



Review of literature on decision support systems for natural hazard risk reduction: Current status and future research directions



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ABSTRACT

Natural hazard risk is largely projected to increase in the future, placing growing responsibility on decision makers to proactively reduce risk. Consequently, decision support systems (DSSs) for natural hazard risk reduction (NHRR) are becoming increasingly important. In order to provide directions for future research in this growing area, a comprehensive classification system for the review of NHRR-DSSs is introduced, including scoping, problem formulation, the analysis framework, user and organisational interaction with the system, user engagement, monitoring and evaluation. A review of 101 papers based on this classification system indicates that most effort has been placed on identifying areas of risk and assessing economic consequences resulting from direct losses. However, less effort has been placed on testing risk-reduction options and considering future changes to risk. Furthermore, there was limited evidence within the reviewed papers on the success of DSSs in practice and whether stakeholders participated in DSS development and use.

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1. Introduction

Model-based Decision Support Systems (DSSs) are used extensively to support the management of our environment across the ecological, social and economic spheres. For example, DSSs have been developed for sustainable management of fisheries (Carrick and Ostendorf, 2007); farming and other agro-systems (Bazzani, 2005; De la Rosa et al., 2004; van Delden et al., 2010); the management of habitat and ecosystems (Booty et al., 2009; Wong et al., 2003); land development (Shi et al., 2012; van Delden and Hurkens, 2011); the delivery of utilities, such as water supply (Abramson et al., 2014) and community planning (Lieske, 2015; Papathanasiou and Kenward, 2014; Sahin and Mohamed, 2013); water resource management considering rivers, lakes, wetlands, reservoirs and their catchments (Berlekamp et al., 2007; Casini et al., 2015; Giupponi, 2007; Matthies et al., 2006; McIntyre and Wheeler, 2004; Mysiak et al., 2005; Románach et al., 2014;

Soncini-Sessa et al., 2003; van Delden et al., 2007); and the management of contaminated sites (Marcomini et al., 2009). The benefit of applying model-based DSSs to decision problems, is that they can:

1. Support policy relevant questions (Geertman and Stillwell, 2003; Parker et al., 2002; van Delden et al., 2007);
2. Focus on long term and strategic issues (Geertman and Stillwell, 2003; van Delden et al., 2007);
3. Facilitate group interaction (Geertman and Stillwell, 2003; Newham et al., 2007);
4. Facilitate effective decision outcomes in complex, poorly-structured or wicked decision problems, which have many actors, factors and relations and are characterised by high or unknown uncertainties and conflicting interests amongst actors (McIntosh et al., 2007; Rittel and Webber, 1973);

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