ABSTRACT

The development of collaborative spatial decision support systems presents a host of challenges, ranging from technical to societal and institutional. Resource managers and environmental planners often need to understand the effect of the distributed and uncoordinated land management practices of individual decision-makers, which in the long run causes significant environmental impact. In many cases environmental planning requires collaborative decision-making tools where complex interacting agents with conflicting goals need to work without any prior idea of the counterpart. This paper identifies research issues on the design and implementation of a Web-based collaborative spatial decision making in the specific context of distributed environmental planning. We demonstrate a Web-based Spatial Decision Support System GEO-ELCA (Exploratory Land Use Change Assessment) 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.

Keywords: spatial decision support, collaboration, Web-based organization, management

INTRODUCTION

The vision of a collaborative spatial decision support system challenges the fundamental criticism directed against Geographic Information Systems (GIS) being an “elitist” tool that harbors the gap between system users (mainly government and large agencies) and non-users (the general public) (Pickles, 1995). In the face of the growing trend of organizations moving towards a flatter structure, environmental resource managers are facing increasing pressure to involve multiple stakeholders in spatial decision-making to bridge the gap brought about by differential access to information and resources. The traditional production of geospatial data and models...
has been relatively centralized (Curry, 1995; Goss, 1995; Lake, 1993; Pickles, 1999). In recent years, there is a growing interest in the distributed access to geospatial information and services to decision makers and planners to promote Collaborative Spatial Decision Making (CSDM). CSDM and public GIS, often called GIS2 (Densham et al., 1995; Sheppard, 1995), involves a “bottom-up” planning model reflecting the stakeholders’ perspective to explore the scientifically projected planning scenarios. The vision requires a broad understanding of organizational settings against the backdrop of distributed information architecture for closer involvement of multiple stakeholders from different geographic locations and social orientations.

Computer networks provide exciting opportunities to extract information from multiple sources in real time. The Internet in general, and the Web in particular, offers tools for more interactivity and connectivity among diverse groups. The integration of conventional planning method and innovative Web-based tools can offer a robust system to solicit community perspectives. Carver et al. (1999) have identified several generic advantages of a Web-based spatial decision support system (SDSS). In this framework public access to data and model is considered the key element of social and political empowerment through the experimentation of ‘what-if?’ modeling. As such a collaborative spatial support system could be reckoned as an empowering tool of the marginalized group. Bosworth et al. (2002) describe an encouraging experience based on public engagement in growth management and transportation planning. “A public workshop is considered a success if 60 people attend, while a Web site on the topic can reach 6000 people a week.” 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, multiple use of natural resources, etc.) in a collaborative environment. The GEO-ELCA system demonstrates how the distributed access to spatial information facilitates productive discourse of land use planning. The rest of the paper is organized as follows. In the next section we discuss issues and approaches on collaborative decision-making in spatial domains. In the following section we describe GEO-ELCA, a prototype system for a collaborative spatial decision support system that addresses some of the issues identified, and in the last section we present our conclusions.

**COLLABORATIVE SPATIAL DECISION MAKING**

**Problems of Spatial Planning**

The complexities associated with spatial problem solving have parallels in other problem domains. In practice, spatial problem solving tends to be a semi-structured and collaborative effort that crosses managerial and disciplinary bounds (Bennett, 1994). Spatial decision problems are intrinsically complex, often contains intangibles that cannot be easily modeled, their structure partially known or burdened by uncertainties (Rittel et al. 1973; Jankowski, 1999). Reitsma et al. (1991) provide a typical example of spatial decision problem illustrating the ‘domain of complexity’ in the case of a river basin management in the western part of the U.S. 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-
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