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Analysis Urban Land use And Its Environs Of Dehradun City

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ABSTRACT:
After 2000 revolutionary changes have been seen in Dehradun city that time Dehradun formed the capital of Uttarakhand state. A sizable amount of immigration from rural areas and nearby adjoining states such as Uttar Pradesh, Haryana, Punjab, and Delhi has also resulted in the gradual expansion of Dehradun city. Earlier Dehradun was famous for its Litchi fruit & good quality rice grains. Almost up to the year 1990 exporting litchi and rice to all the parts of India and now the condition of the city is that even the people of Dehradun not get sufficient supply. It is due to decreasing agriculture land, the cultivation is affected. The aim of this paper is to recognize changes in built-up areas and open areas of Dehradun city using the geographical information system to analyze land use changes of the period 1998, 2008 & 2017. To achieve the objectives three digital images The satellite image downloaded from earth explorer USGS of the year 1998, 2008 & 2017 has been taken to calculate the areas of three main categories they are built-up, vegetation & non-built-up area. The areas changes in three years gap 1998-2008, 2008-2017 and 1998-2017 have been calculated. The downloaded images converted into shape files of the study area as per Dehradun municipal map 2011 using Arc GIS10.3 and last ERDAS for classification of buildup and open areas.The researcher found a lot of changes in these categories. One category decreases with the time where other increases. There is a lot of new development occurred during the two later periods i.e. 1998-2008 & 2008-2017. In the period 1998-2008 vegetation area decreases 15.31% from overall vegetation where built-up 8.89% increases and 6.41% non-built-up area increases. (Refer to Table 5.2 graph 5.5). In the period 1998-2017 the 38.36% vegetation decreases. Where built area increases prominently 32.45% from the year 1998 and 5.91 % increase in non-built-up area.

INTRODUCTION:

The post-Independence period of India has witnessed a radical transformation of the urban scene.Particularly, during this period, the million of cities start to grow quickly; in several cities the population was increased by more than fifty per cent in a decade period. This fast growth of cities is not possible to provide within the existing boundaries of the cities. Study area Dehradun (300 longitudes), a class I (having > 100,000 population) city of medium size located in the fertile tract of near the Himalayan foothills in the NW part of Uttarakhand in North India was carefully chosen as the study area. Dehradun is a well-known tourist spot. It is situated at 60 km from Haridwar. It is Capital of Uttarakhand since Nov 9, 2000, and located in Garhwal region. Uttarakhand is divided into two regions and 13 districts. Regions are Kumaon and further distributed into sub-divisions and blocks. City covers an area 58.46 Sq. km. nearly half of the land is used for residential purposes and other for commercial areas, educational institutes, and research institutes, industrial areas, transport nagar, secret ate, and defense related areas, recreational and open spaces. As per the municipality, this city is further divided into 60 wards as per the municipality 2011 map. Population of Dehradun was 574840 referred Government census department of India (2011). In 1980,

Morphology:

Throughout the world particularly in developing countries, significant increase in urban population has been observed in terms of spatial expansions duc to population increase. Urbanization is a universal processes, resulting in accelerating the growth of urban centers. This process occurs due to economic development opportunities linked to big cities and other urban centers. Furthermo:e, continuous population migration from rural to urban and urban to urban in search of employment, have also necessitated the growth of urban centres. A planned urban form has emerged in the late twentieth century, which is characterized by low density, well-served roads, owned by governmental or non governmental development agencies or private organizations (Garreau, 1991). Throughout the world, economically prosperous towns are taking this form (Holden & turner, 1997) and India is no exception. Furthermore, economic liberalization and the new industrial policies are another such effort to help in the reconstruction of large urban centers. For the development of urban centres, efforts have been made by govt. of India.One such efforts is the recently proclaimed 73rd and 74th amendment of the constitution which aims at implementation of city plans and the integrated development of urban centres.

The rapid growth of urbanization combined with the explosive population growth has made urban areas and it.•s surrounding's regions of dynamic change and increasing demand on urban land and services. As the limited land resources in the city get used, the pressure mounts on the surrounding environs of fertile and vulnerable lands causing faster rate of land conversion from non-urban to urban. This results in uncontrolled aerial e.xpansion Of the Eity as well as problem of providing basic public services and facilities. In the process of monitoring these changes, taking remedial action, and developing perspective plans, the need for data input in terms of the latest information has been a serious constraint. Rapid population yowth followed by high rate of increase in demand for providing services, facilities and rapid landuse change, calls for an urgent need for accurate and timely land use information. To streamline the basic needs of planning, wc felt to create an efficient urban information system (UIS). The system or method used to obtain such information must provide an inventory information of landusc, and Inust be able to monitor changes in landuse. This can provide planners and policy makers a tool to understand different facts of the complex urban environment and preparation ofeffective plans and policies for future development of urban centres. It is generally accepted and established that generation of comprehensive urban information by conventional methods is unscientific, more time consuming and demanding huge manpower. Therefore, there is a need for reliable, real-time, accurate and comprehensive information to tnonitor and predict the growth pattern and development trends of urban centres. To fulfil this irnrucdiate requirements, the development of remote sensing techn0100.' has revolutionized the information-base over the conventional means of
data

acquisition. In this direction the use of air photo and image interpretation techniques have widely been recognized in understanding the cotnple.x nature of urban environment.

Remote Sensing technology coupled with Geographical Information System (GIS) can come to the rescue of planners in terms of making an inventory and mapping of existing landusc, as well as constant tnonitoring and subsequent preparation of urban plans. With respect to urban areas, aerial photographs providing almost real time valuable database information and time are effective. Remote sensing has

the most advanced method of data acquisition system which can provide accurate, timely, reliable and up-to-date spatial information at a regular interval. At present, it is found that remote sensing techniques integrated with GIS has capabilities to generate and analyze the spatial database more efficiently and accurately in comparatively less time. In the background ofabove discussions, the present study is an attempt in using aerial photographs, satellite imageries and GIS to go about systematically in obtaining information on landuse categories and monitor growth to understand the complex nature of the Dehradun city environment.

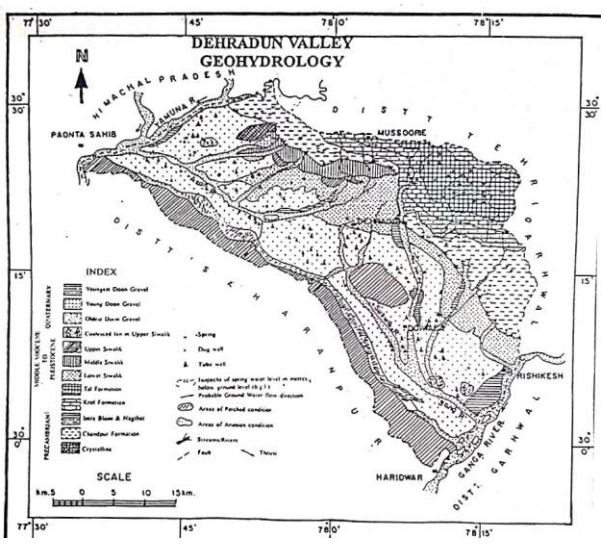
Remote Sensing and GIS techniques in monitoring urban expansion, landuse mapping and change detection in various cities ofworld have been used by various workers (Rao et al., 1997, Raghavswamyet al., 1996, Siddiqi et al., 1995, Holden and Turner, 1997, Grcene, 1997). Due to the capability of providing synoptic view over a large area on large scale data by satellite isa useful base for carrying out micro analysis of settlement patterns at frequent intervals (Mahavir, 1996). Furthermore, the flexibility of several operations in spatial data analysis and integration of non spatial data makes the GIS as indefensible tool.

Based on the above observations, an attempt is being made to bring out the present paper : "Urban landuse analysis of Dehradun city and its Environ", using remote sensing and GIS techniques. One of the criteria for selecting the study area is the availability of aerial photographs and satellite data products. Dehradun is a transportatiön node having a railway junction and being the gateway to Garhwal Himalaya. Being the administrative headquarters oi the state; the city has its own relevance in the state. The study of a urban centre like Dehradun might be of relevance in finding alternatives to the unmanageable growth of metropol itan cities.

Dehradun valley forming a unique geomorphic unit in the Garhwal Himalaya lies in the arrns of the lesser Himalaya in the north and the Siwalik in the south and is transversely bordered by the holy rivers, the Ganga in the SE and the Yamuna in the NW. The vhlley extends from 29030'-30024'N latitudes and 77035'-78020'E longitudes with an area of 2029 sq.km. ranging from 330 to 2500m altitude, and consists ofma.ximum length of72km from NW to SE and maximum Width of35km from North to South. Physiographically, the valley comprises hills of Lesser Himalaya in the north (Jaunsars, Krols and Tals), Siwalik hills in the south (Sandstones and shales) and Doon gravels in the central parts (Medicott, 1984 and Auden, 1934).About 78% ofthe total population of Dehradun districts distributed within the Doon valley itself.

Dehradun is the primatc city of Uttaranchal, currently functioning as state capital.

Main city lies on thc gently sloping (l Sm/km) low intcrflotive of thc Bindal and Rispana Raos. It owes mild climate. well draincd site and (lustfrec atlnospherc in a wide valley boardercd by the Lesser I lirnalaya in the Norlh and Shivaliks in the South. In the background of the vcrdcnt Sal forests it attracted Europian and Indian settlers. 'I'he city maintains moist sub-tropical climatc with rainfall chiefly confined to the monsoon months (80"-85"/annum). May-June arc the hottest ('IOOC) and December-January arc the coldest (I IOC) when the temperature reaches freezing point (Walton, 191 1).



Census 1872 reported 73 16 persons in Dchradun which grew to 166073 in 1970 and the Dchradun city with its setallitc towns (Municipal Corporation) enumerated 447803 persons in 2001 census. During last three

decades the city maintain a steady growth of +30% per decade. The city is cxpanding fast beyond municipal limits in all directions. Present paper takes into account the landuse changes in the main city, its satel lites and the sub-urban areas in a quard angle.

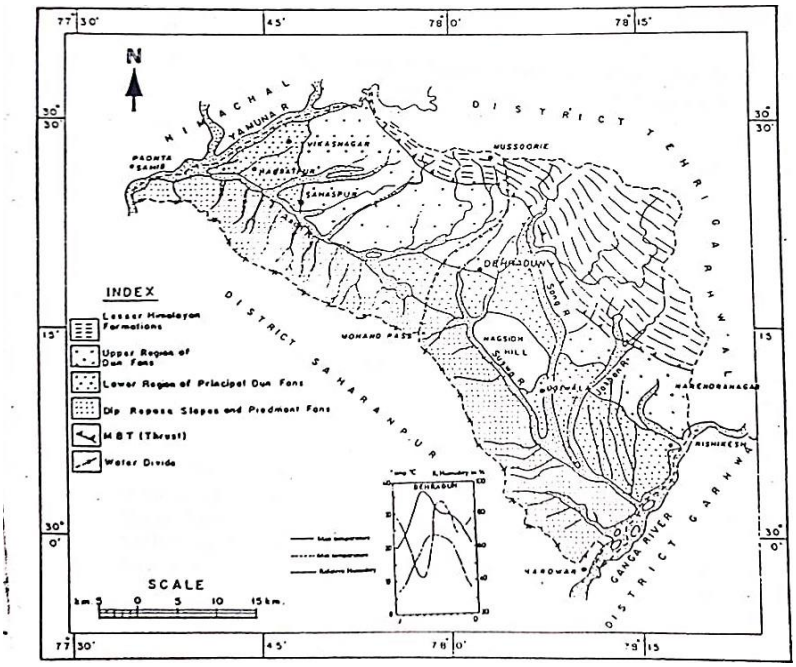


Fig. 2. Dehradun Valley - Twin Watershed of Asarori-Mussoorie Water Divide.

Potential- Utilization.

The Aims and Objcctivcs

In the present paper, the ernphasis is given on monitoring and mapping of urban growth and changing landusc pattern, keeping in view the following main objectives:

Tostudy urban growth, developtnent trends and spatial distribution of landuse•with respect to timc and space;

Toprcparc landusc tables for the years 1973, 1980, 1990, 2000, covering the whole city and its surroundings;

To identify and record the physical changes in landusc particularly the type of land transformation and its degrcc during 1973-80, 1980-90, 1990-2000 using geographical information system;

To study the urban growth pattern;

To analyse the implementation ofcity's Masterplan proposals with existing landusedata of2000;

Todevelop a suitability model for the city to evaluate the land availability and suitability to meet future demand of the city, considering the current trend of growth.

Scope and Limitations

The main scope of this study lies in generating a strong information base for landuse of Dehradun 'City and its environs. The study tries to find out the results by integrating various techniques and methods mainly related to photo/image interpretation and geographical information system for obtaining a reliable database on various aspects of landuse and related changes occuring over different time periods, This would certainly help to suggest some guidelines for the improvements over the existing system of planning and development.

As far as the interpretation and delineation of landuse categories is concerned, it is done quite satisfactorily on aerial photographs and satellite imageries. The first and foremost problem is noticed in orientation and exact plotting of details in areas, where no ground features are availablc on

photographs, except for the vacant or cultivated land. This prob!em can be overcome by carrying out fresh photograph or supplemented with latest satellite imageries to achieve the level of accuracy by increasing the period of survey.

In the present study, the scope is limited to delineating areas as per the photographic coverage as well as information derived from satellite images. Some limited secpndarysource-data arc also incorporated to assess the landuse categories. Furthermore, the study has been confined to the main city area and its surroundings. In the north and south side Of the city, the study is limited due to photographic coverage. Considering the quality and scale of photographs and available satellite data, it is difficult to dernarcate sinall structures in the congested parts of the city and the newly structure or the fringe areas. While updating the landuse map in new built up area, the detnarcation has some limitations in the absence of required landmarks.

Due to inherent quality and spatial resolution of satellite data, it is not possible to delineate and interpret the all the category pi escribed in the: classification systetu. So. attempts liave been to generalise latidusc categories while prcparing the table.

Methodology

Base map on scale is prepared with the hclp of topo sheets of 1 973 of Survey of-India. The visual interpretation of-data IRS- IA, I B, and ID (LISS 11, LISS 111) image is analyscd. Arc Info, and irnagc-processing software arc uscd for the image interpretation. In this study, a change dctection approach has been irnplcrncnted by comparing satellite data with thc 1973 topo sheet (at thc scalc of 1:50000) of the study area.

Land usc Analysis

The land use table of the study arca for the year 1973, 1980, 1990 and 2000 were generated. The visual image interpretation techniques were adopted. On the basis of this following table has been generated.

Tablc I. Land use in Dehradun City (area in ha).

Year	Built up Area	Agriculture	Forest	Garden	Open Space	River	Water Bodies
1973	3291.0 (1 1.5)	11884.8 (41.5)	7344.3 (25.7)	1447.8 (5.1)	1389.1 (4.9)	141 1.5 (4.9)	1788.2 (6.3)
1980	6533.2 (22.6)	9958.7 (34.5)	7218.4 (25.0)	1223.4 (4.2)	1087.9 (3.8)	1296.5 (4.5)	1559.0 (5.4)
1990	7650.7 (26.7)	9248.3 (32.2)	7047.7 (24.6)	963.9 (3.4)	948.3 (3.3)	1290.2 (4.5)	1543,0 (5.4)
2000	8078.2 (28.2)	8946.5 (3 1 .2)	6995.9 (24. 4)	948.7 (3.3)	928.3 (3.2)	1268.2 (4.4)	1529.5 (5.3)

Valucs in parentheses are percentages or the landuse.

The above drawn table slpows that there is a regular increase in the built up area. In

1973 the built up area was 3291 .0 ha, which has increased upto 8078.2 ha in 2000. While cultivated land has decreased from J 1 884.8 ha 1973 to 8946.5 ha in 2000.

Land use Change Analysis

Change detection involves the use or multi temporal data sets to discriminate areas of land use change between different years. The types of changes that might be of interest can range from short term phenomena show flood "vatcr to long term phenomena urban development or desertification. Ideally,

change detection procedures should in•volve data acquired by the same sensor during different time periods.

One way of discriminating changes between two dates of imaging is to employ post classification comparison. In this approach, two dates of' imagery are independently classi fied and registered. Then an algorithm can be employed to deterrn ine those pixels with a change Fig. 3. Dehradun Valley - Physical Features.

in classification between different images. In addition, statistics can be coughed to express the specific nature of the changes between the different dates of imagery. Obviously, the accuracy ofsuch procedures depends upon the classifications systems used in the analysis. fte errors present in each of the initial classifications are compounded in the change detection process.

Another approach to change detection, using spectral pattern recognition, is simply the classification of multi data sets. In this alternative, a single classification is performed on a combined data set for the two dates of interest. Supervised or unsupervised classification is,uscd to categorize the land cover classes in the combined image. The Fuccess of efforts depends upon the extent to which "change classes" are significantly different, spectrally from the "non change" classes. Also, the dimensionality and complexity ofthe classification can be quite great, and if all bands from each date are used, there may be substantial redundancy in their information content.

Resource Potential-Utili2ation. Sustainable Development & Planning

In the present study, the land use tables of different years were cross tabulated for getting a change detection tnatrix for the years 1970 to 1980, 1980 to 1990 and 1990 to 2000.

Conclusion

From thc above analysis, it can be derived that built-up arca has been growing at a faster rate, especially after 1990. Mostly, thc urban growth has bccn confined in the northern part ofthc study arca. With the process or urbanization, thc density in the existing built up land is increasing and more area is constantly being added to the built up area. The area under cultivation is dccrcasing year by year from | 1 884 ha in 1970 to 8946 ha in 2000 as against the urban groMh of 3291 ha in 1973 to 8073 ha in 2000. This type or urban expansion at the expense of fertile cultivated land may not be a good symptom for the health of a city like Dehradun whcrc dependency rate on agriculture is high.

In order to have a systematic study of urban growth for Dehradun city, it is necessary to understand the limitations imposed by its physiography on its pattern and direction of growth. Physical expansion of the city has been strictly governed by the physiography of its sites. Existence of the number ofseasonal streams, dissected topography, hills in the northeast and northwest and other undulations have resulted in sporadic growth, especially in the northern parts. This topography has not only influenced the direction of growth but has also conditioned the shape of the urban built-up area.

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319

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