Identification of Urban Sprawl using Geospatial Techniques: A Review.

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ABSTRACT

Urban growth is a key indicator of development of any area because it contributes by social and economic means to the welfare of any nation. In many developing countries unplanned and unmanaged urban growth is having an adverse impact that leads to an increase in the risk of natural or man-made risks. The understanding of growth momentum, the effects of driving factors and optimal land use planning is important for managing urban growth. Urban growth is important for assessing and forecasting the situation. In addition, proper planning of urban areas requires an hour to prevent or reduce the dangers of numerous human-made and natural disasters. The town of Ajmer in Rajasthan State (India) was chosen by the Govt. as one of the most important places of religious and historical importance. The aim of this study is to understand the land utilization and land cover phenomenon of changes that lead to an evaluation of Ajmer's urban growth by use of geospatial techniques such as remote sensing, digital image and GIS. In addition to the secondary ground reference data from different sources, analyzes of multi-spectral and multi-temporal remote sensing data obtained from different sensors were included. For different years, standard image processing techniques and supervised classification were carried out in order to obtain information on land usage / coverage. In addition, the analysis of the change detection led to an evaluation of urban growth. In outer areas of the town and along important roads such as Pushkar and Jaipur, there have been an increased number of urban areas. This study showed that from 1989 to 2002 the population of Ajmer grew by 25.17 percent, with the built-up area increasing five times more than the population growth by 133.02 percent. Studies are helpful to understand Ajmer's urban dynamics which are useful to plan and develop

Ajmer authorities to ensure less of the potential risk of natural or manufactured disasters. Ajmer is less likely to develop.

Keywords: Assessment, land cover, land use, urban growth, GIS.

1. INTRODUCTION

Urban growth may be defined as the move from mainly or exclusively agricultural communities to other communities and their activities are focused mainly on the government, business, production or allied interests [11]. Urbanization involves moving from one village to another and changing from the farming profession to business, commerce and services, but also changes in the behavior, attitudes and beliefs of migrants. In our villages and cities, the rapidly growing urbanisation overcomes poor resources by invading them, leading to unsustainable and unmanaged development situations. By planning future scenarios for the dynamics of land use area change, we are able to manage urban growth in a planned fashion [2]. Planning sustainable city growth would lead to the planning of natural resources, which would not adversely affect society. Growth in population is a key driver of urban growth. It is of two kinds, natural population growth and population migration to urban areas with an aspiration to better livelihoods, infrastructure, services and facilities. Another important driver of urban growth is industrialization. There are numerous example of the development and expansion of urban areas due to high industrial activities in India such as Tata Nagar. Industries are developed in bulk in the outskirts of a city that transform farmland into built-up areas. In order to further migrate human beings and to support them, industrialization and aspirations to better facilities and facilities are leading to the migration of people that require housing and other infrastructure. Future growth speculation also drives urban expansion. Sometimes speculation is accused of urban sprawl because it results in land withholding for development, one of the main factors for discontinuous development [1].

Consequences of unplanned urban growth

Urban growth will impair the quality of growth in a region if it occurs unplanned and unmanaged. In areas where sprawl is not controlled, impacts on wildlife and ecosystems would cause ecosystem and process disruption. The amount of agriculture, woodlands and water systems decreases urban sprawl [5]. Urban expansion is also responsible for society's poor health due to increasing pollution [3].

Change detection and assessment of urban growth

Residential and industrial demands vary over time. The lack of proper urban planning leads to farm and forest land being built for houses and industries [12]. Change detection is a technique that determines changes over time in land use. Change detection determines changes in land use and land cover such as agricultural class, forests converted into settlements etc. Change detection. Using results for change detection and for the estimate of future urban growth, urban growth assessment is carried out.[13][16] Image processing, GIS and remote sensing play a major role in understanding change in land usage and urban growth. This area has been expanded for further research to estimate future urban growth and its impact [8]. The techniques of land usage / land cover for detection of change can also predict urban growth.

Methodology

The processing and analysis of the Multi Spectral Satellite Data for the preparation of land use / land cover for various years is based on standard image processing techniques, such as image correction, improvement, classification and accuracy assessment. Two types of categories (1) Unattended (2) supervised categorization are commonly available. First classification involves simply classifying the software with the number of classes in which the landuse classes are to be classified. It's a heuristic classification approach. On the other hand, supervised grading requires some sort of user supervision in the form of training samples. Training samples for classification algorithm training are collected by the user in this approach. Compared with unattended classification, this classification method is better. The Maximum Likelihood Algorithm for supervised image classification has been used in this study. The supervised classification was conducted by ERDAS Imagine (Leica Geosystems Inc.). Figure 2 explains the whole methodology for preparing land use cover maps.

Training of Classification Algorithm

The supervised classification needs classification algorithms for which training samples also known as signatures must be collected by onscreen digitisation, based on prior knowledge of these classes, for each class of targeted land use / land cover. Once pixels for each class have been selected, the separations matrix was created to find a band combination in which all land usage / land covering classes for all satellite imagery are separable. The TD (Transformed Divergence) values are evaluated by the seprability matrix in different combinations for each category. The combination of bandage and maximum TD-value indicates the highest separability between land use / country cover classes chosen for classification. Then a contingency matrix has been generated and analyzed to check the error between selected training pixels. It is checked whether the selected pixels in the contingency matrix are in other classes or not. If the matrix error percentage is high, signatures must be refined. The training samples may be examined by drawing histograms for all classes in every band. The uni-modal histogram is the correctness of the signatures collected for various land use / coverage classes, meaning that any class actually has the pixels selected. If this is not the case, new pixels will be removed, and the entire process will be repeated. As discussed above, after selecting correct signatures, the classification algorithm was trained.

Classification

Refined signatures were used with Maximum Likelihood Classification algorithms for supervised classification. The highest probability of matching pixel values between different pixels for each functional class is checked by the maximum similarity algorithm. The same function class is allocated similar pixel values. These methods are used to classify each Ajmer fringe satellite picture. Using the stratified, random sampling method, classified imagery was evaluated after classification accuracy. A kappe statistics, user accuracy, manufacturer accuracy and exactness percentage are calculated by an accuracy assessment to determine whether or not the classes are accurately classified. Standard symbology was adopted during the classification of images in accordance with the NRSA classification scheme.

Processing of Satellite Imageries

Firstly, all the satellite images were previously processed using several methods, including image correction, stacking of the data layer for the preparation of false FCCs and merging resolution. Spectral profiles were created in order to identify differentiable land use / coverage classes and their separability in various spectral bands. Spatial profiles were then examined to see pixel values that can determine the variation of reflectivity in various characteristic classes. Seven land use / coverage classes targeted as such. There has been identified the open land, the forest, barren land, the rocks, body of water, shrubs and settlement.

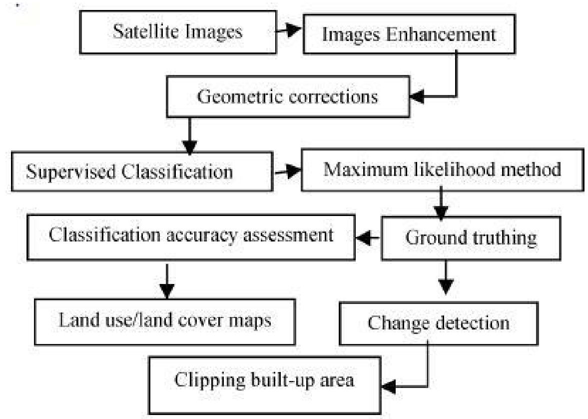

Figure 2. Classification

This study shows that supervised classification using Maximum Likelihood algorithm has produced good results in the field of study. Medium-resolution satellite imagery was used to detect land use / land cover and urban growth. Results are explained in the following sections.

Land use/ Land cover change Detection

The time changes in the land utilization / land cover for 20 years I.. 1989 to 2009 have also been calculated with classified outputs for several years. Results show a significant increase in built-up areas within 20 years and a higher rate of growth than an increase in population rate. Such a major transformation of the peripheral areas into imperceptible areas results in various types of hydrological adverse impacts which lead to flood, drought and groundwater depletion problems. For sustainable urban growth, proper land use planning is necessary. Unbalance in urban density in the study area contributes to the human disaster situation as severe water shortages, local water supplies depletion i.e. the lakes caused by changes in watershed characteristics, pollution, and the risk of heat wave increase. Another example of unsustainable and unforeseen urban growth is Urban Heat Island. Temperature growth is one of the main concerns caused by unplanned urban growth in urban areas relative to rural scenery.

Urban Growth Assessment

The study demonstrates that urban development near Jaipur Road (NH8), nearby highways, Ana Sagar area and between Foy Sagar Lake and the Ana Sagar Lake region are more likely to be more rapidly urbanized in the coming years as people move to these places to better work in conjunction with the interests of people involved. The Foy Sagar area is a very high urban area that can be caused by the development of new settlements in relatively flat areas. Pushkar by pass Road has an influential growth on the road. Madar, which is on the north-east to Ana Sagar Lake, is also growing enormously, given the development and the development of new railway colonies. In the area near Khanpura Pond, there is also a risk that many industrial activities will be developed at a smaller rate. Ajmer is a major place for higher urban growth and seems to continue soon due to the creation of new educational institutions in the region of Pushkar bypass. Pushkar is a popular and religious place, marketing is on the increase and the urban density is growing. It will grow widespread in the next few years.

Statistical analyzes of land use/land coverage change have shown that urban areas were 1,26% of the total area in 1989, 2,28% in 1999, 2,91% in 2000, 2,95% in 2002, 4,54% in 2005 and 5,23% in 2009. In the first place there was a selection of square areas for studying and somewhat larger than Ajmer Fringe in the first quarter of the last year. This statistical analysis indicates that between 1989 and 1997 urban growth amounted to 81.28 percent, whereas between 1989 and 1991 population growth amounted to 1.36 percent, between 1997 and 2000 urban growth amounted to 27 percent, while population growth rose to 19.54

percent (1991-2000), urban growth rose to 1.77 percent between 2000-2002, and population growth was 3.27 percent.

The study shows that population growth rose by 25.17% from 1989 to 2002, while urban growth rose by 133.02%, five times the population growth. Further, urban growth is likely to spread to a larger scale since the growth of population in Ajmer is likely to lead to more demands from new residential colonies and industry developments.

Classes	2002	%	2005	%	2009	%
Other classes (ha)	78763.73	97	77754.3	95.4	77033.8	94.76
Settlement (ha)	78763.73	2.95	3537.11	4.54	4257.54	5.23

Table 2: Built-up area and other classes with respective year land use/ land cover.

For best-in-class land use planning, the study of land use and land cover changes and urban growth evaluation, monitoring and planning is important. GI and image processing are effective for capturing the geospatial phenomenal by geospatial techniques such as remote sensing

CONCLUSIONS

Urbanization is not avoided process, which grows in search of improved living conditions as population growth, industrialization and rural migration increase. Change in land use / land coverage over time can be identified by differentiating information on land use / land cover from classified satellite images. More buoyancy was shown on major pathways such as Pushkar bypass road, Jaipur road, the colony of railways and Foy Sagar in Ajmer's external areas. Urban growth estimated at 81.28% for the years 1989 to 1997, 27% for 1997 to 2000, 1.77% for 2000 and 2002 and 47.71% for 2002 to 2005, and 20.4% for 2005 to 2009, were estimated during the years 2000 to 2002. Urban growth is on the road, a linear growth that leads to higher infrastructure investment costs. The watershed characteristics of Foy Sagar and Anasagar Seas have changed from large scale to impermanent built areas, leading to their depletion. In this study, the use of geospatial analysis techniques for the detection of land use / land cover change and the dynamics of urban growth has been demonstrated. The study also helped to identify the potential areas of future urban development that could help land use planners to make optimal land use planning and investment choices.

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