



University of Zabol  
Graduate school  
Faculty of Natural Resources  
Department of Environment

**The Thesis Submitted for the Degree of M.Sc  
(in the field of Land Assessment and Planning)**

**Evaluating the prediction accuracy of urban expansion model  
developed using SLEUTH-GA, case study of Zahedan city**

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## **Abstract**

The urban population growth has made the extension of urban areas inevitable in the future. Therefore, a correct understanding of the urban extension process is essential in order to implement effective management in the protection of the urban environment and its surroundings. Models are a expositor for complexity of system. One of the most widely popular models is automated cells in land use/ land cover change modeling. Cellular Automata of SLEUTH as an urban modeling tool has been considered in this study to model the process of urban extension in the city of Zahedan. The main trait of the SLEUTH model is that it be calibrated with changes the area in the past, and therefore reasonably predicts the future. For this purpose, SLEUTH and its latest version, SLEUTH-GA, which uses a genetic algorithm to optimize the results, were used to predict urban growth probabilities from 2020 to 2050. The required layers of this model include slope, land cover, excluded regions, urban land cover, transportation, and hill shade. These layers were extracted from the topographic map, digital elevation model (DEM) and classified images of Landsat 8 satellites. In order to land classification for use in modeling, different methods were examined and compared consist of maximum likelihood, minimum distance, Fisher, KNN, fuzzy ARTMAP, artificial neural network and support vector machine, and LCZ and also, build-up indices (DBI, BLFEI, BAEI and BAEM). The results of this comparison showed that the use of LCZ technique with overall accuracy and kappa coefficient of 96.33% and 0.95 has a high efficiency compared to build-up indices and other studied supervised classification methods, and therefore recommended for land cover mapping in arid and semi-arid regions. Urban areas extracted from Landsat satellite imagery were used by the LCZ method to calibrate the model for the period 1990 to 2050, and urban growth was predicted for 2050. According to the results obtained from urban growth prediction with SLEUTH and SLEUTH-GA models, the increase in the area of Zahedan will be in 2050 between 159.18 to 191313.78 hectares in the historical growth scenario and will be 16083.72 hectares in the environmental scenario. This prediction enables the evaluation and comparison of the results of current strategies and helps to adopt appropriate management options and modify its current trend.

**Keyword:** Land use change, urban development, spatial simulation, genetic algorithm (GA)