

Finding Diverse Future Scenarios in Complex Systems

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Scenario sets are commonly used to evaluate policy options in complex socio-technical-environmental systems. They are often generated by experts based on domain knowledge. Policy options may then be evaluated against these “what-if?” future worlds.

However, the robustness of a policy evaluation depends on selecting a scenario set capturing the diversity of the system’s plausible future trajectories. Scenario sets are often created by identifying high and low alternatives for key outcomes of interest. This top-down approach may result in incomplete, biased, or low-diversity sets, as nonlinear effects in the system are overseen.

We present an alternative computational approach to identifying sets of scenarios for decision support in complex systems. We first search the system’s emergent behavior space for the most and least optimal outcomes across multiple decision objectives, and then identify the most dissimilar among these outcomes. This produces a scenario set which describes the maximal behavioral diversity of the system, improving the robustness of policy evaluations by including more distinct and surprising scenarios. We demonstrate the approach with a simple case study on land use change.