird community is one of most sensitive to changes in the ecological condition of the wetland environment. A large variety of resident and migratory species, some of which nest and feed at the edges and shallow wet and riparian water bodies are present in the Jaisamand lake.

Tourism may impact bird behaviour in a number of ways. Feeding behaviour can also be influenced by human activity, avoidance of nest sites and may result in multiple flights, if the human is encountered, which will cause further energy expenditure. Of concern, also, are those times when birds are breeding and migrating when they need relatively undisturbed conditions.

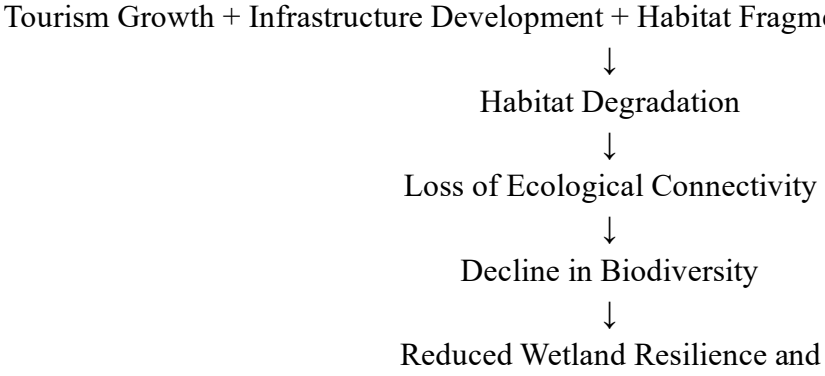
Potential conflicts between conservation/ecological values and recreational values may also exist for high avian diversity areas and there could be overlap between high avian diversity areas and popular tourist sites. The overlapping area indicates that in high biodiversity areas, appropriate design and planning of suitable strategies for managing visitors are required.

**3. Habitat Fragmentation**

Tourism infrastructure could lead to habitat fragmentation and therefore impact on the natural environment and connectivity. Fragmentation (previously continuous habitats could be split into smaller, more discrete habitats) might occur in road, parking area, path and tourism.

Fragmentation of ecological corridors and in wetlands, where ecological connectivity is important in terms of species movement and ecosystem function; is of particular importance. Restricting connectivity will also reduce mobility, and resource availability for wildlife, and increase ecological communities' vulnerability.

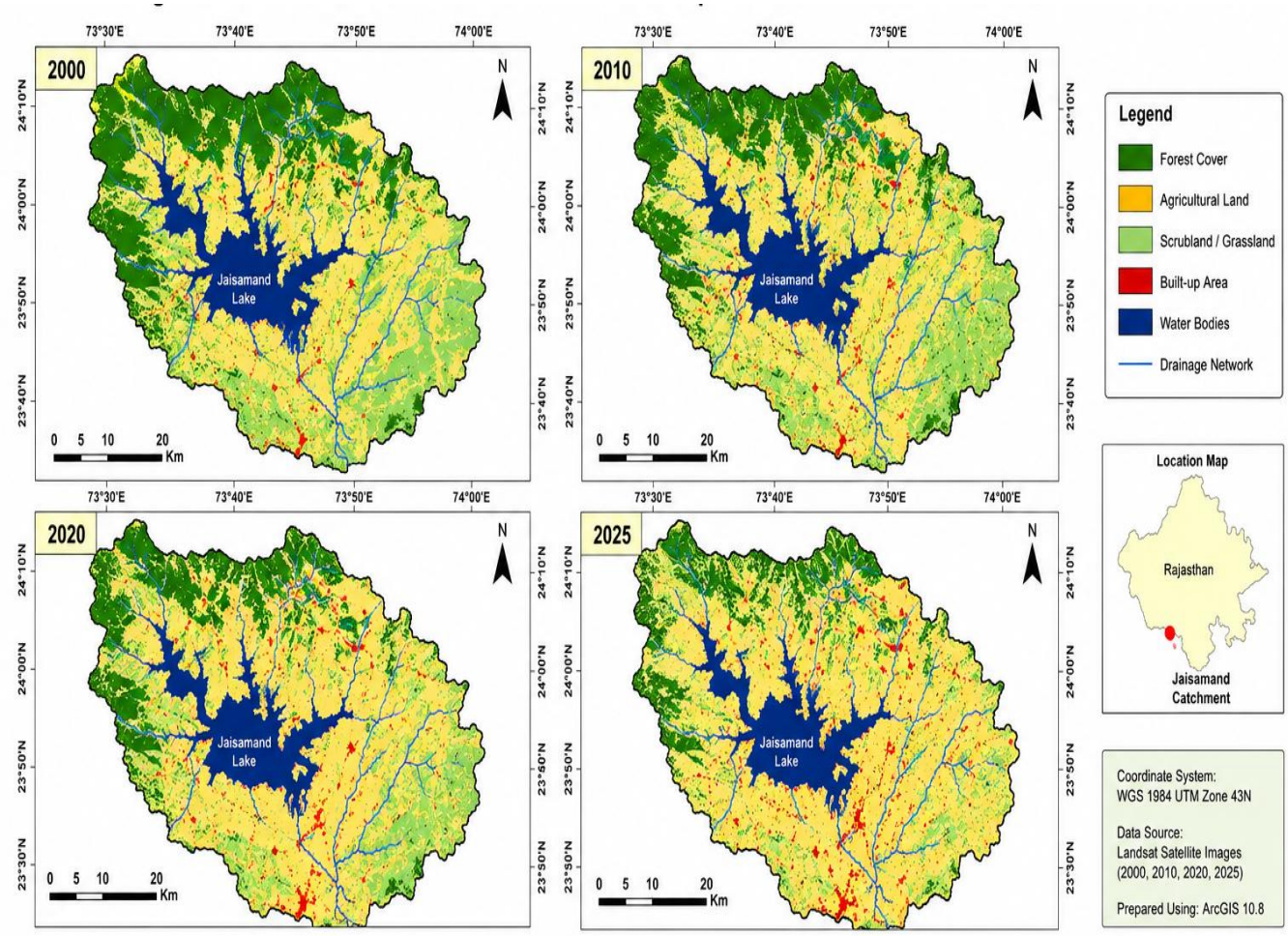
**Figure 1. Conceptual Framework of Habitat Response to Anthropogenic Pressure in Jaisamand Lake**



**4. Wetland Ecosystem Stressors**

Aquatic plants, fish species, reptiles, amphibians and waterbirds are found in the wetland regions around the lake Jaisamand which are the biodiversity hotspot areas. The operation and function of these types of ecosystem is closely related to water resources, vegetation structure and habitat quality and therefore is sensitive to physical modifications.

May be impacted by trampling from the tourist, alteration of aquatic habitat, alteration of shoreline and alteration of ecological process from increased tourism. The likely impact at the individual project level is low; however, if multiple projects are located their impact could be a loss of quality and stability in habitats.




| Land Use / Land Cover Classes | Area (%) | | | |
|---|---|---|---|---|
| | 2000 | 2010 | 2020 | 2025 |
| Forest Cover | 41.2 | 39.4 | 37.1 | 35.6 |
| Agricultural Land | 26.5 | 29.3 | 31.8 | 33.7 |
| Scrubland / Grassland | 18.7 | 17.1 | 15.8 | 14.6 |
| Water Bodies | 12.1 | 11.7 | 11.4 | 11.0 |
| Built-up Area | 1.5 | 2.5 | 3.9 | 5.1 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |

| Land Use / Land Cover Classes | 2000 (%) | 2025 (%) | Net Change (%) (2000–2025) |
|---|---|---|---|
| Forest Cover | 41.2 | 35.6 | -5.6 |
| Agricultural Land | 26.5 | 33.7 | +7.2 |
| Scrubland / Grassland | 18.7 | 14.6 | -4.1 |
| Water Bodies | 12.1 | 11.0 | -1.1 |
| Built-up Area | 1.5 | 5.1 | +3.6 |
| Total | 100.0 | 100.0 | – |

Note: Due to rounding off, the totals may not always equal 100.

**Figure 2. Land Use/Land Cover Change around Jaisamand Lake, 2000–2025**

The results indicate that the effects of tourism on the ecology are most evident where ecologically valuable habitats meet high levels of tourism. The importance of keeping these areas in view in respect of ecological integrity of the lake and Jaisamand Lake area would be great.

## SOCIO-ECONOMIC IMPACTS OF TOURISM

Today, Jaisamand lake is an integral part of the economy and the tourism is developed. Tourism has not only had a negative effect on the environment but on the local people's lifestyle, infrastructure and social life as well. The positive impacts of tourism, in particular, have a particular relevance to less economically active rural areas and/or resource-rich areas.

### 1. Employment Generation

Moreover, creation of jobs (declared) is one of the benefits of Tourism development. Visitor services have been designed and enabled direct and indirect opportunities for local people to earn incomes. Increases in employment across all accommodation establishments, food services, transport and boating and guiding and small industries.

Increasingly these days, tourism is becoming a viable way of making up for the income of a family and many have made it work to boost income from their traditional sources. In some of the families the tourism sector is a new second livelihood which also has a positive effect on the reduction of economic dependence on the agriculture and other climate sensitive livelihoods.

### 2. Infrastructure Development

The development of the Regions' infrastructure has been connected to the Tourism Development and its development is an important goal. Investment in the development of tourism has resulted in the improvement of road infrastructure, communication service, power supply and tourism facilities. Better access has also had a positive impact on the relationship between the local communities and local urban centres, as well as on the tourists.

The latter have helped to improve the economic integration and access to markets, education and public services. In doing so, the tourism infrastructure creates not only a positive impact to tourism, but also for all society.

### 3. Livelihood Diversification

The people residing on the fringes of the lake Jaisamand used to have to do agricultural work, livestock and fishing. These continue to be at the core of regional economy and the other tourism related incomes. This has resulted in better livelihood and lessening the reliance of the rain-fed agriculture systems, thereby boosting their economic resilience. This change is particularly critical for the semi-arid areas where substantial climate variability can also translate into differences in agriculture yields and farm household's income. Thus, tourism is not only as an economic activity but it is also as an adaptation mechanism to livelihood.

### 4. Socio-Cultural Changes

Tourism has also had an impact on the social and cultural fabric of the region. There has been more interaction with visitors and with local people which has led to more awareness of the cultural heritage and traditional practices, and of the environmental resources. In many instances, the continuation and promotion of local traditions, handicrafts and local identity are due to the tourism.

At the same time, commercialization of tourism could lead to a change in the social practices as well. The ability to re-invent the old culture expressions with social/community function and towards visitors is rising. It is natural that such changes are made in a tourist destination and demonstrates the need for balancing the economic benefits with cultural authenticity.

In all, the socio-economic implications of the tourism are far from being negligible. But these benefits need to be sustainable, opportunities need to be equally distributed and ecological conditions – all important to tourism – need to be sustained.

**TOURISM IMPACT ASSESSMENT GIS APPLICATION**

Geospatial analysis might be helpful to analyse the geographic spread of tourism and the interaction with sensitive habitats of the environment. The zones of concentration of the tourism, the zones of high biodiversity and the zones of increasing environmental pressure were identified, using Geographic Information Systems (GIS) and the techniques of Remote Sensing.

**1. High level Tourism Pressure Zones.**

It was concluded from the spatial analysis that the tourist activities are concentrated on boating facilities, around the major vantage points, around concentrations of resorts and around major access routes. Most visitors - and most of the infrastructure development - occurs in these areas. These are thus more susceptible to environmental challenges such as waste accumulation, habitat changes and environmental stressors.

**2. Moderate Tourism is impacting the following areas.**

Moderate levels of impacts from tourism on nature trails, periphery recreational sites and occasional visitor sites. Less visited, less disturbed areas than the core tourism areas but a need to continue to monitor to ensure that there is no progressive change and deterioration of the environment.

**3. Low Tourism Pressures Zones (LTZs).**

Intensive tourism activity takes place in a relatively protected way in remote forest habitats, in core sanctuary areas and environment sensitive wetland areas. These areas continue to be productive wildlife areas, and are for the most part ecologically intact. They play a critical role in the ecosystem of the landscape, and contribute to biodiversity.

Spatial analysis also showed that there was a high overlap between the areas with rich biodiversity and areas where tourism is emerging. However, the scenic is important to the visitor too and is frequently where wetlands meet rivers and streams, and where forests meet wetlands. This co-occurrence can be a cause of tourism/biodiversity conflicts.

**A zoning management strategy is suggested to address these difficulties:**

1. **Core Conservation Zones**: Avoid high levels of tourism and development of intensive infrastructure in more sensitive and/or high biodiversity areas.
2. **Ecological Restoration Zones**: Degraded sites of habitat that need ecological restoration works should be the focus of ecological restoration and habitat enhancement programmes.
3. **The Sustainable Tourism Zones**: Tourism activities which minimise and contribute to the tourism conservation activities in the tourism zones.
4. **Careful use of recreation** (controlled Recreation Zones): Careful management of recreational use – through visitor management, environmental guidelines etc.).
5. **Community Use Zones**: Activities that will improve the quality of life for the community, are consistent with the conservation goals and are activities that can be supported will be included.

The GIS based assessment is just one of the methods where spatial planning and its importance in identifying potential areas for a tourism development that will protect and conserve ecologically important habitats. These kinds of solutions can help reduce the conflict between the conservation and development goals, and evidence-based landscape management of the Jaisamand landscape.

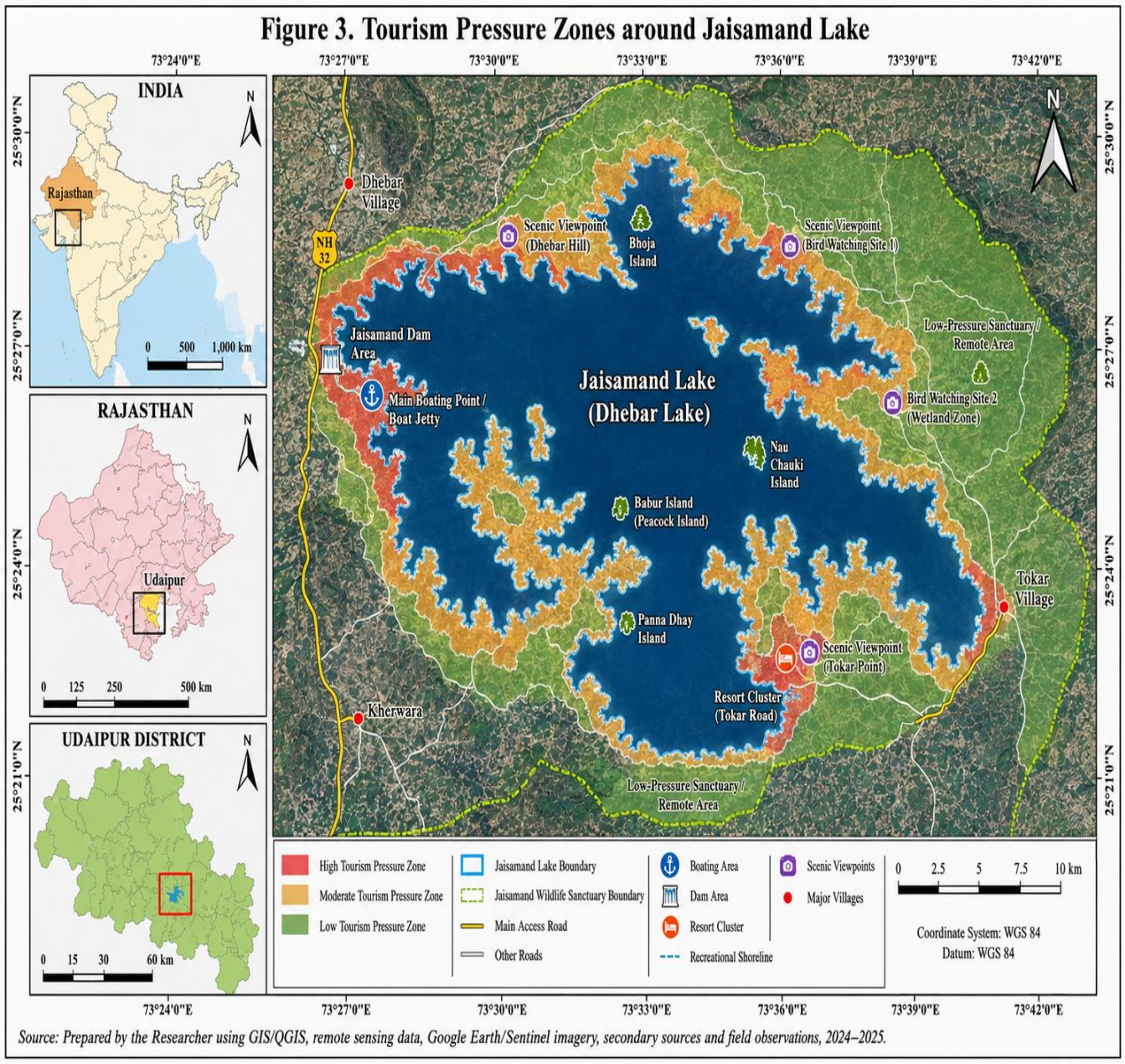



**Figure 3. Tourism Pressure Zones around Jaisamand Lake**

**Implications for policy and sustainable management strategies**

The results of the study show that the tourism in Jaisamand region has contributed significantly in economic development of the region but needs to be managed further without causing any environmental damage. What is challenging, is to keep the tourism sector as such in check and more specifically to ensure that tourism development is in harmony with the ecological nature of the Lake and the habitat.

**1. Environmental Management**

The first step towards sustainable planning for tourism is waste management which will cater for all the waste that can be generated or produced. To decrease the pollution of the tourism carrying areas, it is necessary to have systematic waste collection, separation and disposal systems. An introduction of the ban on single use plastic, and periodical and regular monitoring of the environment would help to mitigate the impact of tourism on the environment and the life of the ecosystem.

**2.Biodiversity Conservation**

Areas of high ecological value, such as wetland margins, riparian corridors and bird nesting areas, should be targeted for conservation. Habitat Restoration Projects can help support ecological resilience of disturbed habitat and projects that create and/or maintain habitat connectivity can help support wildlife movement and landscape persistence of species.

**3. Sustainable Tourism Planning**

Carrying capacity with ecological and social thresholds should be the basis to guide future development of tourism. The number of visitors, the development of infrastructure and the recreational activities need to be harmonized with the environmental capacity of the ecosystem. Through the use of the concept of ecotourism responsible behaviour of visitors can be encouraged and thus the conservation goals can be achieved.

**4. Community Participation**

Planning and managing tourism and the environment should be done with active participation of local communities. Ecotourism is an activity that could be promoted to enhance the economic opportunities and awareness of the conservation issues in the community. A greater degree of participation in decision making, also increases support for conservation programmes.

**5. GIS-Based Monitoring**

The use of GIS and Remote Sensing technologies can be part of the management strategies for regular monitoring. Spatial data can be used to: Monitor land use change; Identify new environmental pressures; Monitor Habitat change and monitor the effectiveness of conservation interventions with respect to land use change.

Finally, a comprehensive integrated management plan that incorporates ecological protection and community involvement, scientific monitoring and sustainable tourism planning would be the most appropriate integrated approach to the development of the region, and the conservation of the lake.

**The main findings of the study are:**

Important findings related to the effect of tourism development on the environmental sustainability in Jaisamand Lake region were given in the study.

1. Tourism is now an important economic activity in the region, and a source of employment and income diversification and infrastructure development.
2. The lake of Jaisamand is one of the popular nature based tourism destination because of its beauty, biodiversity, significance and recreation.
3. Tourism services are space focused around boating areas, around points of view; around resort clusters and around main access routes thus causing uneven distribution of environmental pressures.
4. At places of heavy visitors there are some localized environmental degradation. Common impacts are: solid waste, shoreline change, water resource depletion and water contamination.
5. Some areas of special ecological value or sensitivity such as wetland habitat, riparian corridors and areas of high biodiversity in particular are sensitive to disturbance due to tourism and are especially critical.
6. Tourism infrastructure can cause habitat fragmentation and thereby impact on the ecological connectivity/wildlife movement and ecosystem use and resilience.
7. Some components in the system, such as bird fauna and wetland species, are highly sensitive to disturbance, and may be sensitive at breeding and migratory times.

8. Thanks to tourism, the transportation, communication and public facilities have been improved as well as the tourism industry.
9. Livelihoods such as accommodation, transport, guiding, boating and handicrafts/small business diversify livelihoods of the local communities.
10. GIS and Remote Sensing techniques were identified as helpful tools to zoning the various levels of tourism pressure and the environment sensitive habitats and areas that need conservation action.
11. The areas of future development in tourism should be planned and protected carefully as they are overlapping with areas of biodiversity hotspot as revealed by spatial analysis.
12. Adaptive management, community involvement, ecological monitoring and integrating the development of tourism and biodiversity conservation are essential for sustainability.

Based on the overall results, it can be concluded that in general, tourism is a phenomenon that can be a problem or opportunity for Jaisamand landscape. Although economic benefits are important decisions should not be assumed on ecological considerations if to be made in the future development.

## CONCLUSION

Jaisamand lake is unique in ecological, cultural and tourism aspects in arid geographies of the Rajasthan state. The study reveals that the tourism has benefited the regional development in many positive ways which include job creation, infrastructure development, livelihood diversification and boosting the level of economic activity. All these benefits have helped to consolidate the importance of tourism in the local economy and also made the area more visible.

In conjunction with the increased level of tourism, environmental issues such as localized pollution, habitat fragmentation, modification of shorelines, waste accumulation, and wildlife disturbance have arisen. So far the impacts are relatively small, but may intensify if tourism development is not well managed and monitored.

The results reveal the high degree of correlation between the development of tourism and environmental protection. It's important that the lake and surrounding habitats are preserved so that tourism at Jaisamand can be sustainable in the long term. Not only would loss of wetlands, biodiversity and the quality of landscapes pose a threat to the health of the landscape, but they could also lead to a loss of economic return from tourism.

GIS based monitoring, habitat protection, ecological assessment, community involvement and carrying capacity based management should be part of future planning of tourism for sustainable development. An economics and environment approach to balance economic development and the protection of the environment and to support local livelihoods may be implemented through a conservation strategy.

If properly planned, supported by the institutions and with the cooperation of all the concerned people then the Jaisamand lake can become a model of sustainable wetland tourism in India. The future of the region depends on the ability of policy makers, local communities, conservation groups, researchers and tourism groups to regulate the growth of tourism and the conservation of natural resources. Conservation of Wetlands, Biodiversity and ecosystem services is not a hurdle in the path of development but a stepping stone towards development.

**REFERENCES**

Barbier, E. B., Hacker, S. D., Kennedy, C., Koch, E. W., Stier, A. C., & Silliman, B. R. (2011). The value of estuarine and coastal ecosystem services. *Ecological Monographs, 81*(2), 169–193.

Buckley, R. (2011). Tourism and environment. *Annual Review of Environment and Resources, 36*, 397–416.

Butler, R. W. (1980). The concept of a tourist area cycle of evolution: Implications for management of resources. *The Canadian Geographer, 24*(1), 5–12.

Davidson, N. C. (2014). How much wetland has the world lost? Long-term and recent trends in global wetland area. *Marine and Freshwater Research, 65*(10), 934–941.

Gopal, B. (2007). *Fundamentals of limnology*. Oxford University Press.

Gopal, B. (2013). Future of wetlands in tropical and subtropical Asia, especially in the face of climate change. *Aquatic Sciences, 75*(1), 39–61.

Hall, C. M., & Page, S. J. (2014). *The geography of tourism and recreation: Environment, place and space* (4th ed.). Routledge.

Honey, M. (2008). *Ecotourism and sustainable development: Who owns paradise?* Island Press.

Jaisamand Wildlife Sanctuary Management Plan. (2020). *Management plan of Jaisamand Wildlife Sanctuary*. Rajasthan Forest Department, Government of Rajasthan.

Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. (2015). *Remote sensing and image interpretation* (7th ed.). Wiley.

Mitsch, W. J., & Gosselink, J. G. (2015). *Wetlands* (5th ed.). John Wiley & Sons.

Rajasthan Tourism Department. (2023). *Tourism profile and destination information of Rajasthan*. Government of Rajasthan.

Ramsar Convention Secretariat. (2016). *An introduction to the Convention on Wetlands*. Ramsar Convention Secretariat.

Reed, M. S. (2008). Stakeholder participation for environmental management: A literature review. *Biological Conservation, 141*(10), 2417–2431.

Singh, R. B., & Mishra, D. K. (2012). Green tourism in mountain regions: Reducing vulnerability and promoting people and place centric development in the Himalayas. *Journal of Mountain Science, 9*(2), 280–287.

UNEP. (2011). *Towards a green economy: Pathways to sustainable development and poverty eradication*. United Nations Environment Programme.

UNWTO. (2018). *Tourism and the Sustainable Development Goals: Journey to 2030*. World Tourism Organization.

World Tourism Organization. (2004). *Indicators of sustainable development for tourism destinations: A guidebook*. World Tourism Organization.

Zedler, J. B., & Kercher, S. (2005). Wetland resources: Status, trends, ecosystem services and restorability. *Annual Review of Environment and Resources, 30*, 39–74.

Bhatta, B. (2010). *Analysis of urban growth and sprawl from remote sensing data*. Springer.

Jensen, J. R. (2016). *Introductory digital image processing: A remote sensing perspective* (4th ed.). Pearson.

National Remote Sensing Centre. (2011). *National Wetland Atlas: Rajasthan*. Indian Space Research Organisation, Hyderabad.

Roy, P. S., Behera, M. D., & Murthy, M. S. R. (2015). *Geospatial technology for natural resources management*. Indian Institute of Remote Sensing.

Bassi, N., Kumar, M. D., Sharma, A., & Pardha-Saradhi, P. (2014). Status of wetlands in India: A review of extent, ecosystem benefits, threats and management strategies. *Journal of Hydrology: Regional Studies, 2*, 1–19.

Kumar, R., Horwitz, P., Milton, G. R., Sellamuttu, S. S., Buckton, S. T., Davidson, N. C., Pattnaik, A. K., Zavagli, M., & Baker, C. (2011). *Assessing wetland ecosystem services and poverty interlinkages: A general framework and case study*. Ramsar Convention Secretariat.

MoEFCC. (2017). *Wetlands (Conservation and Management) Rules, 2017*. Ministry of Environment, Forest and Climate Change, Government of India.

Coccossis, H., & Mexa, A. (Eds.). (2004). *The challenge of tourism carrying capacity assessment: Theory and practice*. Ashgate.

Farrell, B. H., & Twining-Ward, L. (2004). Reconceptualizing tourism. *Annals of Tourism Research, 31*(2), 274–295.

Gössling, S. (2002). Global environmental consequences of tourism. *Global Environmental Change, 12*(4), 283–302.

Hunter, C. (1997). Sustainable tourism as an adaptive paradigm. *Annals of Tourism Research, 24*(4), 850–867.

Mathieson, A., & Wall, G. (1982). *Tourism: Economic, physical and social impacts*. Longman.