

## **URBAN SPRAWL AND ITS IMPACT ON NATURAL RESOURCES: A GEO-INFORMATICS APPROACH**

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### **INTRODUCTION**

Urban sprawl is the process by which cities and towns develop and grow into larger areas. It includes the movement of people from rural to urban areas as well as movements among towns and cities (UNHABITAT et al, 2002). The term urbanization is also used for the expansion of urban land uses. Much of the expansion of urban land use is the result of a shift from dense to more dispersed settlement massive urbanization programmes are under way in many parts of the world, often in regions where the available land and resources are limited relative to the size of the population. While urbanization is a natural consequence of economic development and industrialization, it does lead to many challenges, the main being negative impact on resources. Especially it has an opposing effect on agricultural resources. Urban expansion inevitably covers some agricultural land while change in land values and land markets around cities often result in land left vacant as the owners anticipate the gains they will make from sell it or using it for non-agricultural uses. The urban sprawl is determined by where different households, enterprises and public sector activities locate and build, legally or illegally. In most instances, there is little effective control over land-use conversions from agriculture to non-agricultural uses. This unregulated physical expansion brings many serious consequences. Approximately 25 per cent of the world's terrestrial surface is occupied by cultivated land. Urban growth is more likely to reduce arable land availability if it takes place in this zone. To mitigate such effects, sustainable urbanization has to be adopted. Such urbanization world requires conservation of non-renewable resources, mass-scale deployment of renewable resources, and a reduction in the energy-use and waste-production per unit of output/consumption. Moreover, the pattern of urban growth should facilitate a fair distribution of resources, both within the present generation and between present and future generations.

Tamil Nadu ranks first in urbanization among the fifteen major states in the country. Over a century period, since 1901 to 2001, it can be witnesses a gradual increase in the urbanization levels and growth of urban population in Tamil Nadu, comparatively higher than the all India's level. Tamil Nadu State is steadily transforming into a predominantly urban society. According to the 2001 Census, Tamil Nadu has emerged as the State with the highest level of urbanization (44%) in the country among the larger States. At the beginning of this century, Tamil Nadu's population was 20.9 million, of which about 0.31 million was living in urban areas. Over the years, the share of urban population has gone up to 44 percent and shoots at 27.4 million. The last four decades shows an almost three and half times increase in urban population of the state (from 8.99 million in 1961 to 27.48 million in 2001). The urban population in the state has increased from 15.07% during the year 1911 to 34.15% during 1991 census and further to 44.04% during 2001 census. While the percentage of urban population in the country increased from 10.85% to 27.78% during 1901-2001. Due to the increase of the urban population there is conversion of agricultural land into non-agricultural uses, resources depletion and more on environmental degradation have been observed in the urban areas of the Tamil Nadu in the recent past. The notified problems increased there may be a threat to natural resources and the food security to the insitu

population of the region. There is an urgent need to control the existing problem emerging in different scales in various towns of the State.

The Chengalpattu City has been chosen for the present study since it is a satellite city of rapid growing metropolitan city Chennai. The rapid growth of Chennai metropolitan area towards south, the rural urban fringe of Chengalpattu City also modified with the chronological period of time. The land resources and water resources are getting modified by the continuous changes in the urban fringe. The modified agricultural land parcels are not renewable for further agricultural usage of the region. The conversion of land parcels may lead to future food security of insitu population of the city. Hence a systematic study is needed to assess the rapid urbanization and its impact on land resources to predict the future food security of the people. The objectives of the studies are:

- To analyze the spatio- temporal growth of Chengalpattu city between 1970-2010
- To assess the landuse/landcover of the study area between 1970-2010
- To predict the level of urbanization and its impact on agricultural sector of the study area

### **Methodology**

The present study is demonstrating the usefulness of remotes sensing technique to understand the urban sprawl and its impact on resources. To achieve the objective the following steps are involved in the research. The Base map of the study area has been prepared using Survey of India Toposheets on 1:50,000 scale and the adjoining villages has been extracted from the taluk map of Survey and Land Records, Govt. of Tamil Nadu. Remote sensing data of Landsat ETM, IRS-P6 and Geo-eye products for the period 1991, 2006, 2011 has been selected for the present study. The remote sensing data pertaining to the above period were classified into four land use types in ERDAS imagine 9.2 software using supervised classification technique, the urban land use information were extracted according to land use types in study area. The urban land use change information, such as the space distribution feature and quantity of dynamic change information, were calculated by the matrix analysis and vector superposition function in Arc GIS 9.0 software. The Soil map have been prepared using satellite image with the signature set collected from the Soil Survey and Landuse Planning (SSLUP) soil maps. The land capability, land irrigability and soil suitability also extracted from the SSLUP report. By overlaying the soil map over the 1980, 1990 and 2006 urban sprawl map, the level of agricultural land resource loss have been identified and calculated. Based on the crop suitability of the converted land parcels the crop production and economic value of the production have also been arrived. Finally, the driving forces of causing the urban land use changes were discussed from economic progress and population, terrain and administrative factors.

Chengalpattu city is located at 12.7°N 79.98°E. It has an average elevation of 36 metres (118 ft). The study area includes Chengalpattu town and its adjoining 14 villages namely, Melameyyur, Venbakkam, Alapakkam, Ammanambakkam, Hanumanthai, Hanumanthaputheri, Pulipakkam, Paranur, Kunnavakkam, Rajakulipettai, Vallam, Palaveli, Edayankodumanthangal and Patravakkam. It occupies a total area of 4015.13 hectares.

### **Discussion and Conclusion**

The supervised classification of level-1 landuse category has been adopted for the given period of time for the Chengalpattu City and the surrounded 14 revenue villages. The area calculation has been made and the change detection also has been studied.



*Built-up land change detection (1991-2011)* : The total built up land during 1991 is about 228.52 ha. Six revenue villages namely Rajakulipettai, Paranur, Kunnavakkam, Vallam, Alapakkam and Hanumanthaputheri observed less percentage of built-up land in 1991. The villages namely Palaveli, Hanumanthai and Edayankodumanthangal had the moderate percentage of built up land. The highest was in Chengalpattu (130.92 ha). The year 1991 show the total built up land raised to 367.49 ha. Alapakkam and Hanumanthaputheri revenue villages had an increased built up land during this year. Chengalpattu had the highest built up area (177.09 ha). An increase of 138.97 ha in built up land was observed. The process of urbanization is more rapid in the year 2011 and recorded about 1061.33 ha.

*Crop land change detection (1991-2011)*: In the year 1991, the study area had a large area under cropland ie 2,456 ha. The cropland observed in the year 1991 is about 1982 ha. and it has been reduced into 741.01 ha in the year 2011. The declining area details clearly shows that the conversion of land into non-agricultural usages. Except Melameyyur, Palveli, kunnavakkam, Hanumanthaputheri, Chengalpattu villages the conversion of crop land is in rapid manner. This is because of the large scale purchase of land for other uses and they kept as fallow for a longer period. Since the study area is producing more paddy for the near by area peoples requirements, the conversion will give adverse effect to the neighbouring villages..

According to the soil map three major types of soils are found in the study area are Lithic Rhodustalfs (Chengalpattu series), Vertic Ustropepts (Edayankodumanthangal series) and Montmorillonitic Ustropepts (Hanumanthai series).

*Montmorillonitic Ustropepts*: are the most fertile of all the three soils. They are moderately suitable lands having moderate limitations of calcareousness, salinity, sodicity and soil texture. Crops like sorghum, chilli, sunflower grow on them. However they are most suited for paddy, sugarcane, cotton and groundnut. *Vertic Ustropepts* are marginally suitable lands having severe limitations of calcareousness or drainage or climate, associated with moderately suitable lands having moderate limitations. Rainfed crops like sorghum, bajra, ragi, sugarcane, rice, groundnuts, chillies, maize, virginia tobacco, mesta grow on them. Also the main crops that grow on them are paddy, sugarcane, cotton and groundnut. *Rhodustalfs* are not much relevant for agriculture. They support only dry crops. The crops like sorghum, tobacco, chilli, groundnut, castor, bajra etc grow on them. However the crop best suited is groundnut. All the soil types in the study area support rice cultivation. According to the attribute table, the montmorillonitic ustropepts soil occupies 1943.28 ha., Vertic ustropepts occupies 480.83 ha. and Rhodustalfs occupies 1591.02 ha. of the study area

According to the rapid appraisal with the people the following loss of productivity and its cost have been arrived due to land conversion. The total built up land in the year 2011 is 1061.33 ha. Out of this 383.87 ha belongs to Chengalpattu series, 198.85 ha belongs to Edayankodumanthangal series and 309.44 ha belong to Hanumanthai series. Considering that the built up land had been covered by paddy, then the loss would have been 1421120.9 kg of production. Considering groundnut had been cultivated, then the loss would have been 1485862 kg of production. In case of cotton, Rs. 63679800 would have been loss from 1061330 kg of production. In case of sugarcane then the loss would have been 68986450 kg of production.

The present study concluded that the remote sensing data is the best source for preparing thematic maps spatially and temporally. Remote sensing and collateral will be more useful for the study of urban sprawl and its impact. The study clearly proves that the conversion of agricultural land into non-agricultural purpose leads to food grain loss and threat on food security of a region.

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