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Community-informed Decisions for Equitable, Cost-effective, and Inclusive Disaster Resilience planning (Co-DECIDR): A Hybrid Framework

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Research Summary

Evaluating coping strategies for community resilience planning in the face of natural hazards and disasters presents significant challenges, including limited system clarity, diverging community priorities, resource inequalities, and inherent uncertainties. Traditional methods—often reliant on economic metrics through benefit-cost analysis—primarily assess monetary aspects, overlooking critical non-monetary factors. In response, the increasing shift towards transdisciplinary methods underscores the importance of integrating local community values into resilience planning. This research introduces the Co-DECIDR modeling framework, designed to evaluate resilience planning alternatives by embracing community-identified values, leveraging local insights, navigating uncertainties, and balancing monetary with non-monetary considerations. By merging Fuzzy Cognitive Mapping (FCM) for qualitative depth with Benefit-Cost Analysis (BCA) for quantitative rigor, Co-DECIDR enables a comprehensive understanding of complex social-ecological systems.

Research Advancement Details

Local communities face significant risks associated with increased natural and human-caused disasters. These disasters impact communities either through acute shocks (e.g., earthquakes, hurricanes, disease outbreaks, market shocks) or chronic stressors (e.g., drought, poverty, food insecurity, social marginalization). Furthermore, complex events can result from multiple traumatic events, often through a complex combination of both natural and human-made causes that exacerbate both the social and physical vulnerabilities of communities. Thus, community resilience planning requires actions and

strategies to prepare for such hazards and to adapt to, withstand, and quickly recover from disruptions. However, adopting investment strategies with the greatest net benefit for the community requires the understanding of benefits, costs, and trade-offs involved in making capital improvements to the social institutions, built environment, and the natural ecosystems associated with the local community for increased resilience. Yet, there are other factors that communities care about, for which monetary values are challenging or even impossible to calculate (e.g., cultural ecosystem services associated with nature-based solutions). In such cases, a community may want to establish what additional factors are important in evaluating alternative investment strategies and consider these factors when deciding on strategies for implementation. Thus, community resilience planning needs to take place in the context of multiple objectives—a complex combination of social, environmental, equity, economic, and other determinants. Such complexities, however, can undermine the community's ability to make optimum decisions, which may eventually compromise community resilience.

Here, we propose the application of Community-informed Decisions for Equitable, Cost-effective, and Inclusive Disaster Resilience planning (Co-DECIDR): a hybrid framework to help community planners navigate through the complex multi-criteria decision analysis (MCDA). Co-DECIDR enables collaborative planning teams (who do not necessarily possess expertise/resources for conducting MCDA) to perform trade-off analysis and decide between alternatives that reduce their social and physical vulnerabilities with their limited economic resources while taking into account the interdependences between physical infrastructure, social institutions, and natural ecosystems. To address these complexities, Co-DECIDR combines a participatory fuzzy cognitive mapping (FCM) approach with a standard economic methodology for benefit-cost analysis (BCA).

EDGE\$ is produced by the National Institute of Standards and Technology (NIST) and provides communities with a standard economic methodology for evaluating investment decisions required to improve community resilience by helping the users identify and compare the relevant present and future resilience costs and benefits associated with new capital investment and perform BCA. Therefore, communities can use *Mental Modeler* and *EDGE\$* in tandem to determine the possible outcomes of their planning strategies and decisions, and thus administer trade-off analysis between their multiple objectives (Fig. 1).



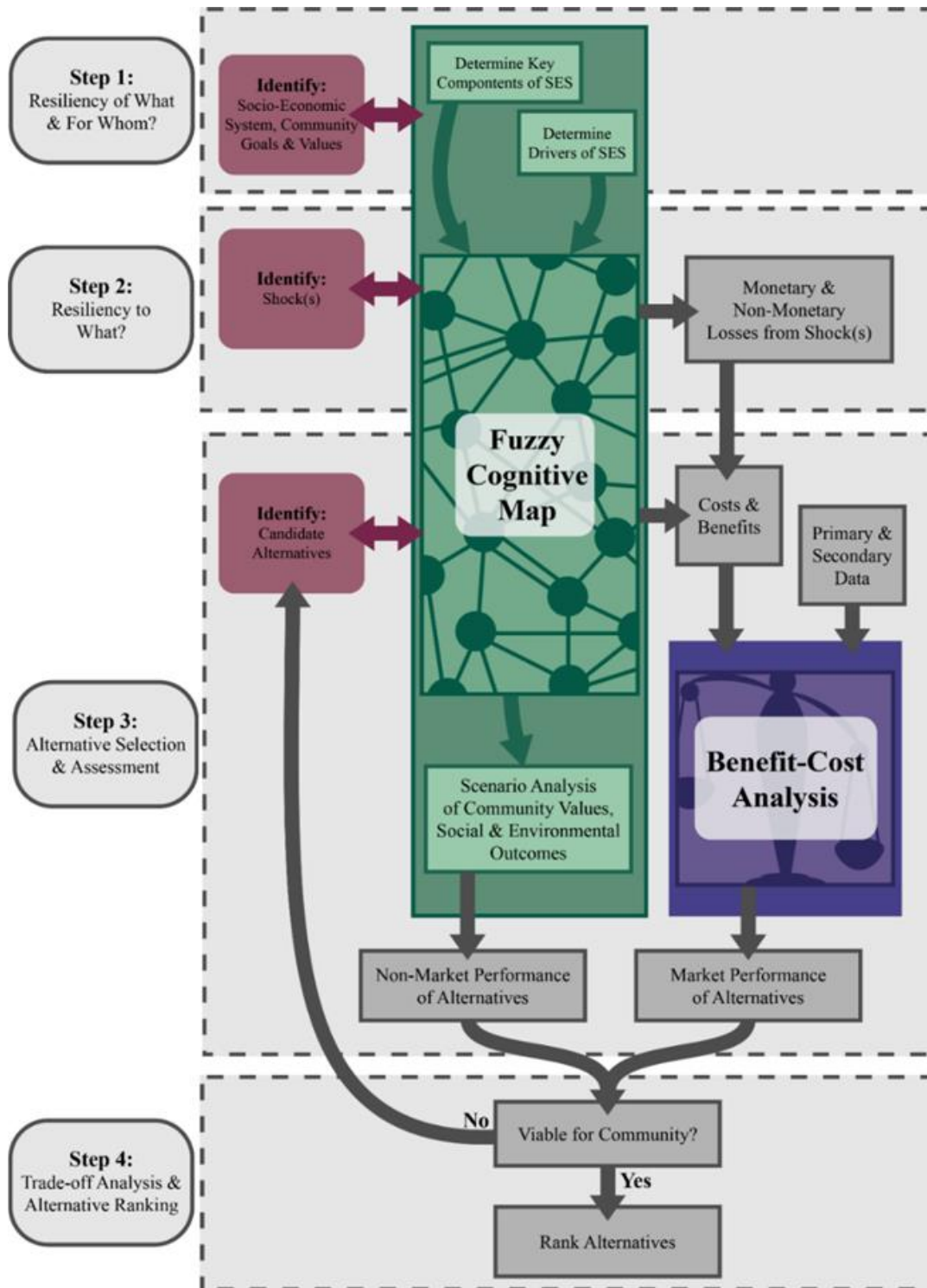


Fig.1. Four steps to implement Co-DECIDR framework.

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