

A Study on Application of Remote Sensing Techniques with Reference to Udaipur City

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Abstract

Remote sensing technique has emerged as an effective tool for systematic survey, analysis, and better management of natural resources (land, soil, water, forests, mountains) along with the monitoring of desertification, flood, drought, and landform change. It provides a vast scope to explore, identify, and analyse the natural resources of undeveloped regions. It documents the dynamic changes in physical processes and resulting landforms, usually by satellite images. This paper provides a general overview of remote sensing. While this technique has been used on beaches, valleys, and other landforms, the main concern of this paper is its role in geography.

Keywords: Remote, Sense, flood, Geographical Information system (GIS)

INTRODUCTION

Geographical Information system or GIS has become a slogan in the present-day Scientific literature. It has attained a status of multidiscipline. The thrust area basically meant for geographers has been taken over by resource, scientists, physicists, computer scientists, electronic engineers, surveyors and statisticians, apart from the remote sensing application scientists. All have a say in this matter. Nevertheless, due to such interactions, this multi-disciplinary thrust area has developed very fast during last decade of the century. Everybody would like to plot the information in order to get a spatial pattern of a particular theme. The computer companies, electronics industries, programmers have accepted this idea as a challenge.

With the possibility of using vector and raster information for GIS, there has been an impetus to use the remote sensing data at least as one of the inputs. GIS does provide a right opportunity for much desired integration of remote sensing data with the collateral data. The remote sensing companies would like to push the concept that the GIS application is only a step after processing the remote sensing data. There are computer companies which will plead for a total solution, i.e. integration of aerial photography, digital mapping, digital image processing, data base management system (DBMS). an of course field information.

REMOTE SENSING AND GIS

From the recent trends it appears that all the mapping related technologies are coming closer and merging. The digital image processing and the GIS can now be integrated. The hardware requirements have much in common and the vendors are coming forward with interface solutions for both the programmes. If the basic GIS work is done in raster (or scan) format it is more the easy to

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connect with the remote sensing data. Contrary to the scenario in the near past, the GIS is having more and more raster data. This is also due to this reason that scanning is becoming common now a day. On the other hand, the vector digitization takes a long time.

There is certainly a possibility to include the remote sensing data as one of the inputs. The satellite data cannot be exactly be superimposed on a map of specific project. Apart from having different projections, the remote sensing data has its own inherent problems. There are standard procedures to recreate this information according to a geographic base.

For the development of remote sensing-based GIS, whether the data is to be rectified first and then manipulated for different themes, or vice versa is a debatable issue. Both have their own advantages and disadvantages. The rectified remote sensing data can readily be used for bringing out a variety of themes. However, image processed remote control points (GCPS) can easily be identified which in turn contributes to develop better mathematical model between the map and image, or image to image. There can be mid-way as well.

The remote sensing data can be enhanced by basic image processing techniques, such as contrast stretching or filtering, and then rectification. The rectified data can now be used for more serious image processing initiatives. such as band rationing or principal component analysis.

The processed remote sensing data can be a valuable input in the GIS. The relevant data can be extracted and form one or more layers of information. Some GIS/image processing software does have provision to bring out limit lines of the grey values changes beyond a specific or given limits. These limit lines have to be analysed with other information or ground realities so that they become meaningful. However, such options provide a wide scope for remote sensing data manipulation in order to fit in a GIS.

APPLICATION OF REMOTE SENSING AND GIS TECHNIQUES

The combination of image processing and GIS technologies are enormous. As indicated earlier, they both are coming closer and it is now becoming extremely difficult to differentiate each other. The problems of transfer of data are also being circumvented. The private companies are combining their efforts in this direction (Parker, 1991)

The most common application of this combination is the land cover mapping. In addition to areas photographs, it also provides a synoptic view of the surface features. Due to its repeatability and scope of manipulation, it has a edge over the photographs. Further, such a combination is preferred where the integration of spatial data with current information is required, such

as land Information System (LIS). Recently, GIS packages are also supported by Digital Terrain Models (DTMs) which has further enlarged the applicability. For example, in case of the Canadian GIS, "the widespread distribution of lands at and SPOT imagery, and the availability of digital elevation models and street files in many countries have certainly lead to applications well beyond those used to justify the data compilation." (Goodchild, 1992)2.

With better resolution and with always improving software, the topographical mapping requirements are being met by GIS remote sensing combination. It has almost become unavoidable source for cross

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checking or updating in digital surveying. Furthermore, the GIS software can now accept the Global Positioning System (GPS) information in their programme, which is an additional advantage. (Prithvish nag & M.kudrat 1998).

ANALYSIS OF URBAN FEATURES

We have repeatedly noted that satellite remote sensing is an important source of information for urban analysis at the territorial scale. In that sense, digital image data not only provide a means of exploring and exemplifying existing hypotheses and models, but also for constructing new theories of urban areas by defining and identifying relevant spatial entities and examining the relationships between them. Despite this, the qualitative (categorical/ordinal scale) nature of the land use categories identified through the image classification process, and the discrete spatial distribution of the regions that defines, limit the value of such images in mathematical models of urban areas. The letter frequently presupposes the presence of one or more

quantitative (interval/ratio scale), spatial continuous variables. Consequently, land use data sets derived from remotely-sensed images may need to be further transformed if they are to be readily integrated in many urban models. Where this is achieved, the transformed data may then be used in a much wider range of applications, including

- a) Physical planning (e.g. spatial analysis, impact assessment and other environmental issues)
- b) Economic planning (eg. accessibility, location analysis, and transport studies)
- c) Social planning (eg population and other sociodemographic distributions, urban structures);
and
- d) Forecasting models (e.g. diffusion and urban growth)

We note in passing, that the accuracy and reliability of the results derived for any of the applications outlined above is dependent on the quality of the input data, and that the process of transforming the image data is not a natural one.

REMOTE SENSING AND GIS FOR STUDIES OF URBAN AREAS

Although we have frequently referred to GIS in this review, it has tended to be in an indirect fashion. Nevertheless, the key role of GIS in providing a framework for spatial analysis of remotely-sensed data products and other sources of spatial data on urban areas is recognized. The integration of GIS and remote sensing has justifiably received widespread and extensive in the recent literature. Most of the scientific and commercial journals have devoted at least one special issue to this subject and this trend will likely increase over the next few years the interface between GIS and remote sensing can be envisaged in one of three different ways

- a) Remote sensing can be used as a tool to gather data sets for use in GIS
- b) GIS data sets can be used as ancillary information with which to improve the products derived from remote sensing and
- c) Remote sensing data and GIS data can be used together for modelling and analysis.

Each of these views is pertinent to urban remote sensing. Urban analysis needs to exploit the

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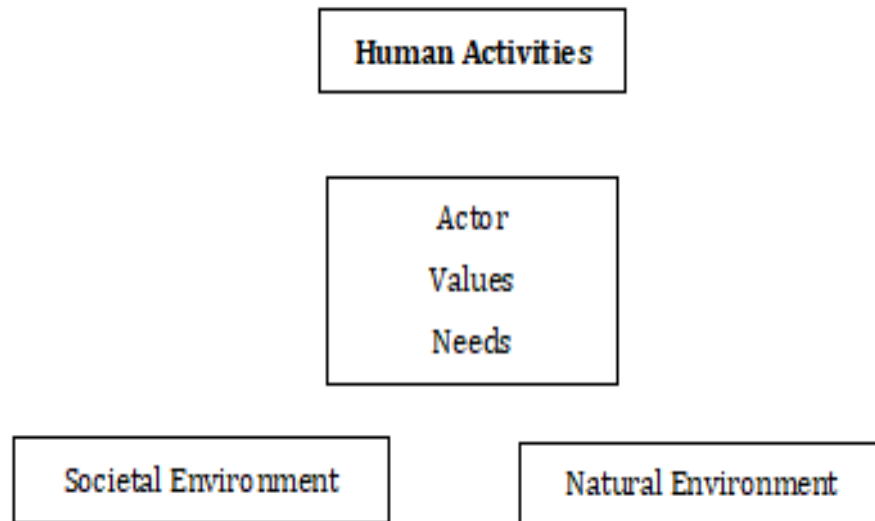
capabilities of remote sensing system in terms of their spatial coverage and detail but because of the limitations in terms of distinguishing all aspects of the urban milieu soberly on the basis of their spectral reflectance properties, classification, analyses and models of urban area will always be dependent on ancillary spatial information and the analytical capabilities of GIS. Ultimately, urban remote sensing is not only a meeting point of the social and physical sciences, but it is also a field of research that forms a bridge between remote sensing and GIS.

ENVIRONMENTAL MANAGEMENT

Man desire for ultimate joy and comfort has led him to exploit nature "free" gift to the extent of reducing its natural capacity for self-sustainability. Man in his pursuit of ever faster economic growth, is upsetting the environmental equilibrium or eco-balance and destroying his life support system. Hence environmental management must regulate the demands and activities of man in such a way that the ability of the environment to sustain future development remains unimpaired. Environment management should aim

1. The development of the environment for the human benefit in the integrative ecological, cultural and social process in a holistic manner.
2. The environment quality targets by the set of activities and institutional arrangements.
3. The co-ordinated efforts of the division makers and those for whom decisions are taken.

Environment management is a positive concept, not a negative "half progress" or "back to nature" concept. Process of environmental management is best depicted diagrammatically as under: -



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Environmental management employs the following three key concepts: -

- (a) System approach: A procedure which recognizes the relationship between natural and man-made systems.
- (b) Systems analysis: - It concerns itself with finding solutions to a problem and does not concern itself with applying those solutions.
- (c) Systems management: - Consists of actual techniques of management for solving problems.

The management of the environment in general development process in particular requires the steps:

- (1) An analysis of the existing environmental situation and behaviour and interaction of the various components of the environment including man.
- (2) A study to understand the thresholds (outer limit)
- (3) The setting of social, economic and environmental goals, and objectives.
- (4) The formulation of a balanced programme
- (5) The development of criteria for evaluation and romping programmes. eg. equity, economic efficiency etc.
- (6) The promotion, supervision and guidance of such a programme and EIA.

REMOTE SENSING FOR ENVIRONMENTAL STUDIES

Remote sensing involves collection of the data, on environment, by system which is not in direct contact with the object or phenomenon under investigation. Aerospace imageries register reflected or emitted electromagnetic radiation from the earth environment, on the images which when analysed visually or digitally yield information of importance.

Space borne sensors have the advantages of high ground resolution and respectively. Synoptic view is another advantage to study regional climatic and/or meteorological data. Space borne sensors also have the advantage at recording beyond visible spectrum and in longer microwave regions. Radar, being an active sensor, has the all-weather and all day capability, though cost involved is high. With the advent of SPOT and IRS the high resolution upto 10m and respectively of 9 to 12 days has been realised.

Formulation of environment management plans are always preceded by studies about the state of environment and impact of and planned activity on it. There are various attributes relevant of the environment. These are air, water, land, ecology, noise, human, and animal life energy, economics, aesthetics and many other natural and social aspects.

Until recently, the monitoring of various parameters has been done by conventional methods. Recently, the application at remote sensing technology in diversified area has led to on integrated approach in the environmental studies. This modern technology is being applied successfully for

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resource inventory and its management, dispersion studies, watershed management, land use pattern change detection, weather and climate analysis, ecology and conservation aspect.

APPLICATION REMOTE SENSING TECHNIQUES AND INTERPRETATION OF SATELLITE IMAGERIES OF UDAIPUR CITY

The Udaipur City is located in southern Aravali hills. The satellite imagery (IRS) presents the picture that the whole city is surrounded by hills and the sites of city can be identified through the imagery of Udaipur city which provides information about urban area. The city is located in Ahar valley and the urban region can be divided in following sub division:

I. Upper Ahar Region - Thar, Bargaon, Bedla, Fatehpura Area

II. Main City of Udaipur

- (A) Wall city
- (B) Out of the Wall City
- (C) South Eastern undulating region
- (D) Eastern city region
- (E) North Eastern industrial area
- (F) Middle Ahar

III. **Lower Ahar Valley** - Sevashram Chouraha, Bhoiyon Ki Pancholi, Lakarwas, Kalarwas and Udai Sagar Area. Satellite imagery provides information about the geographical features of the region and which can be studied on the basis of following outline.

- (1) Physical Features
- (II) Drainage and water bodies
- (III) Soil
- (IV) Vegetation
- (V) Agricultural fields
- (VI) Urban area expansion
 - I. Residential areas
 - II. Industrial areas
 - III. Road Transport
 - IV. Expansion of sub urban areas

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1. UPPER AIAR REGION

The satellite imagery is showing the relief features of upper Ahar basin. It can be demarcated from the foot hills of Borhat plateau to THUR village where river makes small turn towards Udaipur city particularly in north eastern to south eastern direction. Topographical eminence availability of perennial water from natural springs abundance of forest cover, at least in earlier days; insulation, isolation and dense forest were extended there, but today the scenario has been changed due to human activity like Agricultural development, permanent expansion of human habitation. This region can be identified as sub-urban region of Udaipur city. Ahar River originated from this region. This river is non perennial although it has large discharge of water. The satellite imagery shows that the land use pattern has been specially in agricultural activity to industrial expansion.

Soil:

This region has good fertile soil particularly red or dhamani soil being a mixture a brown and black soil contain more An alkali, less or nitrogen or organic metal and is therefore less productive. Thur is located on the bank of Ahar in this region where yellowish-brown foothill soils can be seen.

Vegetation:

Vegetation is an important aspect for the study of urban region. It is to be noted the region is facing the problem of deforestation due to expansion of Udaipur city. The region is characterized by a rich bio-diversity in earlier days, but today the vegetal part is decreasing day by day. The satellite imagery provides information about extension of forest areas it can be seen that most of the foot hills are looking open rocky area where vegetal part is very much poor. Near Kavita, village it has been observed that hills are blank in point of view of vegetation. Most dominate species Dhak, Neem, Jamun, Pappal, Bargad etc. are found in this region. Now more attention is required for the plantation in this region. Imagery is showing that some patches of vegetation is being developed particularly near the bank of Ahar river or some patches are also located along with the road or agriculture fields

Agricultural Fields:

The study of agricultural activities is based on field observation particularly in areas of nearby Kavita village. Cultivation of various food crops, vegetables can be seen in this region along with the Ahar river. The studies have been made to define out relationship between various geographical phenomena and human activities, which are taking place in this region. The geographical environment has changed due to rapidly changes in agricultural land-use pattern.

Urban Area Expansion:

This region is also experienced with urban expansion of Udaipur City. The imagery presents the trends of expansion of residential area along with the main road where some patches of new residential areas can be seen on the other hand expansion some residential colonies are taking place between Bargoan to Thur village. After Thur some agricultural farms have been developed by local people recreational facilities to tourist, those who want to stay in natural environment.

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Industrial Expansion:

Satellite imagery provides information about industrial areas of Udaipur city. The region has two industrial units namely shurti synthetic located near Bargoan area or another unit is located near Mewar Boting. It is interesting to note that the region has much scope of for urban expansion and also for industrial development particularly in Bargoan and Thur area.

Road Transport:

Road Transport can also be observed from the imagery of the region, IRS present the information about the main transport network that can be seen from Udaipur to Gogunda road although the road is not prominently seen due to single track. It is suggested that much planning is required to provide facility to urban commuters.

Expansion of Sub Urban Areas:

Sub urban areas are main forces behind urban expansion of city. Here following aspects can be discussed. this direction due to three aspects: -

- (1) Urban expansion is taking palce due to development of resort centre.
- (2) Expansion of residential colonies in open areas.
- (3) Expansion of industrial areas along with main road.

Middel Ahar Valley:

The satellite imagery is considered as base to study of urban environment of Udaipur city keeping the view in mind that the internal structure of city creates urban environment through this imagery. The main Udaipur city is located in this middle Ahar basin. The city can be demarcated from Chirwa near Ambari in east. Again it is connected up to Kaveda Ki Nall in south than near Dhol Ki Pati than it can been extended up to Goverdhan Vilas in west near Machala Magra and Sajjangarh than Neemuch Mata up to Bargoan area in nothern direction. The satellite imagery gives clear demarcation of city region.

Further this can be divided in following sub region:

- (1) Main wall city
- (2) North Udaipur city
- (3) East Udaipur city
- (4) South Udaipur city
- (5) West Udaipur between near lakes of Udaipur city

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(1) Main Wall City

The satellite imagery provides indication of urban features about is densely populated where no vacant land is seen in that particular part of city area. This area is bounded by wall in medieval period, and this area is also bounded by lakes in western side where Picchola and Swaroop Sagar are located. On the other hand western part of the area is extended up to Macchala Magra where Sajjan Garden is seen in imagery. The imagery also presents some relief features about expansion of wall city area in surrounding of wall side near Delhigate, Surajpole Kishanpole, Chandpole, Hospital areas. Some field observations have been also conducted during the study, and it has observed that the city wall is located near Patel circle to Udaipole. After Udaipole no prominent feature of wall can be seen up to Delhigate area only Delhi gate and Hatipole (big gate) remains and showing the indication of wall of Udaipur city. Other part of wall along with Swaroop Sagar to Chandpole area then Kishanpole area have some indication of city wall anyway the following observation have been taken in to consideration to study the urban into environment.

- (i) The wall city is known as the old Udaipur city. This city is originated on the bank of Ahar river and this Picchola lake was constructed by nomadic group of Banjara in 1556. Maharana Udaisingh came from Chittorgarh and decided shift his capital here on this particular site because availability of water as well as security point of view. The whole region is surrounding by Aravali hills which present a shape like bowl.
- ii) It has also been observed by field study that the residential areas are expanding out of the wall city. many new residential areas are taking place.
- iii) No transport road facility is available for heavy vehicle particularly in wall city.
- (iv) No clear functional classification can be seen in the city area all the functions are mixed the misstep like commercial, education, residential areas etc.
- (vi) The satellite imagery is also presenting sort of indication about urban environment in terms of vegetation no single patches can be seen in this particular region except areas of Sajjan Niwas garden and Sahelion Ki Bari as some vegetation.
- (vii) Imagery is also showing the expansion of lakes like Pichhola, Swaroopsagar, Fateh Sagar etc. The over all environment of this region is not healthy due to unplanned development of city.

(2) North Udaipur City

North Udaipur city area is extended from Hatipole to Badgoan in North Fatehsager to Ashok Nagar and Ahar in cast. The following urban features have been studied through field observation.

- (i) Resendantion area have much space particularly in Fatehpura, Pologround, Madhuban, Bhopalpura, Ashok Nagar, Sardarpura, these areas are planned areas of city.
- (ii) So far development of vegetation is concerned it can be seen along with main roads like Sheli Marg, Pologround Area, Ashok Nagar, Bhopalpura, Durga Nursery main road area.

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- (iii) Some market canters have been developed particularly in Panchwati, Chatek Circle, Hospital Road, Shastri Circle, Main Ashok Nagar Road.
- (iv) Urban environment is comparatively better than city area particularly in this part in terms of urban planning. The area has sufficient number of garden like Shahalio Ki Bari, Sukhadia Circle etc.
- (v) The recreational activities can also be seen in this area like fountains in Sukhadia Circle, Chatak Circle and Shastri Circle etc. Where fountains have been provided by municipality for recreation.
- (i) City urban transport has also been developed in proper manner particularly in this part of city.

This study reveals that the urban environment draw much attention about sewerage and community services in this north udaipur city region.

(3) Eastern Udaipur

This area is taken into consideration to study of the urban environment. It is extended from Durga Nursery Road, RCA campus, M.B. college road in western side, and Sevasharam up to Pratap Nagar in the eastern side and eastern Ahar area university campus in northern side and up to central school of Pratap Nagar and Rajathan Vidyapeeth Campus in the southern side. The satellite imagery presents the information about expansion of the residential areas, educational institutions, and expansion of industrial complexes etc. It is interesting to note imagery is showing the expansion Zinc Smelter near Udaisagar.

The following features have been studied during the field work This area has much vacant land like archaeological site of arahar culture. Some Agricultural and in urban fringe area particularly Amberi, Dhokli, Berwas etc. Residential colonies are growing in unplanned manner particularly Keshav Nagar, New Bhupalpura, Sunderwas Area, Khempura areatc.

- (i) Some new colonyies have also been developed in this area which requires some attention about urban planning, where urban amenities must be provided.
- (ii) Four lines road transport have been developed from Surajpol to Debok area during 1996-97 which links Udaipur city to air port.
- (iii) This area is also having has green vegetation. Some patches can be seen in imagery like three patches particularly in RCA campus, Durga Nursery Road, M.B. college road and along with the Ahar River.

The over all status of urban environment requires some proper direction of urban planning and should be related to social development well being in urban envi, like health, housing, employment, education, personal security and assess and urban quality.

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Southern Udaipur City

The southern Udaipur city located from Sevasharam area to Hiran Magri area and it is extended upto Goverdhan Vilas area the following urban section can be seen in satellite imagery: -

- (i) The Hiran Magri area is one of the longest urban residential area, which has been developed properly through proper urban planning. The whole residential area has been divided in sixteen sectors. Each sector has sufficient social amenities like education, health, community center, park etc.
- (ii) The satellite imagery presents some prominent features in terms of expansion of urban area particularly in southern part of Udaipur City. It has crossed the limit of bypass road transport in Goverdhan Vilas and Pratap Nagar area.
- (iii) The residential areas have been taking place along with the N.H. No. 8.
- (iv) So far development of vegetation is concerned no single part or area can be seen in this area only sec. 11 to 14 other vegetation patches can also be seen in cantonment area near Machhalamagra.
- (v) This region has much scope for development of industrial units along with the highway from goverdhan vilas to ameri area and on the side from Pratap Nagar to Dabok area.

(5) Western Udaipur City

This area is located from Swaroop Sagar to Mulla Talai area and it has much scope for tourism development. The following characteristics have been observed during field observation :

- i) Hotels are taking place along with lake near Ambamata colony, Master colony, Alkapuri, Civil Lines Govt. Quarters etc. Which creates water pollution in Fateh Sagar Lake.
- ii) This area has much scope in Tourism development in various hotels have been developed like Lake Place inside of Pichhola and recently one another Oberai Group has been develop a five star hotel in Haridas Ji Magri area.
- iii) On the other hand other activities are also being developed like resorts centres, water parks etc.
- iv) The Satellite imagery is also showing some plantation along with the road as well as in hilly area like Sajjangarh and Nai, Nimmach Mata area etc.

The above study reveals the over all status of urban environment which has much scope for urban development. Udaipur city has site of natural environment as well as natural geographical land scape for further development. This city has become a major tourist centre of western India. Geographically, Udaipur city region is known as the Kashmir of Rajasthan which has many water channels, natural lakes, natural landscape, vegetation area, fertile soil. For development of tourist center therefore

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more attention should be given to landuse planning of the city.

(6) Lower Ahar

The lower Ahar hasin of Udaipur city is extended from Sevashram to Udaisagar area. The Satellite Imagery showing the scene where most of the area is also having green vegetation particularly in lower valley region, near village of Kalarwas area, Purohiton ki Madri, Bhioyo ki Pancholi, Udai-Niwas etc., where agricultural fields can also be seen in imagery. On the other hand the main road line from Udaipur to Dabok area presents the scene of industrial expansion along with the road. The industrial area is taking place from Madri Industrial Area to Debari Zinc Smelter area. On the Eastern Side some plantations also been placed in between hilly tracks and city area e.g. near Debari Village. The Temporal variation can be studied through the previous record of forest & present situation. This area is environmentally degraded day by day due to urban expansion, expansion of RIICO industrial area near Debari. Only some patches can be seen along with roads in terms of vegetation. It is concluded this lower valley region is requires much attention for protection of natural environment.

CONCLUSION:

The over all study reveals that the status of urban environment can be improved through proper planning. This city region is facing the problem of environmental degradation. This region was known as Ahar civilization centre due to availability of natural resources of water, green vegetation, fertile soil but today the situation has changed due to problems of scarcity of drinking water as well as fertile land in surrounded particularly in sub-urban area. The water of natural lake is polluted due to unchecked human interference with nature. Now time has come that all the lakes must be guard properly, and all the activities like development of Hotels, and tourist activities must be checked properly well-in-time.

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