

Chapter 2.27

Web GIS and Knowledge Management Systems: An Integrated Design for Collaborative Community Planning

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ABSTRACT

Environmental problems are multidimensional and usually complex. Collaborative integration of multiple forms of knowledge is one approach used to develop meaningful solutions to complex problems. In this regard, spatial data and knowledge about the environment have been managed extensively with Web geographic information systems (Web GIS). However, past Web GIS research has focused mostly on using spatial tools to manage explicit (codified) knowledge. This has reduced the complementary contribution that tacit (experiential) knowledge can provide to environmental solutions. In this study, Web GIS and knowledge management technologies are used to integrate multiple forms of spatial knowledge in support of collaborative community planning. The system design included a customized

end-user interface for data entry, georeferencing tools for asynchronous collection of local data, and protocols for knowledge management dealing with species location, ecological habitats, and environmentally sensitive areas among others. The system enabled access, query, sharing, and updating of environmental knowledge using visual map-based tools. The utility of the integrated system design is discussed.

INTRODUCTION

Environmental problems are affected by many factors that can be classified along physical, ecological, socio-cultural, and political-legislative dimensions (Gunderson & Holling, 2002). These factors interact nonlinearly and with feedback such that the system outputs influence the system

inputs. The emergent complexity is a challenge for environmental management, planning and decision making. The literature suggests that approaches that consider collaboration, data partnerships, and knowledge management can provide an effective means to manage the complexity of environmental systems (Andelman, Bowles, Willig, & Waide, 2004; Blumenthal & Jannink, 2000; Jankowski & Nyerges, 2001; Johnson & Singh, 2003). In this study, a collaborative Web GIS and knowledge management system is presented to support access, query, sharing, and updating of environmental knowledge using visual map-based tools.

Collaboration in a spatial context has its roots in the participatory planning literature, and involves the inclusion of a wide range of individual perspectives in the decision-making process (Hemmati, Dodds, Enatati, & McHarry, 2002; Jankowski & Nyerges, 2001). In order to facilitate partnerships and collaborative interactions among stakeholders and planners, extensive use has been made of community GIS (Ghose, 2001; Talen, 1999) and Web GIS (Houle, Dragicevic, & Boudreault, 2000; Kangas & Store, 2003; Rinner, 2003). One limitation of community GIS is that increasing the involvement of individuals demands more efficient management and spatial support tools to reduce process delays. Because the planning process is temporal, Web GIS has increasingly been used to continually engage a wider cross section of stakeholder groups. Moreover, the open source Web GIS movement has positively impacted the adoption and use of Web GIS among individuals and groups. As such, Web GIS can provide a robust infrastructure to support collaboration across multiple spatial and time scales.

Web GIS are designed to integrate the distributive capabilities of the Internet with the spatial analytical features of geographic information systems (Peng, 2001; Peng & Tsu, 2003). Web GIS uses the multimedia protocols of the Internet and forms a focused subset of Internet GIS. The early implementations of Web GIS were limited

to static maps and simple navigation such as pan and zoom (Plewe, 1997). Web GIS has now rapidly evolved to offer a full suite of interactive spatial data management, analysis, and mapping capabilities (Dragicevic, 2004; Gitis, Andrienko, & Andrienko, 2004; Tsou, 2004). An advantage of Web GIS is that they integrate stakeholders, planners, and spatial data in synchronous and asynchronous implementations to search for joint solutions (Dragicevic & Balram, 2004; Kingston, Carver, Evans, & Turton, 2000). The research and applications of Web GIS have mostly focused on designing and using spatial tools to manage explicit (documented) knowledge. This has reduced the complementary contribution that tacit (personal experiences) knowledge can provide to environmental solutions. Extending current Web GIS to support knowledge processes requires that knowledge management systems (KMS) capabilities be integrated in complementary designs.

Knowledge management systems contain tools, techniques, and processes to elicit, assess, organize, expand, and share expertise (McElroy, 2003). Expertise is classified generally as tacit knowledge or explicit knowledge (Fuller, 2002). Tacit knowledge is personal knowledge that has evolved within individuals or communities and has been passed on from one generation to another. This type of knowledge is difficult to transfer to a spatial and digital environment because it is not easily codified. For example, the location of traditional hunting grounds for a First Nation community is common oral knowledge and difficult to translate into a map. The consequence is that tacit knowledge is usually excluded from the map-driven planning process. Researchers have also used the term "local knowledge systems" to describe frameworks for operationalizing tacit knowledge (Lawas & Luning, 1997). Local knowledge, traditional knowledge, and traditional ecological knowledge are other terms that describe tacit knowledge (Zurayk, el-Awar, Hamadeh, Talhouk, Sayegh, Chehab et al., 2001). Explicit knowledge is documented knowledge obtained by

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