ABSTRACT

Guwahati is one of the fastest growing cities in India. It is the gateway to the entire North Eastern region besides being the most prominent. During the recent years, the population of the city has increased at an exponential rate due to its many fold expansion in regards to settlement as well as industrial growth. This study is aimed at to understand the impact and thereby assess its relation to urban sprawl vis-à-vis geo-environment and ground water regime of a representative part (eastern part) of the city area. For understanding the issue it is necessary to generate primary as well as to collect secondary database on urbanization, terrain condition, geo-environmental problems (soil erosion and landslides) and ground water of the study area. For better understanding of the problem the latest techniques of Remote Sensing and GIS has been utilized to yield better input as well as to suggest proposed mitigation measures for future development of the study area.

The various parameters that have been identified for the investigation are population study, urban sprawl pattern evaluation, land use/land cover, slope, Digital Elevation Model (DEM), geology, geomorphology, soil erosion, landslide and ground water data. The main focus of this study is on the following aspects:
1. To study the urban sprawl.
2. To measure the soil erosion and identify erosion prone zones.
3. To identify landslide prone zones.
4. To study the effect of urbanization on ground water and to identify artificial recharge areas for ground water recharge.
5. To recommend suitable measures to reduce or minimize the effects of the geo-environmental degradation.

To achieve the aforesaid goals, Remote Sensing and GIS based technology was attempted to generate spatial and non-spatial database. Both the spatial and non-spatial database in the GIS environment is used for analysis, which helped to arrive at the final output.

The base map was prepared using Survey of India toposheet. Moreover, other available maps like soil, land use/land cover generated by various departments/organizations were consulted for comparison and updating with the present findings. All the thematic maps prepared are in the 1:50,000 scale. The maps have been updated by taking help of the satellite imagery, Survey of India Toposheet and already available maps with the support of field evidence. The attribute information is collected from the primary as well as secondary sources.

To get an overview about the general condition on the eastern part of the Guwahati city; its location, communication, physiography, drainage, climate and rainfall, soil and industrial activities have been taken up for this
study. As our study area forms a part of the Guwahati city, hence systematically past to present scenario of urbanization and landuse pattern of the city has been very much emphasized in our present evaluation.

The land use/land cover, urban sprawl pattern, geology and geomorphology of the area are the parameters whose information was extracted by the interpretation of recent satellite imagery supported by field verification. The study area is divided into seven major land use/land cover categories, dominated by built-up lands (51%). The urban sprawl pattern indicates development of built-up lands over all other categories in all directions. On the other hand, urbanized hills are geologically hazardous for habitation. Geomorphologically, residual hills are dominant class in the study area followed by valley fills. These hills are gradually encroached by settlements leading to landslide, soil erosion and cause ecological imbalance.

The elevation information available in the Survey of India toposheet in the form of contour line and spot height have been used to generate the Digital Elevation Model (DEM) and slope map of the study area. The DEM is helpful in studying the drainage, land use/land cover, urban sprawl pattern and identification of artificial recharge zone in the area. Based on percent of slope, the area is divided into five slope classes, where 0 – 25% slope class is suitable for construction activities for settlement. People
started occupying the steep slopes for habitation, which are susceptible to landslide.

In the geo-environmental study, attempt has been made to find out causes of soil erosion as well as landslides within the area. The soil erosion is measured by observed method by collecting samples in the field, and also by Universal Soil Loss Equation (USLE), results of which have been brought to a logical conclusion by using GIS technology. Observed method showed that the average soil loss is 0.30 t/ha for a rainfall intensity of 11.25 mm/hr during a period of 2 hours, whereas, application of USLE showed that the mean annual soil loss of the study area is 2.43 t/ha/y. On the basis of this study soil erosion prone zone map has been prepared. The entire area is divided into five zones; amongst these high and severe soil erosion prone zones are most hazardous.

Majority of the landslides in this area are influenced by rainfall supported by adverse geological conditions. Extensive earth cutting on hill slopes, deforestation, haphazard construction activities on hill slopes are the most important factors that instigate landslides in the study area. The landslide prone zonation map of the study area showed that 11% of the total area falls in very high-risk and high-risk zones and rest is in the no risk zone.

In the ground water study, attempt has been made to study the effect of urban sprawl on ground water regime and to identify artificial
ground water recharge sites to augment the future ground water scarcity. On the basis of the study of 142 dug wells (February-March, 2003) the area is divided into seven depth to water level zones at an interval of 2 m. Study showed that rainfall is the main controlling factor of the water level fluctuation in the study area. Out of the 18 dug wells studied for water level fluctuation from 2002-03 to 2007-08, 5 wells are affected by increasing urbanization.

In view of ground water scarcity in near future, besides suggesting rainwater harvesting, six artificial recharge sites have been identified for ground water recharge. Recommendations have been made to reduce or minimize the effects of the geo-environmental degradation in the study area.