Chapter 12
An Approach for Land-Use Suitability Assessment Using Decision Support Systems, AHP and GIS

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ABSTRACT

Nowadays, analysis of land-use suitability requires consideration of variety of criteria including not only natural/physical capacity of a land unit but also socio-economic and environmental impact implications. This chapter suggests an approach instead of typical synthesis and land-use suitability assessment methods that is used in the urban and regional planning. Using the decision support systems with AHP and GIS, a participative, GIS-supported, different, new, flexible, and soft approach is proposed for land-use suitability assessment of cities and regions in particular. The chapter presents a technique integrating SWOT-CATWOE analysis, the Delphi and Inquiry Technique, the Analytical Hierarchy Process (AHP), and a Geographic Information System (GIS) to evaluate the land-use suitability for cities. By the help of this study, settlement suitability analyses have been achieved according to the socio-economic and infrastructure, environmental or physical thresholds of the settlement, and this integration could benefit urban planners and decision makers. The proposed method begins with the identification of settlement requirements, followed by the derivation of settlement evaluation criteria with SWOT-CATWOE analysis and the Delphi and Inquiry Technique. Then, pairwise comparisons (PC matrices) are formed between each pair of settlement criteria. The AHP is used to measure the relative importance or weight of each settlement criterion. This chapter has intended a theoretical and scientific base for an AHP and GIS combination with decision support systems. Thus, when land-use suitability assessment has taken as this combination of decision support systems, AHP and GIS, more realistic, more accurate, and applicable results emerge.

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INTRODUCTION

Urbanization is a continuous process and now a common feature of world countries. The twenty-first century is likely to be dominated by urban living in a way (Thorns, 2002). Over half the world's populations are now city dwellers. By 2025, according to World Bank estimates, 88 per cent of the world's total population growth will be located in rapidly expanding urban areas and 90 per cent of that urban growth will be absorbed by the developing world (World Bank, 1996). Worldwide economic, cultural, environmental, social etc. trends are having a greater and greater impact on urbanization. These global and glocal forces worldwide need to be understood to make sense of urbanization trends and other changes in the spatial distribution of the world's population over the last 15-20 years (Polat, 2009).

Because of rapid urbanization processes, it is important to identify land-use suitability for future development of cities and regions. As urban regions grow, more land will be needed to satisfy further growth of urban population in the future. In this context it is very important to find suitable areas for urban and rural development or settlements to overcome the undesirable growth in cities.

The consideration of natural resources (soil, water, roads, forest, etc.) is a necessity for large-scale planning aimed at conservation and transferring natural resources to the next generation. However, socio-economic conditions and infrastructure are also very important in planning. The uncontrolled momentum of urban sprawl and land-use change raises many issues (Brook & Davila, 2000), which might have both positive and negative impacts on the natural, social and economic environment.

Urban spatial pattern is also debated in the literature in deference to the new urban or smart growth sustainability principles that have received attention in urban development control. Multiple sustainability principles address various dimensions of the built and natural environment density, land-use mix, access, open space preservation, resource conservation, and the like.

The focus on the urban level is significant not only because of the continual process of the urbanization of world population, but also because the proverbial devilin-the-details has a manifestation at the urban scale. As Breheny (1993) remarked, increasingly, sustainability is debated with an urban focus. Little wonder, then, that the term "sustainable urban development" is associated with smart growth or new urbanism, which are about urban spatial patterns (substance) as well as decision-making (procedure) in bringing about a desirable urban form (e.g., Katz, 1994). The physical form that human settlements must take qualitatively is integral to the debates about sustainability, with a view of ecology that poses the natural and the built-environment as one whole (see Lynch, 1984; Calthorpe & Fulton, 2001).

In the land-use and urban spatial planning process, land-use (or land) suitability can be regarded as a bridging phase linking land resources assessment to the decision-making process. Land-use suitability analysis is the process of determining the fitness of a given tract of land for a defined use (Steiner et al., 2000). The inherent conflicts and the complex network of socio-economical and ecological constraints affecting land use planning call for a flexible decision-making support tool able to incorporate multiple evaluation criteria, including several stakeholder points of views. Land-use suitability gives transparent indications to planners and decision-makers concerning land uses which can be sustainable fostered in the land under consideration, allowing areas to be ranked according to their degree of suitability for a specific land use. Land-use suitability assessment can be regarded as a specific case of land evaluation: It is an appraisal of land characteristics in terms of their suitability for a specific use (Corona et al., 2008).

The study includes three stages (Figure 1). In the first stage, the sufficiency and reliability of