



Use of Geospatial Techniques to Manage the Tourists & Administration: A Case Study of Mount Abu, Rajasthan

Rajeev Singh Chandel and Shruti Kanga*

Centre for Climate Change and Water Research, Suresh Gyan Vihar University, Jaipur (India)

*Email: shruti.mgi@gmail.com

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Abstract

Tourism is extremely acknowledged as a crucial supply of economic gain to any country. The success of any tourism business can be easily determined by its tourism planning, development and marketing. The best site selection for tourism development and the best way to facilitate the tourists is to exchange information using GIS tool and this help in economic development and information needs for the whole society. In this study GIS, being used as a tool for data mapping and analysis to serve as an efficient and effective tool for the tourists. GIS technology used to integrate various data sets both qualitative and quantitative in a single system. Similarly, the effective planning and information exchange also determine the success of the tourism industry. The main aim of this exploration is to locate the capability of geospatial procedures and to encourage the tourism and administration in the Mount Abu of Rajasthan. Geospatial innovation offers a scope of chances for the improvement of current tourism applications utilizing digital maps. The use of spatial and non-spatial database information is to facilitate in visualizing, analyzing and to querying through digital maps to the present and upcoming tourists. The GIS Data set has been created by extensive survey and analysis. On the other hand, Global Position System (GPS) is used to collect the spatial information. The base map used for this study is IRS CARTOSAT 1 Satellite data. Thematic layers have been used for providing basic tourist facilities such as hotel, home stay, guest house, transportation, food hubs, heritage sites, bank, ATM, post office, police help, health facilities and all the tourist attraction sites etc., has been developed. Present study deals with how to facilitate the tourists in Mount Abu as well as to develop a GIS based information system for the administrators of government officials or planners, which will also help in management, and the department of tourism for enhancement and beautification of site.

Introduction

In India tourism always contributed significantly to the economy and socio-economic development and growing at a very rapid pace (Kanga *et al.*, 2011; Kanga *et al.*, 2017). According to the World Travel & Tourism Council it has been calculated that tourism generated 14.02 lakh crore (US\$220 billion) or 9.6% of the nation's GDP in 2016 and supported 40.343 million jobs, 9.3% of its total employment. About 88.90 lakh (8.89 million) foreign tourists arrived in India in 2016 compared to 80.27 lakh (8.027 million) in 2015, recording a growth of 10.7% (Tisca *et al.*, 2016; Allen *et al.*, 1999). This helps in revenue generation for the country and creates a good image throughout the world. According to Kushwaha, (2011) "Tourism is a composite of activities, facilities, services and industries that deliver a travel experience, i.e. transportation, accommodation, eating and drinking establishments, entertainment, recreation, historical and cultural experiences, destination attractions, shopping and other services available to travellers away from home".

Tourism comes under service industry and aimed to facilitate the users comes across the globe (Ayed *et al.*, 2010; Baghipour *et al.*, 2015; Roy *et al.*, 2017). Tourists are people who are travelling and staying in places outside their usual environment, for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited (Bunruamkaew, 2012; Fadahunsi, 2011; Sadhu *et al.*, 2017).

In this association it is additionally characterized tourism as an administration industry that deals with guests when they are far from home. Additionally, tourism is characterized as total of the wonder and connections emerging from the collaboration of traveller and host groups during the time spent pulling in and facilitating these sightseers, and different guests (Mohd and Ujang., 2016; Riasi and Pourmiri, 2015; Tomar *et al.*, 2017; Singh, 2016). Sightseers are individuals who are voyaging and remaining in places outside their typical condition for not in excess of one continuous year for recreation, business and different purposes not identified with the activity of a movement compensated frame inside the place went by (Wei, 2012; Singh *et al.*, 2017; Singh and Kanga, 2017). Geospatial approach was used for allocation of potential tourism gradient sites in Mount Abu, Sirohi District in Rajasthan, India. Mount Abu is the only hill station in Rajasthan. It used to be a preferred leisure destination of the ruling royal family back when the Maharajas reigned. It is present at the highest point of the Aravalli's ranges, located at elevation of 1165 m or 3822 ft on a distinct rocky plateau above sea level and is situated amidst the lush green hills. Mount Abu has several attractions, healthy climatic conditions and easy accessibility. Rajasthan state is one of the most important part of India which has a major tourist attractions and is full of tourists throughout the year due to heritage structure mainly Fort, Hawellies etc. All these make Mount Abu an attractive destination throughout the world. It is suggested that Geographical Information System (GIS) can have great potential for tourism development to facilitate the tourist through mapping from future prospective.

Materials and Methods

Study Area: The history of Mount Abu is wrapped up in legends. According to one, Mount Abu derives its name from Mount Arbud when the youngest son of Himalaya, along with the assistance of a snake called Arbud flooded the gorge in the area with water to save Shiva's revered bull. In the Puranas the region has been referred to as Arbudaranya, ("forest of Arbhu") and 'Abu' is a diminutive of this ancient name. It is believed that sage Vasistha retired to the southern spur at Mount Abu after following his differences with sage Vishvamitra. The history of Mount Abu indicates that it was once under the rule of the Chauhan dynasty and later served as a summer retreat for the royalty. The British too favoured this region and made it their impromptu getaway from the heat and dust of Rajasthan.

The Mount Abu is one of the important part of Sirohi district and the only hill station in Rajasthan State near Gujrat border. The Spatial Location of Mount Abu is (24.5926° N, 72.7156° E) at the elevation of 1,220 M above mean sea level. It is situated on a high rocky plateau in the Aravalli Ranges which is surrounded by forest, it also offers a relatively cool climate and views over the arid plains below. In Mount Abu, Nakki Lake is a popular spot for boating and tourist point of view. Mount Abu is the highest peak in the Aravalli Range of Rajasthan state in western India. It is located in Sirohi district. The mountain forms a distinct rocky plateau 22 km long by 9 km wide. The highest peak on the mountain is Guru Shikhar, at 1722. It is located at a distance of about 185 km from Udaipur, 221 km from Ahmedabad, 264 km from Jodhpur, 500 km from Jaipur and 765 km from Delhi. Location of the Mount Abu, Rajasthan is displayed in Fig. 1. Mount Abu is immensely famous for its tourist spots. The main reason is the amazing climate condition which prevails in the region all year round. It stands on an enormous, detached mass of gneissic rock, which rises steeply out of the flat plain, and stands well apart from the rest of the Aravalis Mountain.

Data Set: In this study both primary as well as secondary data have been used. The primary information is gathered through intensive field work, by visiting different destinations of the study region utilizing a handheld Global Positioning System (GPS) to obtain POI (Point of Interest). On the other hand, secondary data have been collected from published as well as unpublished sources. Published sources mainly include those articles or information, which is already referenced or printed in the magazines, journals, newspaper and books of different sources. And published data has been collected from different government Sirohi Municipal Corporation, railway department, department of tourism, department of transportation and other non-government agencies. The flow chart of the methodology used is shown in Fig. 2. The main objective is to find suited tourist spots, how the geospatial technology helps the tourists, optimum utilization of maximum resources for tourist welfare and guidance. Since the study is focused on GIS and Remote Sensing to facilitate the tourist within the country and outside the country using geospatial database. Geospatial database has been created by the use of the software mainly ArcGIS 10.5 and ERDAS Imagine 2015.

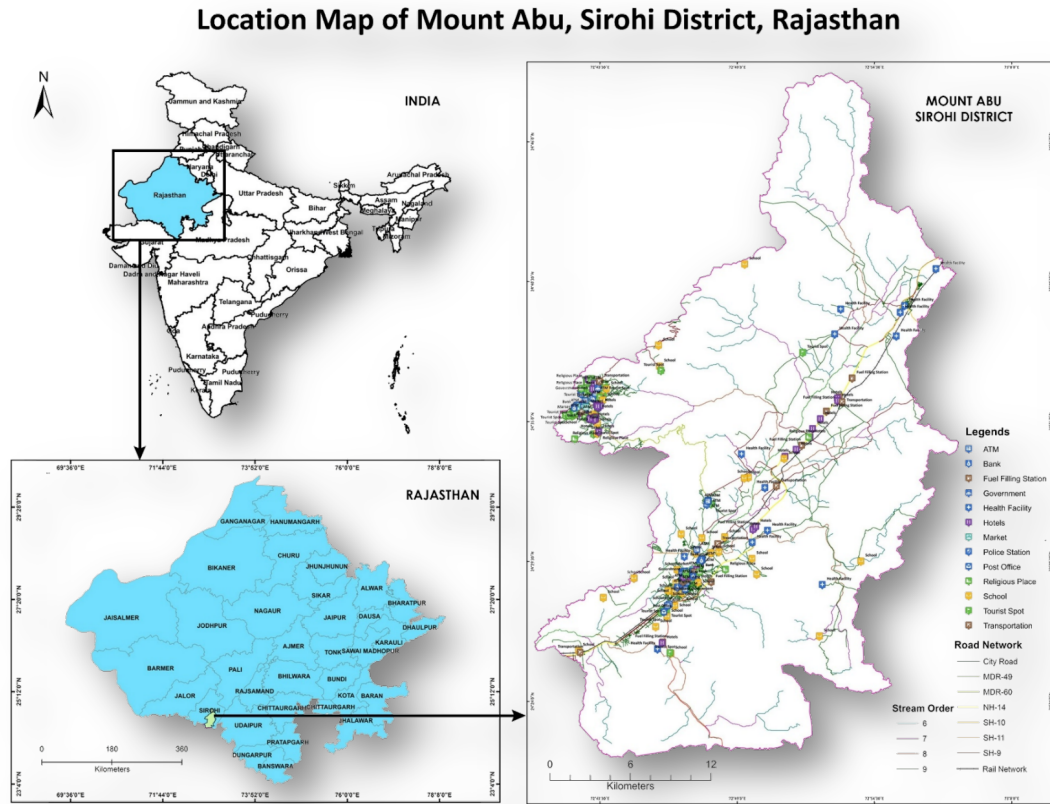


Figure 1 Location Map of the Mount Abu, Rajasthan, India.

In order to provide better prospect to the tourist various locations has been acquired by Global Positioning System (GPS). After that categorization of various Point of interest (POI) has conducted for data processing. These categorization is necessary to evaluating the features geospatially. It helps a lot in identifying the particular feature in the group. The procedure involved during the spatial database creation is as follows. Firstly, the primary data of POI has been collected through GPS i.e. hotels, government offices, railway stations, bus stand, post office, banks, ATMs etc. and secondary data of government and private organizations mainly tourist spots, parking information. Secondly all the collected information has been digitised using ArcGIS 10.5 software in point, line & polygon form. To make data more informational attribute values has been added in the form of local address, categorization and location details. Validity of the data is totally depending upon the ground truth of the POI location. In other words, we called as field verification of the data. After all the quality checks next step is to represent the data in form of maps using legends, scales, grids and labels. The GIS database of

Mount Abu is consisting of road network, tourist spots, important places, stream networks, aspect, slope and contour lines etc (Figure 2).

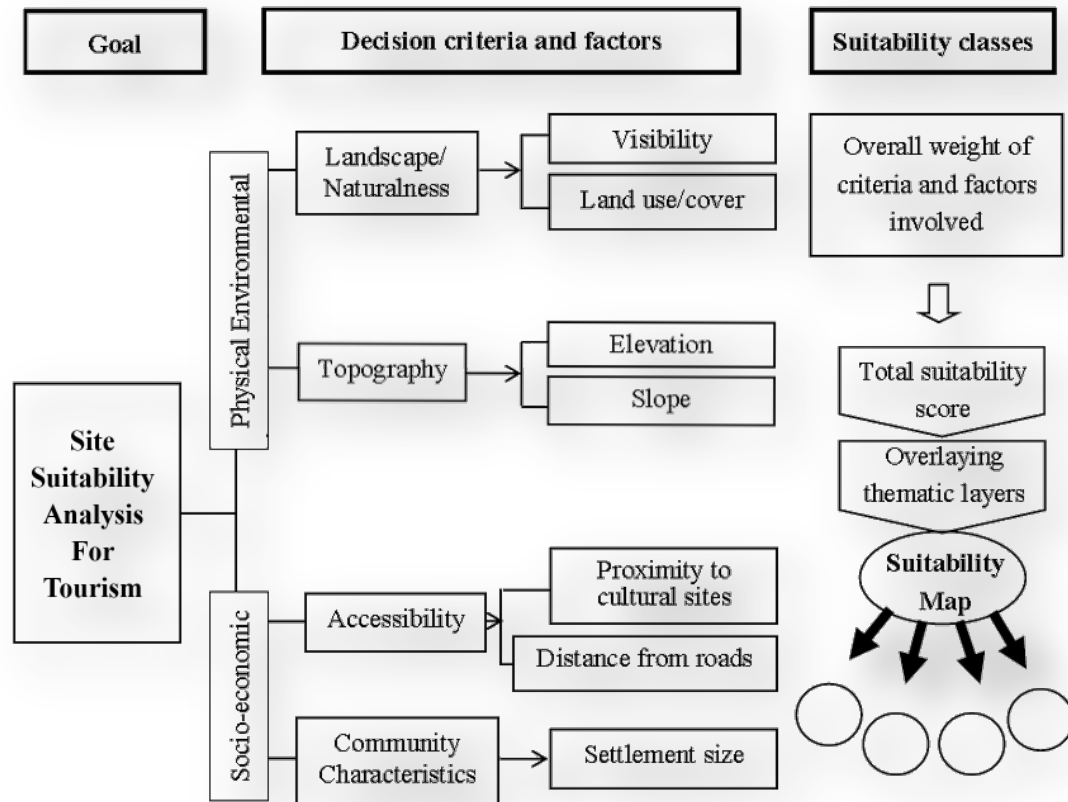


Figure 2 Flow Chart of Methods

Result and Discussion

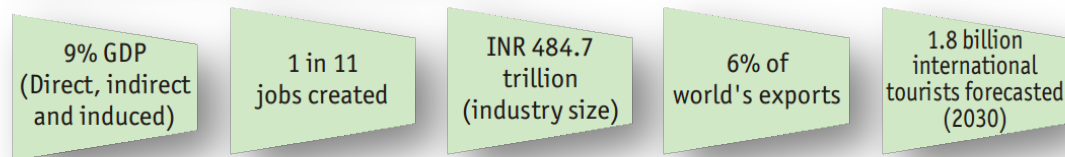
Physical Features: Rajasthan has had a significant share of foreign tourism in the country with 7.2% FTAs in India. The state has a fully operational international airport at Jaipur, with flights to Dubai, Sharjah, Bangkok and Singapore. The Tourism policy of the state has been successful in identifying the key sectors in tourism such as heritage hotels, MICE, etc., and provides fiscal benefits for developing the same. The state government is encouraging Joint Ventures (JVs) and contract management of private heritage properties (forts, fortresses, palaces and hawellies) as well as identifying heritage government properties to award on a lease basis. Some of the focus areas and projects initiated by the state are as follows:

1. Development of a 'Mega Desert Tourist Circuit' comprising Bikaner, Jodhpur, Jaisalmer, Pali, Mount Abu and Sambhar by heritage conservation, landscaping and other works.

2. 16 air strips to be improved/ renovated and commercial airlines to be invited to start operations construction of way side facilities of RTDC situated on National Highways.
3. Jaipur to be developed as a MICE destination given its international connectivity.

Analysing the states, the tourism infrastructure and the initiatives proposed by each of them, a set of broad recommendations are proposed which will enable the states in achieving the desired growth in the tourist numbers (Farsari, 2003; Guan *et al.*, 2011). Tourism industry today has turned into a key driver of socio-economic progress through the creation of jobs, enterprises and infrastructure development globally. Over the past six decades, tourism has experienced continued expansion and diversification, to become one of the largest and fastest-growing economic sectors in the world. Past years have seen the global Travel & Tourism industry growing at a higher rate than significant sectors such as automotive, financial services and health care. In 2014, the Travel & Tourism industry generated INR 484.69 trillion and 27.7 crore jobs for the global economy*. India has a huge potential to become a preferred tourist destination globally with both foreign and domestic tourist numbers rising each year. India sees the 11th largest tourist inflow in the Asia-Pacific region and the 42nd worldwide, according to India Tourism Statistics 2013. The table below shows the foreign tourist arrivals in India over the years. The tourism growth statistics, 2014 has shown in Figure 3.

Global tourism industry statistics, 2014



Source: Annual Report 2014, World Travel and Tourism Council

Figure 3 Tourism Growth Statistics, 2014

*Note: Statistics taken from FICCI Tourism Infrastructure the Role State Play, 2015.

Mount Abu is the highest peak of the Aravalli Range within the state of Rajasthan. It consists of various geospatial features mainly in the form of point, line and polygon using Arc GIS 10.5. Contour mapping has been done using Cartosat-1 DEM of 10-meter interval as shown in Fig.5 (A), 5 (B).

DEM (Digital Elevation Model) Map is a 3D Representation of terrain surface. It provides a very valuable information regarding earth surface. Most of the elevation data are stored in a digital elevation model that can be analysed in conjunction with other spatial data in a GIS. A digital elevation model (DEM) is defined as a file or database

containing elevation points over a contiguous area. It is also very helpful contour mapping and also a very high quality cartographic mapping of features. And this leads to engineering and managing solution to complex integrated resource management problems, especially for micro-level development.

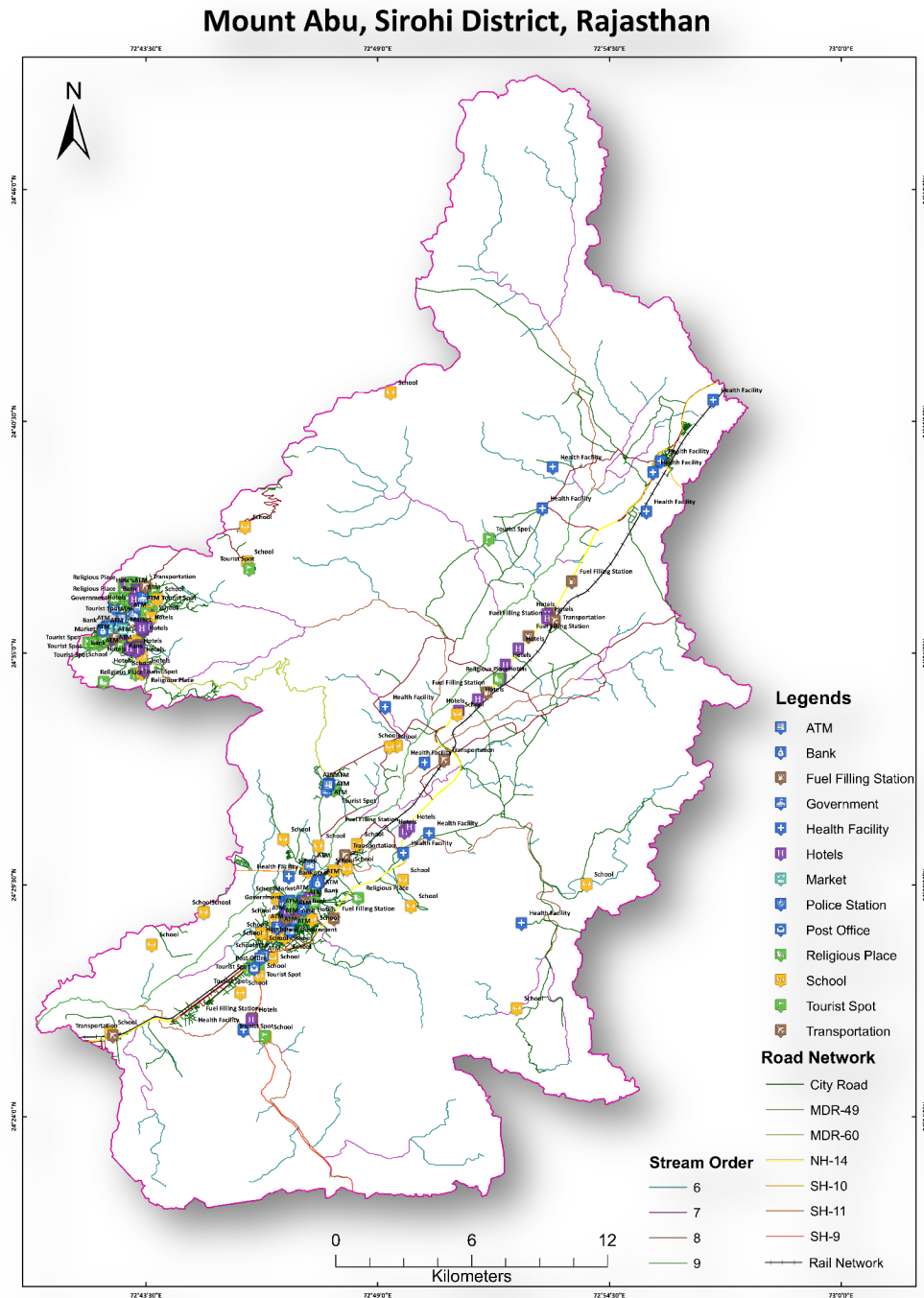


Figure 4 Area of Interest (AOI) of Mount Abu, Sirohi District, Rajasthan, India

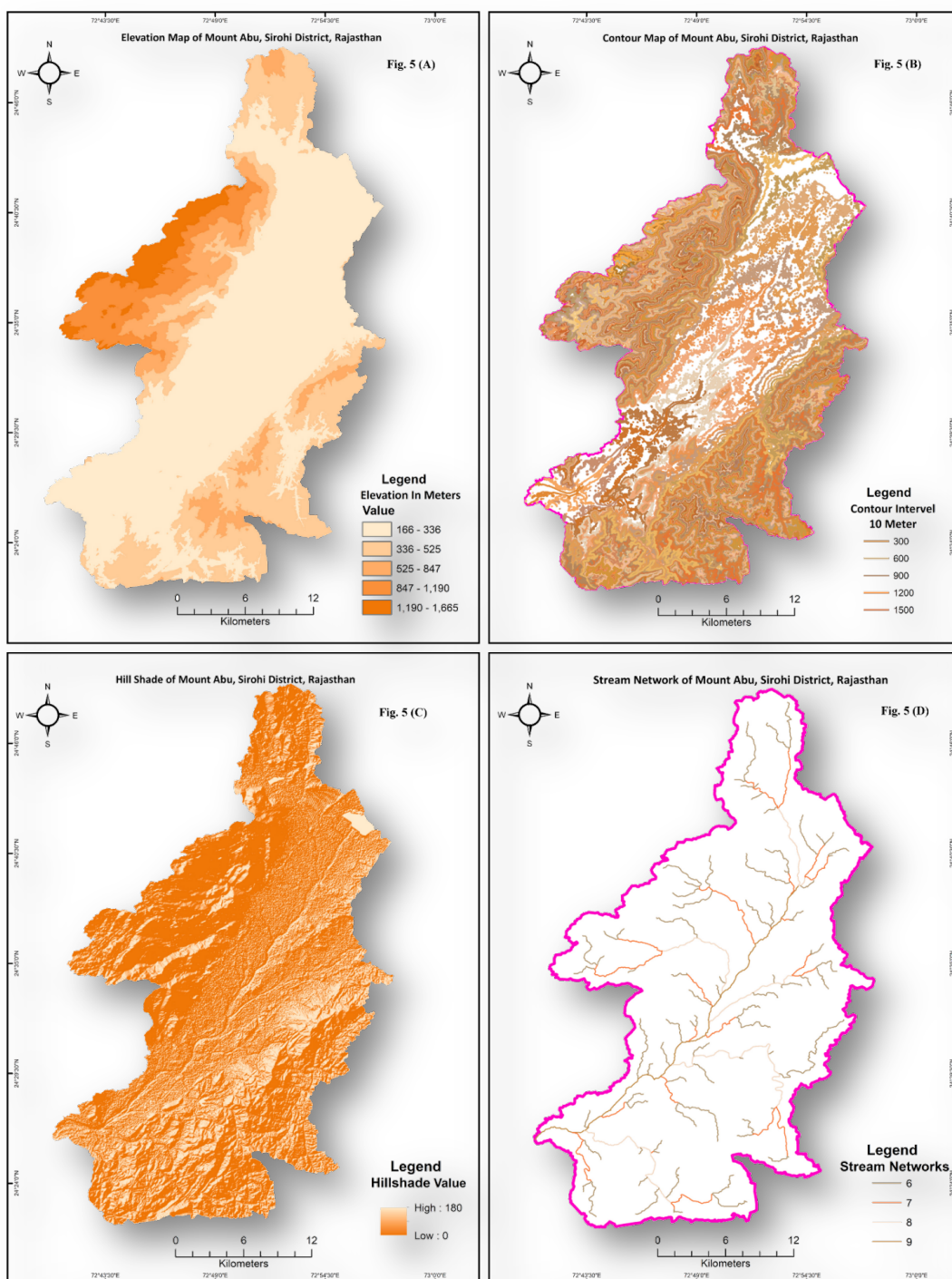


Figure 5 (A) Elevation Map, Figure 5 (B) Counour Map, Figure 5 (C) Hill shade and Figure 5 (D) Stream Network of Mount Abu, Sirohi District, Rajsthan

In emerging Indian scenario is the combination of the availability of data product, the facilities for processing of the digital data and the research trends for proper governance and better tourism in Mount Abu. Mount Abu is lying between 300M to 1500 M from mean sea level as shown in Figure 5 (B) it remains moderate and pleasant in summer. However, in winters the nights are often frosty. Maximum rainfall (av. 1500 mm) is during July-September, from the south-west monsoon. Hill shade of the AOI is also provided for better prospect to analyse the area and its value ranges from 0 to 180 in Figure 5(C). Temperatures on the plateau ranges from -2°C to 35°C . The vegetation of the area varies from xeromorphic sub-tropical thorn forest in the foothills to sub-tropical evergreen forest along water courses and valleys at higher altitudes. The stream network has also been provided for better analysis as shown in Figure 5 (D). In Mount Abu infrastructural works like the expansion of build-ups, increase or road and railway networks, better transportation facilities as well as health care facilities to promote tourism at a large scale. Location of different features present those facilitates the tourists in Mount Abu has been shown through different maps Figure 6-17

Prime Attraction:

Gaumukh Temple: A natural spring flowing through a sculpted cow's head gives the shrine its name.

The famous 'Yagya' of Sage Vashishtha was performed here. A beautifully sculpted hill temple of Arbuda - the mighty serpent, stands against the beautiful backdrop. Nearby is the magnificent marble image of Nandi, the celestial bull rescued by Arbuda.

Nakki Lake: A tiny lake picturesquely set amid hills. The lake is dotted with several islets approachable by a boat of particular interest are strange rock formations around the lake. Especially notable is the Toad Rock which looks like a real toad about to jump into the lake. Others are Nun Rock and Nandi Rock etc. Set in the heart of the town, the lake gets its name from the legend that it was scooped out by the gods with their finger nails or 'Nakh'. It is the only artificial lake in India that is 1200 Mts. above sea level.

Delwara Jain Temples: These beautifully carved temples built between 11th and 13th century A.D. is sheer elegance in marble, dedicated to the Jain Tirthankaras. The Vimal Vasahi temple is the oldest of these dedicated to the first Tirthankara. Built in 1031 A.D. (by Vimal Shah - a merchant and representative of the then Gujarat ruler), it is superb example of temple architecture. The central shrine has an image of Rishabhdev and large courtyard with 52 small shrines, each housing a beautiful statue of Thirthankaras with 48 elegantly carved pillars from the entrance to the courtyard. The Lun Vasahi Temple, dedicated to the 22nd Tirthabnkara - Neminath, was built in 1231 A.D. by two brothers- Vastupal and Tejpal, Ministers of Raja Vir Dhawal, a ruler of Gujarat - belonging to the Porwal Jain community. With door casings, pillars, architraves, and sculptures on porticos, the temple is a fine specimen of craftsmanship.

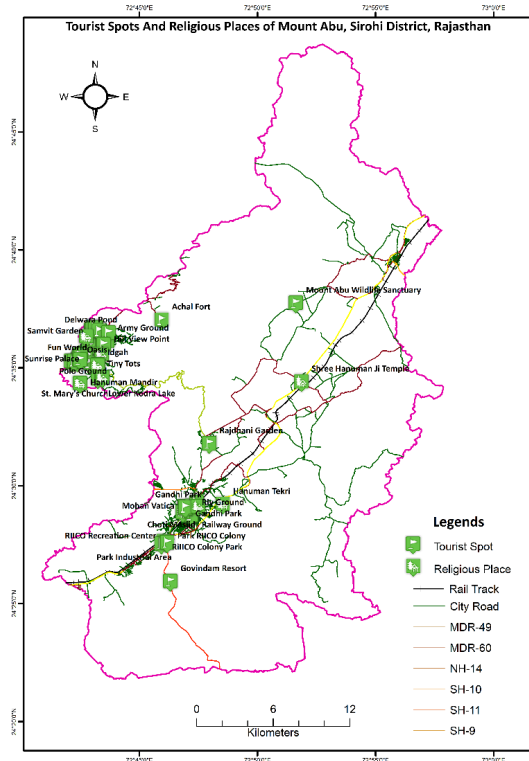


Figure 6 Map showing religious places

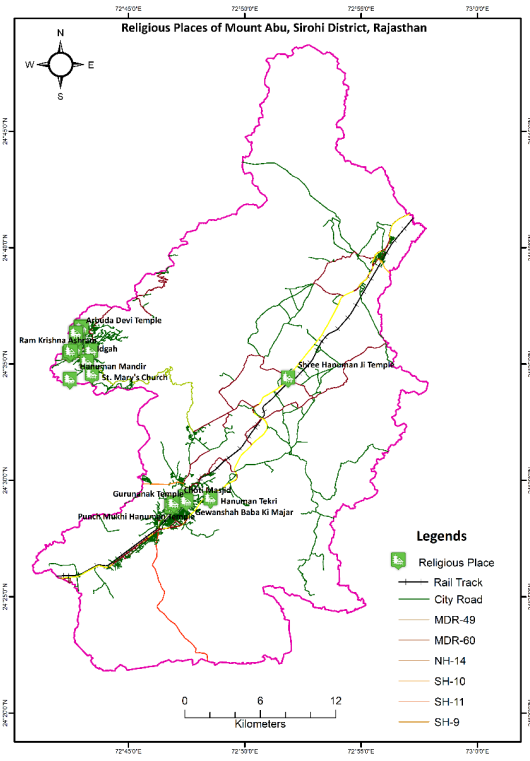


Figure 7 Map showing tourist spots

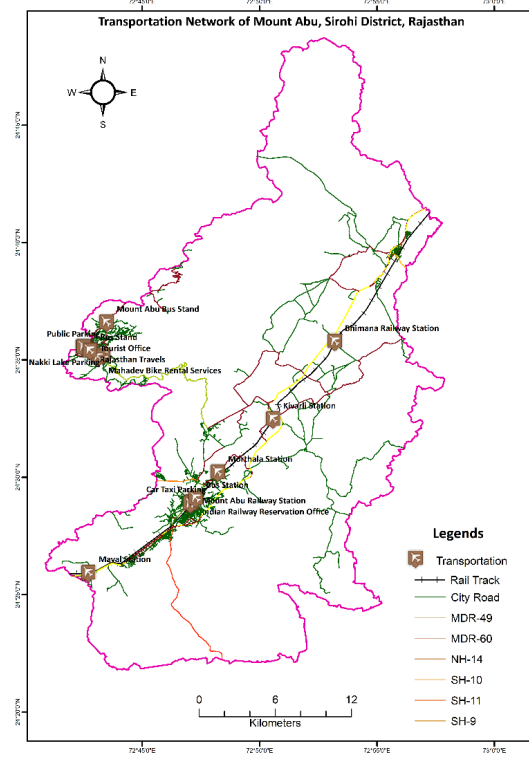


Figure 8 Map showing transportation

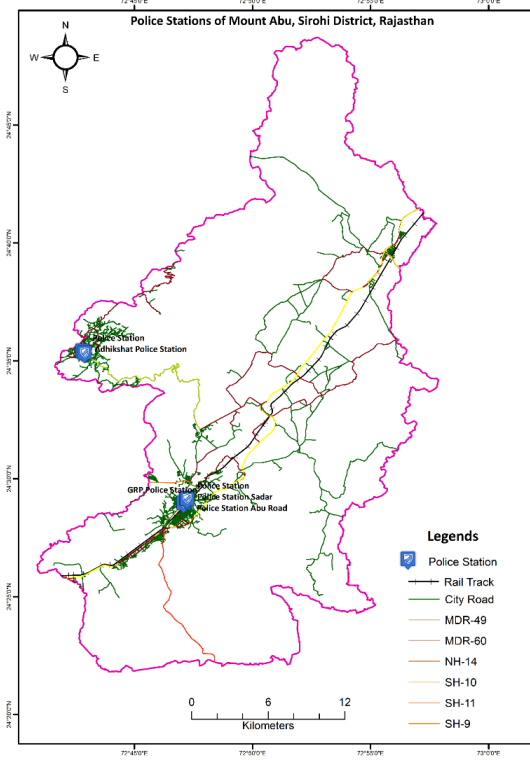


Figure 9 Map showing police station

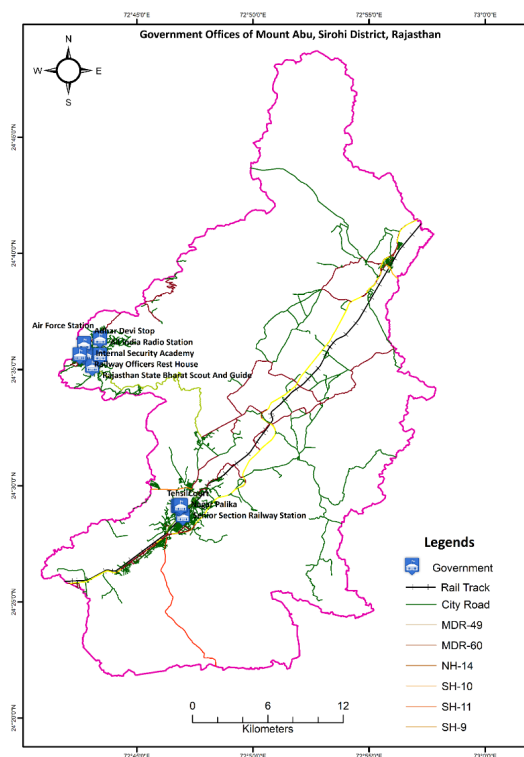


Figure 10 Map showing government offices

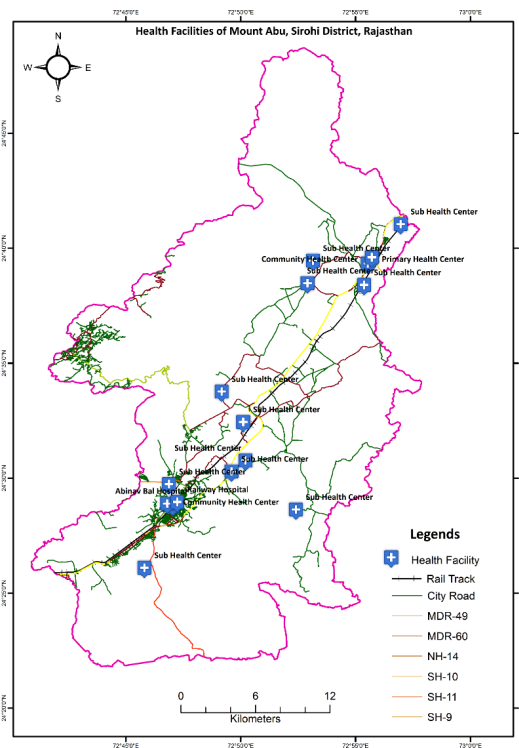


Figure 11 Map showing health facilities

Adhar Devi Temple: The temple is chiselled out of a huge rock reached by a height of 360 stairs. A favourite tourist spot.

Sunset Point: Spectacular sight of the setting sun when the hills are covered in the golden glow can be viewed from here.

Honeymoon Point: - Also known as Anadra Point, offers an enchanting view of the verdant plains and valleys. The place looks most beautiful during the dusk hours.

Shri Raghunath Ji Temple: Situated near the ‘Nakki Lake’ is the temple dedicated to Shri Raghunath Ji with a beautiful image of the deity that was placed here in 14th century A.D. by Sri Ramanand - The famous Hindu preacher.

Gardens and Parks: - Beautifully laid parks and gardens are interspersed throughout the hilly paradise. Ashok Vatika, Gandhi Park, Municipal Park, Shaitan Singh Park and Terrace Garden are some of the noteworthy gardens.

Museum and Art Gallery: - Located in the Raj Bhawan premises it has a collection of archaeological excavations dating back to 8th - 12th century A.D. It also has jain bronze carvings, brass works etc., for viewing

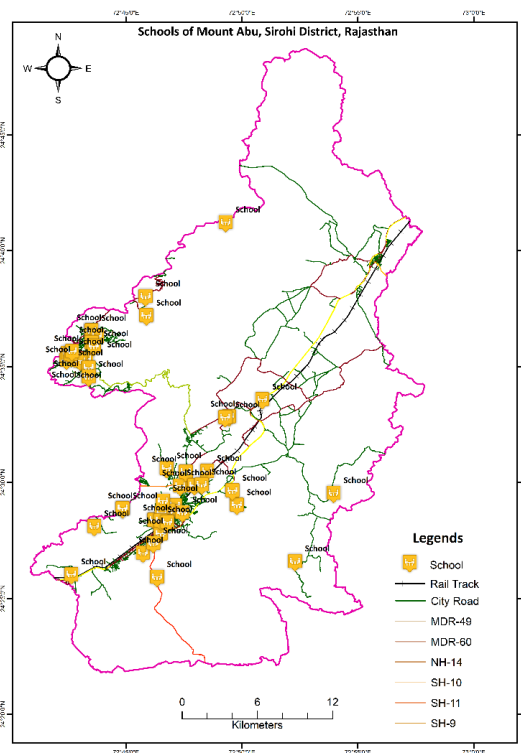
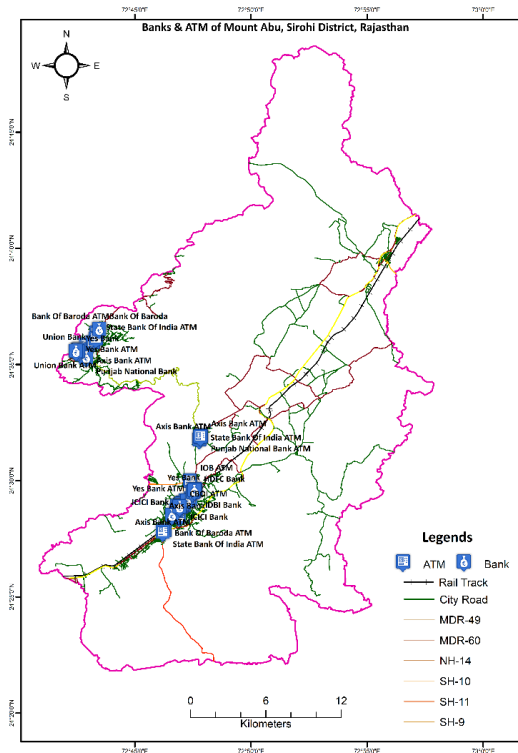


Figure 12 Map showing schools

Figure 13 Map showing bank and ATMs

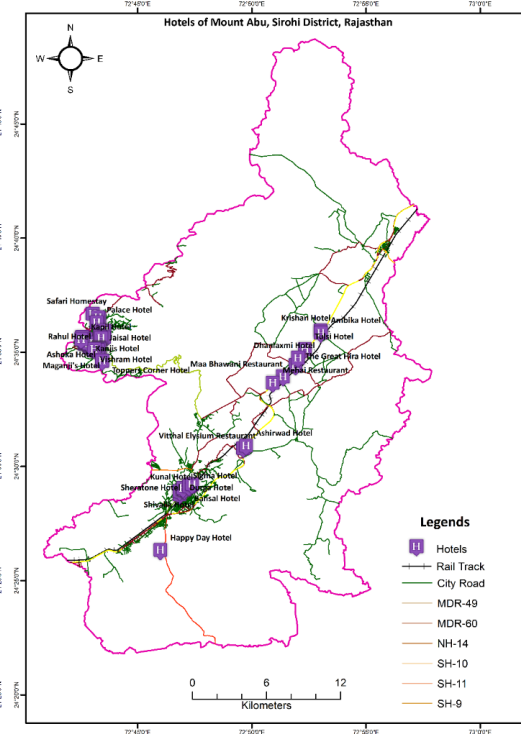
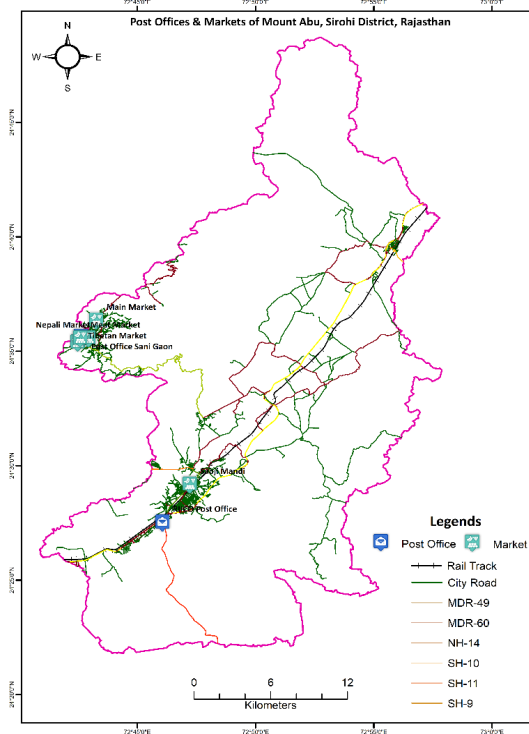


Figure 14 Map showing hotels

Figure 15 Map showing post office and markets

Achalgarh: - An impressive fort with some beautiful Jain temples enclosed within. Among the noteworthy temples are Achaleswar Mahadev Temple (1412 A.D) and Kantinath Jain Temple (1513 A.D). The latter has a gold plated image. Mandakini Kund and a sculpture of Parmar Dharavarsh are situated close to the Achaleswar Mahadev Temple. The Fort was built in the 14th century A.D. by Rana Kumbha and is approachable by a motor able road.

Guru Seikhar: - The highest peak on the mount (1722 mts above the sea level) allows a bird's eye view of the sylvan surroundings of Mount Abu. A small Shaivite shrine and a temple of Dattatreya standing on the shikhar are worth a visit.

Festive Fun: -Summer Festival (1st - 3rd June): The summer season is the time for exuberant festivities in this sylvan retreat of Rajasthan. The hill town, covered with mango groves, beautiful bauhinia trees and thickets of wild berries, stirs with life in the first week of June every year. Tribal festivities, a folk and classical music performance admits the lush surroundings and lovely lakes make it a joyous event.

Tourism industry in Rajasthan is a vital breath in the economic activity. Tourism has direct and indirect impact on financial, social and cultural life of people. This industry is considered as leisure industry with many economic benefits like foreign exchange earnings, regional development, promotion of local handicrafts and artisans, infrastructure development and increasing standard of living.

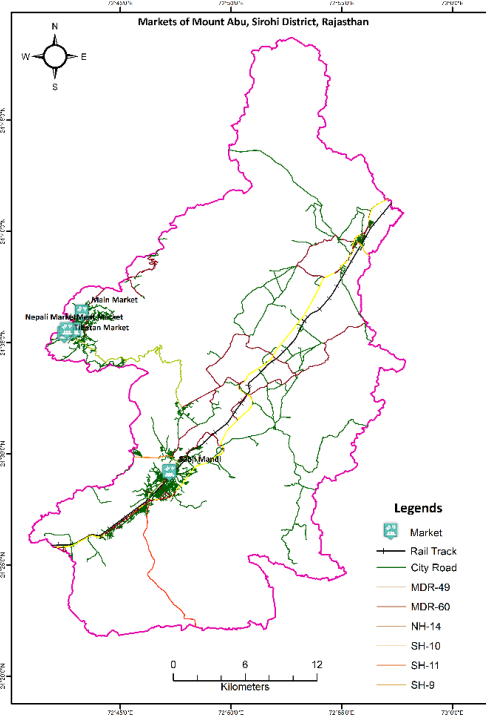


Figure 16 Map showing fuel filling station

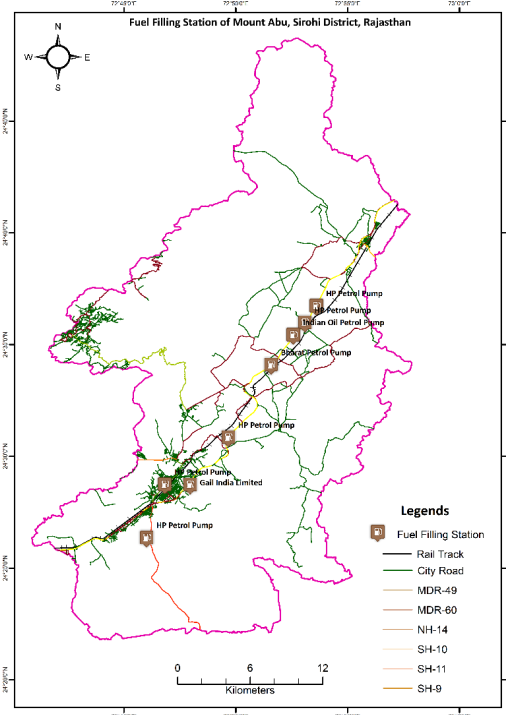


Figure 17 Map showing markets

Conclusion

After studying Mount Abu, the tourism infrastructure and the initiatives proposed by each of them, a set of broad recommendations are proposed which will enable in achieving the desired growth in the tourist numbers. And development of geographical data with the help of GIS technology and also to discuss and examine the basic data (primary and secondary) so as to develop a basic database. Spatial information has been developed for present study such as map coordinates expressed in longitude and latitude of various places; hotels, heritage site and trekking sites, emergency services, economic services, tourist spots including religious places, recreations transportation routes etc. Geospatial technology makes it easier for tourists to find their way around their destinations such how to find the best route, how to evaluate accessibility across destinations, what are the closest facility, how to set up locations to visit and how to customize directions. It also helps to track the location in real time basis.

1. **Introduction of a robust and inclusive tourism policy:** It is the first step towards introducing the right set of initiatives and achieving the desired tourist inflow. The policy should focus on specific interventions, incentives offered to developers/private players and vision for development of tourism in the state, among others.
2. **Inter and intra state connectivity:** Improvement of regional connectivity through creation of rural roads, high speed passenger trains, identifying and equipping air strips, converting domestic airports into international, introducing inland waterway connectivity are some of the areas to explore for improving the connectivity between cities and states.
3. **Tourist facilities:** Ensure easy availability of the visa offices/ centres at all the key destinations experiencing high foreign turnout. Provision of other facilities such as adequate parking and way side facilities is the need of the hour.
4. **Explore new concepts such as MICE to attract tourists:** There is an increased focus in many states on the MICE sector as an engine of growth for the business tourism sector. To build upon this opportunity, connectivity and availability of world-class infrastructure should be ensured. Incentives and subsidies to attract investors may be proposed as part of the MICE strategy.
5. **Accommodation facilities-** Setting up accommodation facilities in select unexplored destinations, upgrading the service levels of hotels, introducing theme based resorts, are some options to be explored. Some popular themes could be golf resorts, wild life resort, green/clean technology resorts, etc.
6. **Collaboration with other governments:** It is critical for the holistic growth of tourism that the states combine their efforts and offer comprehensive services and solutions. To create an enabling environment, the states need to explore possibilities by initiating dialogue with key states/ countries and creating roadmaps for implementation.

Authors Contribution: *Rajeev Singh Chandel (Research Scholar) performing the research work and data collection; Shruti Kanga (Assistant Professor) has responsible for performing the guidance the research work and is the main corresponding author of manuscript.*

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