

Influence diagrams as oil spill decision science tools

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Abstract (limit of 2500 characters including spaces)

Making inferences on risks to ecosystem services (ES) from ecological crises can be more reliably handled using decision science tools. Influence diagrams (IDs) are probabilistic networks that explicitly represent the decisions related to a problem and evidence of their influence on outcomes. The construction of IDs allows one to consider the important variables influencing prospects and the interdependencies between decisions, random variables and objectives. After constructing a directed graph of the relevant or irrelevant relationships between variables, marginal or conditional probability distributions are assigned to express uncertainty and assess knowledge gaps and information needs. Reducing the uncertainty among these relationships can be done through targeted data collection and experimentation that evaluates the strength and nature of the conditional relationships.

Conceptual frameworks relating deepwater, offshore, and onshore responses to the magnitude of spilled oil and ES impacts were developed for the Deepwater Horizon spill event. From these frameworks, an ID was constructed to display the potential interactions between exposure events and the trade-offs between costs and ES impacts from spilled oil and response decisions. Hypothetical probabilities were assigned for conditional relationships in the ID and scenarios examining the impact of different response actions on components of spilled oil were investigated. Identified knowledge gaps included better understanding of the fate and transport of oil, the ecological risk of different spill-related stressors to important receptors (e.g., endangered species, fish for fisheries), and the need for stakeholder valuation of the ES benefits that could be impacted by a spill.

Framing the Deepwater Horizon problem domain in an ID provided a retrodictive model of the trade-offs faced in the spill event. Moreover, the ID conceptualized important variables and relationships that could be optimally accounted for in preparing and managing responses to spilled oil. The potential

impacts from decisions that mitigate exposure to ecological receptors and how exposure events could inhibit the provisioning of ES were described in the ID construction process. These features of the developed IDs will assist in better investigating the uncertainty in deepwater spills, the costs from losing ES, and the necessary trade-offs for minimizing these losses if future deep water disasters were to occur again.

Statement of relevancy to meeting objectives and topics – see example topic list below:

(Note: 500 character limit including spaces.)

Our poster discusses a modeling framework for considering impacts of stressors from decisions and spilled oil. The framework graphically represents the conditional influences among variables important for assessing ecological risks and trade-offs from the Deepwater Horizon response and quantifies the relationships with conditional or marginal probabilities. The authors believe that influence diagrams can be advantageous tools to evaluate trade-offs in oil spill responses more explicitly.

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