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## Chapter VI

# Collaborative Decision Making in Web-Based GIS

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## ABSTRACT

*There are numerous technical and organizational challenges in the design and implementation of spatial decision support systems. Part of the problem stems from the distributed and uncoordinated land management practices of individual decision-makers. For example, in environmental planning, multiple decision makers with conflicting goals may need to make collective decisions. This requires collaborative decision-making tools and conflict resolution capabilities. In this chapter, we identify the research issues related to the design and implementation of Web- based collaborative spatial decision-making support systems in the context of distributed environmental planning. We implemented a Web-based Spatial Decision Support System called GEO-ELCA (**E**xploratory **L**and Use **C**hange **A**ssessment) for typical decision-making tasks by urban or municipal planning agencies where resource managers or stakeholders of different interest groups can express their options for future land use changes and assess the resulting hydrological impacts in a collaborative environment.*

# INTRODUCTION

Geographic Information Systems (GIS) have been criticized as an "elitist" tool that creates a gap between internal users (mainly government and large agencies) and external users (the general public) (Pickles, 1995). As organizations move towards less hierarchical structures, environmental resource managers are facing increasing pressure to involve multiple stakeholders in spatial decision-making that reduces differential access to information and resources. As a result, geospatial data and models have become relatively centralized (Curry, 1995; Goss, 1995; Lake, 1993; Pickles, 1999). In the recent years, there has been a growing interest in distributed access to geospatial information and services to decision makers and planners. Although as much as 80% of general information contains spatial components (OGC, 2001), making these data available to users in consistent with native domain model for decision making is still a great challenge. A broader understanding of distributed information architecture is needed in order to make spatial data model available and interoperable to the users.

The World Wide Web has offered tools for increased interactivity and connectivity among diverse user groups. Before a web-based spatial decision support becomes reality, empirical studies are necessary to explore the feasibility of solving spatial decision-making (e.g., hazardous facility location, urban land use/resource development negotiations or multiple use of natural resources) in collaborative environments. One of the major challenges is that a user's access, inference and analytical ability of spatial data sets and services are limited by proprietary standards, platform dependence and incompatibility. Since spatial information is dependent on representation models of geometric and topologic features, it is often difficult to interoperate disparate models in a collaborative distributed environment.

# COLLABORATIVE DECISION MAKING IN SPATIAL APPLICATIONS

Problem solving in spatial domains tends to be semi-structured and collaborative efforts can span across disciplinary and managerial boundaries (Bennett, 1994). Spatial decision support is intrinsically complex, often containing intangibles that cannot be easily modeled. Spatial applications deal with structures that are partially known or burdened with uncertainties (Rittel et al., 1973; Jankowski, 1999). Reitsma et al. (1991) provide a typical example of a problem in spatial domains, illustrating the 'domain of complexity' in the case of a river basin management in the western part of the US. Very often, potential solutions become NIMBY (Not In My Back Yard) controversies (e.g., "You can't put a landfill in my neighborhood," "The retail must be placed in a dense neighbor-