

Impact of Disasters on Tourism in India and their Management using GIS and Remote Sensing Techniques

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Abstract—*Tourism is an excursion activity, requires beautiful and adventurous locations and environments for its development. Geography is fundamental to the study of tourism, physical geography forms the essential background against which tourist places are created. Environmental impacts are major issues which are to be concerned in managing the development of tourism places. India has immense potential for the development of coastal tourism as it has a long coast line extending for about 7,517 km, from Gujarat to Orissa.*

Coastal disasters are a major threat for the development of coastal tourism in India. Major coastal disasters prevalent in India are Tropical Cyclones, Storm Surge, Tsunami floods etc. India has witnessed several coastal disasters in the last four decades.

Disaster impact can be reduced by the identification of risk, risk assessment, risk reduction.

Disaster mitigation can be achieved through the use of GIS and Remote sensing techniques. Tourist planners need to be aware of use of Aerial photographs and Satellite imageries.

Keywords: *Coastal tourism, coastal disasters, environmental impacts, risk assessment, risk reduction.*

1. INTRODUCTION:

Tourism is a leisure oriented temporary mobility which has spatial and temporal dimensions.

A tour represents a journey in that it is a round trip i.e., the act of leaving and then returning to the original point. In 1941, Hunziker and Krapf defined tourism as people who travel, the sum of the phenomena and relationships arising from the travel and stay of non-residents, they do not lead to permanent residence and are not connected with any earning activity.

Tourism is the only industry that sells a product but does not own. WTO defines tourism as “the activities of a person travelling outside his or her usual environment for less than a specified period of time and whose main purpose of travelling is other than the exercise of an activity remunerated from the place visited”. Tourism is a popular leisure activity, people travel for recreation, leisure or business purposes. Tourism is a highly fragmented activity it requires specific environments

and destinations for its location. The growth of tourism in general is related to three main factors: increased level of incomes, well developed transport facilities and greater public awareness of tourist places.

Geography is fundamental to the study of tourism, because tourism is geographical in nature. Tourism involves movement and activities between places and it is an activity in which both place characteristics and personal identities are formed, through the relationships that are created among places, landscapes and people. Physical geography form the essential background, against which tourist places are created. Environmental impacts are major issues which are to be concerned in managing the development of tourism places. Tourism is strictly a geographical phenomena which promotes physical development and resource exploitation. The existing competition in tourism industry demands new and innovative methods for the development of the tourist spots. In order to reach important tourist target groups it is vital to prepare information in a geo-media information system.

Tourism has proven to be a pillar of economic development for many regions around the world. In 2003, tourism was the largest business sector in the world economy, employing 200 million people, generating 3.6 million in economic activity and accounting for 1 in every 12 or 8 per cent of jobs worldwide. India is a place where people live with variety, thrive on diversity. Tourism in India is largest service industry with a contribution of 6.23% to the national GDP.

India has vast natural resources ranging from snow capped mountains, blooming valleys sea resorts, rolling rivers, dense forests, priceless mountains and places of cultural heritage. In spite of this India accounts for about 0.4% of the global tourism market. There is a need to develop tourist destination that can be managed scientifically to attract large number of international as well as domestic tourists.

2. COASTAL TOURISM IN INDIA:

India has immense potential for the development of coastal tourism. Coastal tourism is based on a unique resource combination at the interface of land and sea offering facilities of beautiful beaches, sceneries, rich marine and terrestrial flora and fauna, diversified cultural and historic heritage, healthy food and good infrastructure. The growth of tourism in coastal areas has reached its peak in recent decades. Coastal tourism strongly depends upon the climate, landscape and cultural settings of the place. India has a vast coastline extending for about 7,517 km from Gujarat to Orissa, thus India has best prospects for the development of coastal tourism. All the coastal states of India are engaged in tourism industry. Coastal India is geo-cultural region in the Indian sub-continent that spans entire coastline of India. Coastal India extends from the south Indian coastline along the Arabian Sea from the Gulf of Kutch in its western most corner and stretches across the Gulf of Khumbat and through the Salsette Island of Mumbai along the Konkan and southward across the Raigad region through cape comorin in South India and through Coromandal Coast along the Bay of Bengal until the eastern most corner of shoreline near the Sunderbans in Coastal India.

Andhra Pradesh: Situated on the south eastern coast of India. It is bordered by Bay of Bengal in the east. Andhra Pradesh is home of many religious pilgrim centres. Andhra Pradesh has many scenic hills, forests, beaches and temples. Hyderabad the city of Nizams is the capital of Andhra Pradesh lies here. Hyderabad is famous for its rich history, culture and architecture. The golden beaches at Vishakhapatnam, Yarada Beach and beaches of Vizag, Elliots, Maginapudi and Waltair are important tourist attractions. Andhra Pradesh attracts about 15578984 domestic tourist which is 21 per cent of the total domestic tourists in India.

Gujarat: is the seventh largest state in western India has an area of 75,686 sq miles, with a coastline of 1600 km. The state is bordered by Arabian Sea on the west. It is the tenth most popular state in the country for tourists with annual footfall of around 20 million tourists. Gujarat has many beautiful sceneries from Rann of Kutch to the hills of Satpura. Gujarat is the home of Asiatic Lions and is among the most important protected areas in Asia. Porbandar and Kodinar are important beaches. Gujarat accounts for 18861296 domestic tourists that is 2.5 per cent of the total domestic tourists.

Goa: is the smallest state of India located in the west India, bordered by Arabian sea on the western coast. Renowned for its beaches, places of worship and world heritage architecture. Goa is visited by large number of international and domestic tourists each year. Tourism is Goa's most important industry. In Goa tourism is mainly concentrated on the coastal areas. Some important beaches of Goa are Anjuna, Baga, Calangute, Miramar, Dona Paula, Bogmalo, Varca etc. Goa accounts for 441053 (2.5 per cent) foreign tourists.

Earnings from the tourist industry in Goa were around 4000 crores in 2007.

Karnataka: Is the fifth most popular destination for tourism among states of India. It has highest number of national protected monuments in India. Karnataka is famous for its waterfalls, Jog falls of Shimoga district is one of the highest waterfalls in Asia. The state has twenty one wildlife Sanctuaries and five national Parks. The state also have important beaches like Ankola, Gokam and Suratkal. Karnataka attracts about 38202077 domestic tourists which is 5.2 per cent of the total domestic tourists.

Kerala: Located on the Malabar coast of South West India flanked by Arabian sea on the west. Kerala known as 'God's own country' is famous for its beautiful beaches, houseboats and greenways. Kerala is also known for its tropical backwaters. Some of its pristine beaches are Kovalam, Kollam, Shankmugham, cherai, Varkala, Calicut beach and Silver beach.

The state promotes ecologically sustained tourism focuses on the local culture.

Maharashtra: is the most visited state in India by foreign tourists bordered by Arabian sea on the western side. Mumbai is most important place which attracts tourists, coastal tourism is also quite developed. Maharashtra has several pristine national parks and reserves, some of the best one are at Tadoba. Maharashtra has amazing wildlife destinations like Koyna and Nagzira.

Mawari, Erangal, Alibagh and Hamai.

Maharashtra attracts approximately 48465492 (6.5%) domestic and 5083126 (28.5%) foreign tourists every year.

Orissa: lies on the eastern coast of India flanked by Bay of Bengal on the eastern side. It has many pristine sea beaches. Important beaches of Orissa are Puri and Konak. Orissa is the home for tribal communities, their culture, handicrafts different dance forms have got worldwide recognition.

Pondicherry: the most popular tourist destinations in south India. It comprises four coastal regions- Pondicherry, Karikal, Mahe and Yonam. City beach is a famous tourist destination.

Tamil Nadu: Is the southernmost state of India bordered by the Indian Ocean. Tamil Nadu has maximum number of UNESCO World Heritage Sites. It provides scenic view of sunset and sunshine over the Indian ocean. Picharanum the world's second largest mangrove forest is located here. Kanya Kumari is the southernmost tip of India located here. Many wildlife sanctuaries and waterfalls are also located here. Marina beach is most important beach. Tamil Nadu attracts 111637104 (15.1%) domestic and 2804687 (15.7%) foreign tourists every year.

West Bengal: Kolkata the capital of West Bengal is called the city of palaces and the city of Joy. West Bengal is famous for

Sunderbans largest mangrove forests in the world, the state is home of five national parks. Digsha is an important beach. Sunderbans are noted for a reserve project conserving the endangered Bengal Tiger. West Bengal accounts for about 21072324 (2.8%) domestic and 1192187 (6.7 %) foreign tourists every year.

Andaman and Nicobar and Lakshadweep islands have many beautiful beaches and a well developed coastal tourism.

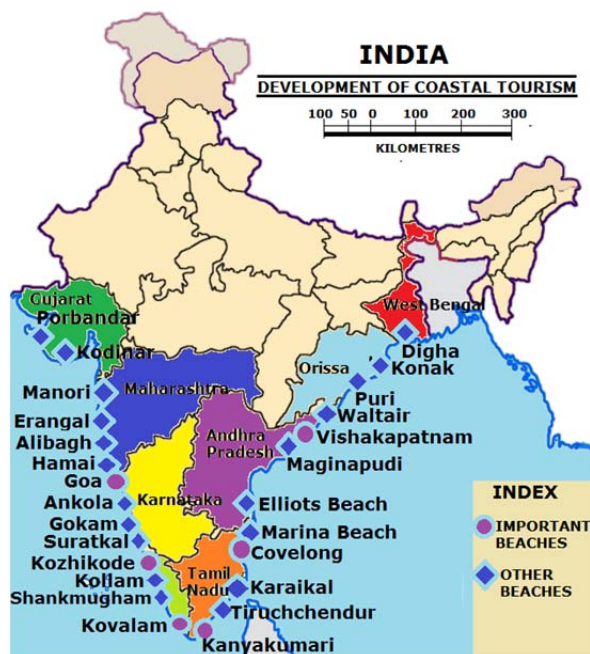


Fig. 1: Coastal Tourism in India

3. TYPES OF DISASTERS AFFECT COASTAL TOURISM:

Around fifty per cent of the world's population lives near or on the coast. India is no exception. Major coastal disasters faces by India are tropical cyclones, storm surge/ tidal floods, coastal erosion, sea level rise and tsunamis. India has witnessed several major disasters in the last four decades among these Super Cyclone of Orissa October 29th 1999, floods in Orissa during July 2001, Gujarat earthquake of 2001, Great Indian ocean Tsunami of December 2004. Many types of disasters hit India due to its varied geographical, geological and climatic conditions. The impact of disaster is increasing manifold because of explosive growth of population. The population pressure forces people to live in hazard prone areas which not suitable for human habitation.

Tsunami: Tsunami or harbor waves originate under sea or coastal seismic and volcanic activity, sea water is displaced with a violent motion and swells up, ultimately surging over land with great destructive power. Tsunami consists of ten or more waves.

The Indian ocean Tsunami of 2004, has depicted how national and international tourists had faced the tragic consequences. About 270,000 people died and injured half a million others and as many as five million affected directly or indirectly in. Coastal resorts in India and Malaysia were hit, and January 2005 saw an 85 per cent decline in international tourists. This incidence is considered as the greatest catastrophe ever recorded in the history of world tourism.

Cyclones: Tropical Cyclones are intense low-pressure areas confined to the areas lying between 30° N and 30° S latitudes. Tropical cyclones are characterized by large pressure gradients. The centre of the cyclone is mostly a warm and a low pressure, cloudless core. The entire coast of India is exposed to cyclones, Tidal waves and storm Surge, on an average five to six tropical cyclones strike annually. Every year the eastern coast is affected by cyclones. During 1890-2000 nearly 308 cyclones affected the Eastern coast. Some important cyclones struck the Indian coast are:

Super –cyclone with winds 260-300 km/hour hit the coast of Orissa on 29th October 1999, with a storm surge that created the Bay of Bengal water level 30 feet higher than normal. The super storm ravaged more than 200 lakh hectares of land, devouring trees and vegetation, leaving behind a huge trail of destruction, killed thousand and devastated millions.

Bengal cyclone struck the coast of Calcutta in 1942 killed 40,000 people.

Cyclone Laila struck the Andhra coast, 30,000 had been evacuated from low lying areas.

Cyclone struck Bombay in 1948 created havoc and heavy loss of life and property. Another cyclone struck Gujarat coast near Porbandar in 1948, 1173 people killed, 1774 were missing caused loss of property worth Rs. 1865.38 crores.

Storm Surge and Tidal Floods: A storm surge is a sudden rise in sea level, which is associated with an approaching storm. The winds create high waves over the oceans and the coastal waters caused by tropical cyclone may produce a flash flood. Flash floods can prove great disasters in the coastal areas. The height of the waves exceeds up to 2 to 3 meters.

Events mentioned above and many more are dangerous for the safety of the tourists.

Despite, this relatively less systematic research has been carried out on impact of disasters on tourism industry and responses of governments, to learn from every event and develop strategies for avoiding such events in the future.

4. TOURISM DISASTERS CAN BE REDUCED BY THE FOLLOWING MEASURES:

Identification of risk: Risks are far greater and can be disastrous if not identified and properly addressed in terms of reducing the probability of the risk, where feasible, protecting assets through shifting all or a percentage of risk, and

minimizing the potential harm of the risk in a disaster event. The potential risks can be identified and priority profile needs to be prepared for different hazards and risks, it needs to be recognized that tourists are vulnerable

In tourist places as they don't know the local geography and thus they suffer more than the local people. It is therefore essential that on the basis of historical records of the region the tourists must be informed about the possible hazards and their remedies if any like does and don'ts during disaster, evacuation routes etc.

Risk Assessment: Involves the assessment of location, the process, the environment, the structure and related factors. The assessment of potential risks and hazards in a destination can be made with the help of history of natural disasters in the region, the satellite images of the current and emerging environments. The risk assessment includes the assessment of location, the process, the environment, the structure and related factors. An assessment identifies which potential risks are greatest and which potential risks are substantially lower in terms of economic losses, potential of injury and death and other potential losses.

Disaster Risk Reduction: After the assessment of potential risks an effort is made to minimize the risks. Disaster reduction and mitigation can lessen the disruption caused by natural disasters, save lives and protect property. In tourist destinations strategies for disaster reduction can play an important role because tourism is a global phenomenon, involving the movement of millions of individuals on the globe.

Public Awareness: The introduction of public awareness programmes about vulnerabilities is a *sin qua non* for disaster prevention, mitigation and preparedness. For awareness generation electronic media and information systems can be used for dissemination of information and evacuation measures.

Disaster mitigation can be achieved through risk assessment, disaster prevention and disaster warning, a useful source of information, reducing the time and cost of scientific assessment. So, there is a need to bring the geographers, environmentalist and tourism planners more closely together for resort planning, and disaster mitigation. Careful coastal planning should not be neglected in low lying areas and in all the coastal zones vulnerable to natural disasters such as coastal flooding, storm surges, cyclones and tsunamis. The coasts are vulnerable because of sea level rise due to climate change and resultant melting of polar ice caps and glaciers. The availability of high spatial resolution aerial photographs are highly recommended for the study of tourism resorts. Scanned photos after importing into GIS software and then be used for the mapping of tourism resorts and facilities.

5. APPLICATION OF REMOTE SENSING AND GIS TECHNIQUES FOR THE MANAGEMENT OF TOURISM DISASTERS:

Management of Coastal Disasters require an understanding of coastal processes, vulnerability of hazards, identification of risky areas and development of mitigation techniques. Remote Sensing techniques can be effectively utilize to understand and mitigate coastal zone hazards (Rajawat and Nayak, 2000).

6. APPLICATION OF SPACE TECHNOLOGY IN COASTAL DISASTER MANAGEMENT IN INDIA:

Disaster	Data used for	Mitigation
Tropical cyclone	Detection, Monitoring and Evaluation, mapping of damages.	Cyclone Warning
Storm Surge and floods	Storm surge/ flood forecasting, mapping of inundated areas and selection of relief distribution sites	Mapping of the hazard prone areas, vulnerable to storm surge and floods.
Coastal erosion	Monitoring of shoreline changes and coastal erosion.	Mapping of risk zones and prediction of shoreline changes.
Earthquakes	Detection of surface deformations, monitoring of fault lines, database preparation.	Identification of risk zones, mapping of active faults measurements of fault displacement.

Space technology plays a crucial role in the coastal disaster management in India. The Indian satellites, the INSAT series, the INSAT-3A and 3D. The satellite data is extremely helpful for disaster mitigation, prevention, monitoring, damage assessment, relief and rehabilitation of disturbed population. In addition to this ISRO has planned improved sensors in its Megha Trophiques Mission, for providing information related to weather elements like water vapour, cloud, precipitation, wind speed and radiation budget in the equatorial orbit with repetivity. Storms, Cyclones and other wind related hazards can be detected by Storm warning Radars. Radar units transmit a beam towards a target and then record the reflected scattered beam of radiation. The centre of the cyclone generally appears as a cloud free circular zone, and the eye is usually seen as a small circle at the centre of the cyclone. The Doppler effect or change in frequency enables us to determine whether the target is in motion and if so, what is the direction of the motion. Tropical cyclone forecasting involves, locating the position of the cyclone, assessment of intensity of the cyclone and prediction of future movement of cyclone. For damage assessments in the post cyclone period high resolution data of IRS-1C/1D LISS-III and PAN can be used. The Satellite data is also useful for disaster prevention along the coastal areas.

Storm Surge and Tidal floods are associated with the cyclones cause heavy destruction in the coastal areas. IRS-P4 OCM data is useful to understand the impact of flooding due to super cyclone hitting the Orissa coast in October, 1999 (Nayak et al., 2001).

Earthquake prone areas and damages caused by earthquakes can be easily assessed by Remote Sensing data. The Synthetic Aperture Radar (SAR) interferometry techniques are extremely useful in detecting early deformation of the crust due to an earthquake.

Through the use of Remote Sensing and GIS technology we can develop tourist destinations very successfully particularly in the remote areas where impact of disasters minimizes the prospects of tourism, in all those areas which are prone to hazards and disasters the Remote-Sensing and GIS data bases can provide valuable information about the safer locations. The periodic applications can track and monitor the cumulative impact of Land use change, within short period of time with little manpower a large amount of data can be obtained and analyzed. The Imageries and aerial photographs permit the interpreter to intensively study an area and infer information.

In the field of recreation studies, a lot is still to be done with aerial photographs. Aerial photographs have better spatial resolutions, they can be used to make inventories of tourism places, resources and facilities. Aerial photographs can also be used to interpret tourism activities, by comparing of photographs of different time period, changes in recreation and tourism can also be traced, the tourism potential maps can be generated.

The vulnerability of tourism to risk, crisis and disaster has long been evident (Sharpley, 2005). At the tourist places for the safety of tourist it is essential that tourists must know the geography of their surroundings so that at the time of onset of a disaster they must know the location of critical support services such as shelters, evacuation routes, hospitals, fire stations, police stations and airports. The disaster risk management for sustainable tourism in India and the world can be undertaken to reduce the vulnerability of the tourism sector to natural hazards.

Tourists at vulnerable destinations are more exposed to disasters than the local people because they are less aware of local hazards and they are less independent also unfamiliar surroundings and high priority must be placed to their safety. The exposure of tourism to natural disaster is linked with the attractiveness of many high risk exotic locations. (Murphy and Baylay) (1989). The tourists also have high risk of hijacking and terrorism (Lehman 1986). Mostly the tourist destinations have risk of natural disasters like hurricanes, cyclones, floods landslides, which can easily be monitor and predicted with remote sensing and GIS satellites.

Tourism planners need to be aware of various sources of information such as aerial photographs and satellite images are

very rarely used by tourism planners. They are however, a useful source of information, reducing the time and cost of scientific assessment. So, there is a need to bringing the geographers, environmentalist and tourism planners more closely together for resort planning and disaster mitigation. Due to availability of high spatial resolution aerial photographs are highly recommended for the study of tourism resorts.

Scanned photos after importing into GIS software and then be used for the mapping of tourism resorts and facilities.

7. CONCLUSIONS:

Tourism disasters are very common in the coastal areas and need a mitigation strategy which can successfully reduce the impact of disasters. Remote sensing and GIS techniques have great potential for reducing the tourism disasters and development of new destinations in the disaster prone remote areas of India. Tourism disasters can be avoided with the help of disaster management techniques. Disaster planning, risk assessment, preparedness and mitigation are the act through which we can reduce the impact of tourism disasters.

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