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Stakeholder engagement in dredged material management decisions

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HIGHLIGHTS

- Stakeholder engagement can facilitate dredged material management decisions.
- Multi-criteria decision analysis can be used with groups to frame these problems.
- This approach was used with stakeholders in Long Island Sound.
- Participatory model building led to shared understanding of dredging issues.
- Focusing on values rather than management alternatives aided in consensus building.

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ABSTRACT

Dredging and disposal issues often become controversial with local stakeholders because of their competing interests. These interests tend to manifest themselves in stakeholders holding onto entrenched positions, and deadlock can result without a methodology to move the stakeholder group past the status quo. However, these situations can be represented as multi-stakeholder, multi-criteria decision problems. In this paper, we describe a case study in which multi-criteria decision analysis was implemented in a multi-stakeholder setting in order to generate recommendations on dredged material placement for Long Island Sound's Dredged Material Management Plan. A working-group of representatives from various stakeholder organizations was formed and consulted to help prioritize sediment placement sites for each dredging center in the region by collaboratively building a multi-criteria decision model. The resulting model framed the problem as several alternatives, criteria, sub-criteria, and metrics relevant to stakeholder interests in the Long Island Sound region. An elicitation of values, represented as criteria weights, was then conducted. Results show that in general, stakeholders tended to agree that all criteria were at least somewhat important, and on average there was strong agreement on the order of preferences among the diverse groups of stakeholders. By developing the decision model iteratively with stakeholders as a group and soliciting their preferences, the process sought to increase stakeholder involvement at the front-end of the prioritization process and lead to increased knowledge and consensus regarding the importance of site-specific criteria.

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1. Introduction

Ensuring navigation throughout the waterways of the United States is one of the missions of the US Army Corps of Engineers (USACE). Navigational dredging is required to sustain the operation of coastal infrastructure and facilitate commerce. In the process, millions of cubic yards of sediment are dredged (235 million cubic yards in 2012) and must be placed or otherwise managed (USACE, 2013). However, sediment management and remediation projects are often performed in complicated political environments where stakeholders are sensitive to different decision paths and actively engaged in championing for or against specific project alternatives (Rogers et al., 2013). Management of contaminated sediments, in particular, can prove challenging in a multi-stakeholder setting, since sites may be contaminated from industrial activities that occurred in the distant past and from multiple sources — the industry entities may no longer exist or responsibility may be difficult to pinpoint, yet the current stakeholders in the community must select a course of action (Sparrevik et al., 2011a). Inviting the active participation of relevant stakeholder groups at the forefront of the decision process can avoid later conflict, but only if all parties feel that their views are being accurately and meaningfully incorporated into the process and if all groups feel that they have a fair say in the final recommendation.

Effective stakeholder engagement has been shown to be an invaluable component for the successful design and execution of policies and services in environmental management as well as other domains.

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Reyers et al. (2009) argue that these planning domains with a strong scientific or technical component are at their core social processes that require effective participation and learning. This engagement and learning, in turn, promote acceptance and adoption of resulting policy plans (Hadorn et al., 2006). Support for this point of view has been found in such environmental domains as catchment management (Allen et al., 2011), water resource and ecological planning (Stevenson et al., 2012), and land stewardship (Cocklin et al., 2007). For instance, Allen et al. (2011) reports that concerted stakeholder engagement efforts resulted in increased collaboration and cooperation. Stevenson et al. (2012) show that this increased collaboration, in turn, can lead to improved ecosystem management. Stakeholder engagement efforts have also produced beneficial outcomes in other domains including public health (Gustavsen and Hanson, 2009; Menon et al., 2007; Sibbald et al., 2009), transportation planning (Forrester, 2009), and corporate social responsibility efforts (Kannabiran, 2009), among others. These efforts are successful in part because they help decision makers to consider factors that might otherwise be neglected during the design process (Cagan and Vogel, 2002). For instance, Sibbald et al. (2009) report that stakeholders that were surveyed as part of an initiative to improve health system priority setting focused on themes of inclusiveness and education for end users, and made no mention of the health outcomes that were the focus of the academics and decision makers who were surveyed.

Sparrevik et al. (2011a) evaluated the factors that affected the contentious dredging project in Oslo Harbor, Norway, in which the dredging of contaminated sediments precipitated protests and civil disobedience. They point to the stakeholders' perceptions of transparency and controllability in the decision making process as strong factors affecting their risk perceptions and thus strong negative reactions. This objection to the nature of the process as opposed to the decision itself is supported by behavioral decision research, which shows that both individuals and groups face difficulties in complex decision environments where uncertainties and value judgments must be made, leading groups to revert to established, entrenched positions (McDaniels et al., 1999). To improve this, the National Research Council (NRC) recommends that for contaminated sediment management decisions, "early involvement of stakeholders is important for heading off disagreements and for building consensus" (NRC, 1997). However, not all stakeholder engagement plans are equally effective, and it is not sufficient to merely inform stakeholders throughout the decision making process, one must actively engage them in decision making (Oen et al., 2010; Hermans et al., 2007).

Moreover, the NRC recommends structured decision analysis as a method to balance risks, costs, and benefits of various sediment management strategies (NRC, 1997). The conceptual decision models that lie at the heart of decision analytic approaches are a way to represent the shared social reality that reflects the problem at hand (Phillips, 1984). Multi-criteria decision analysis (MCDA) is one such framework for establishing common understanding among disparate stakeholder groups and guiding the process of stakeholder preference elicitation (Keeney and Raiffa, 1976; Linkov and Moberg, 2011). MCDA and related approaches have been used as a vehicle for promoting stakeholder engagement and participation in public policy development, and have been shown to effectively synthesize and address concerns, preferences, and aspirations from disparate stakeholder groups (Kiker et al., 2005). These approaches often use decision analysis or other modeling tools as a way to focus discussions about complex systems across stakeholder groups. Decision conferencing (Phillips, 1984, 2006; Phillips and Bana e Costa, 2007) uses decision analysis methods like MCDA, but focuses more on developing a shared understanding of each others' values, a commitment to the problem, and on-the-fly exploration of how different alternatives may be valued by the group of stakeholders. Value-focused thinking (Arvai et al., 2001; Keeney, 2009) uses the MCDA structure to facilitate discussion, but starts with the question of what is valuable about the decision rather than the value of the alternatives given the decision. Mediated modeling (van den Belt, 2004) and shared vision planning (Creighton, 2010) use system dynamic models that represent the interactions among system entities and evaluate the extent to which each alternative alters the system and how those changes provide value to involved stakeholders. Stakeholder engagement initiatives that promote effective communication (Fischhoff et al., 2011; Fischhoff and Scheufele, 2013) and are grounded in decision analytic methods like MCDA have demonstrated effectiveness in incorporating a wide range of objectives and stakeholders into the decision making process across a variety of environmental decision-making applications (Estevez et al., 2013).

In the sediment management domain, approaches based on or related to MCDA have been applied to several case studies. Sparrevik et al. (2011b) and Kim et al. (2009) involved stakeholder groups in the sediment management process in Norway and South Korea, respectively, but the stakeholder involvement in the MCDA modeling was mainly limited to identification of alternatives and criteria weighting. MCDA was used for managing sediments in the New York/New Jersey Harbor, but in this case, experts were involved instead of a broader set of stakeholders (Linkov et al., 2006, 2007; Yatsalo et al., 2007). Seager et al. (2006) engaged stakeholders in the entire management process of contaminated sediment in the Cocheco River in Dover, New Hampshire. However, only four criteria (human habitat, ecological habitat, environmental quality, and cost) were evaluated in this stakeholder-driven decision model.

In this paper, we seek to build upon these existing approaches of MCDA for sediment management responsive to the calls for structured decision analysis by the NRC (1997). We propose to do this by exploring a case study which included a broader set of stakeholders throughout the process of criteria and alternative identification, as well as elicitation of criteria weights. Herein, we describe the multi-criteria, multi-stakeholder engagement process carried out in Long Island Sound (LIS) in greater detail. First, the specific stakeholder engagement methods and their foundation in MCDA are described, followed by the results gained through working group feedback and stakeholder elicitation. Finally, discussions and recommendations for future work are explored.

2. Methods

2.1. Study area

Long Island Sound (LIS), in the northeastern United States, is an important body of water for shipping, recreation, and the environment (Fig. 1). Over the next 30 years, the dredging centers located in the LIS region are projected to produce approximately 38.5 million cubic yards of dredged material (Long Island Sound Dredged Material Management Plan Working Group, 2011a).

The local economy of LIS is dependent upon navigation in and around the area. Economic activities include marine transportation (e.g., cargo vessels and chartered fishing services), commercial fishing and seafood industries, recreational boating, ferry-dependent tourism, and the Naval Submarine Base New London (Long Island Sound Dredged Material Management Plan Working Group, 2011b). Together, these activities contribute to an economic output of $9.4 billion per year, including 55,720 jobs and $1.6 billion in annual federal and state tax revenues (Long Island Sound Dredged Material Management Plan Working Group, 2011b).

The development of a dredged material management plan (DMMP) for LIS was requested after the US Environmental Protection Agency (EPA) designated two open water dredged material disposal sites in LIS. The current project is motivated in part by a previous multi-year, multi-million dollar failed effort to establish a LIS DMMP because of public backlash over concerns about impacts of open water placement of potentially contaminated dredged material. The overall goal of the LIS DMMP is to develop a comprehensive dredged material