

# Decision Making under Deep Uncertainty (DMDU)

## What is it and how might NOAA use it?

### Report to the Science Advisory Board

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# What is Deep Uncertainty?

- Likelihood of future events & outcomes cannot be well-characterized with existing data and models
- Uncertainty cannot be reduced by gathering additional information
- Stakeholders disagree on consequences of actions





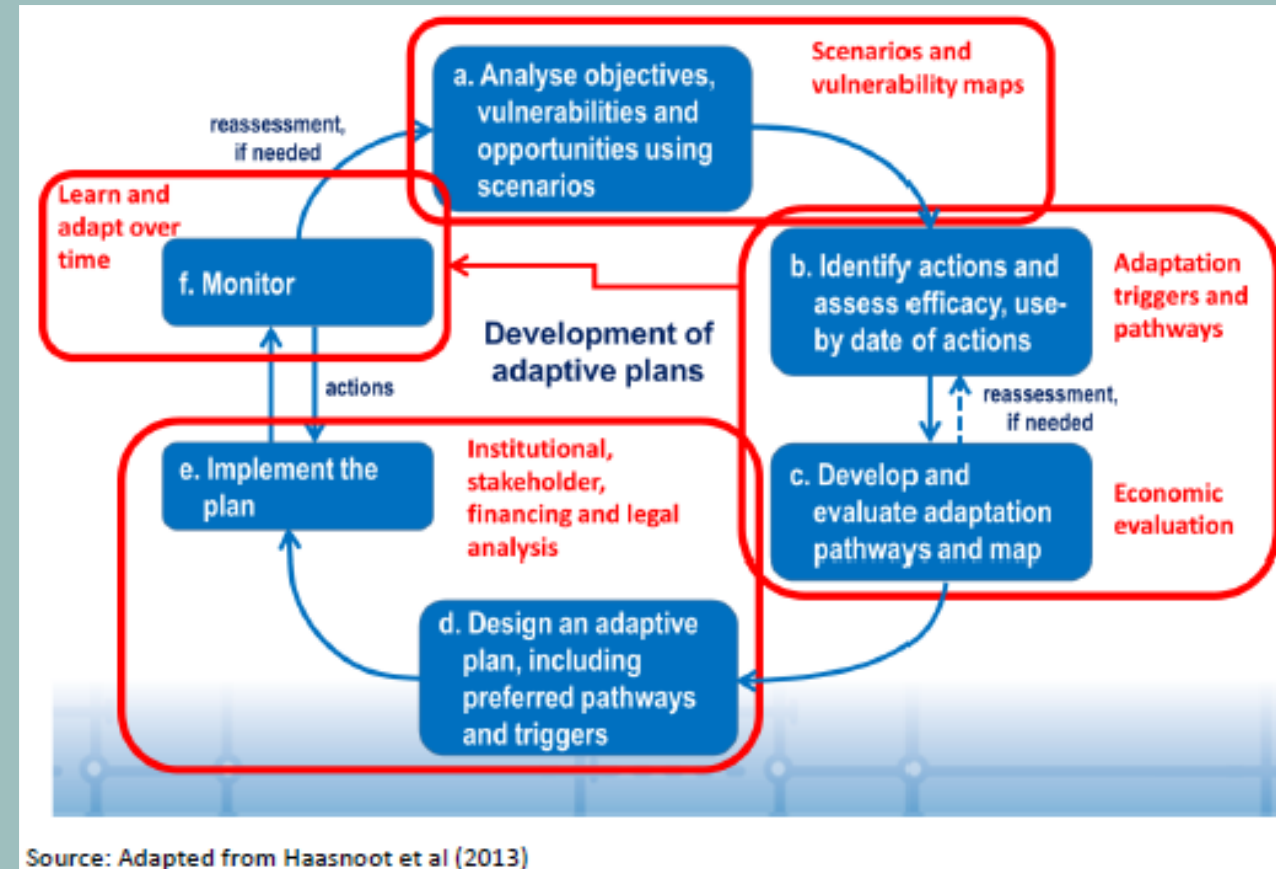
# DMDU Techniques to Manage Deep Uncertainty

Common goal - Identify decisions that succeed under a wide range of plausible, but not necessarily likely, outcomes

- Robust Decision Making
- Probability-Bounds Analysis
- Info-Gap Theory
- Resilience Analytics
- Dynamic Adaptive Policy Pathways or Dynamic Adaptive Planning

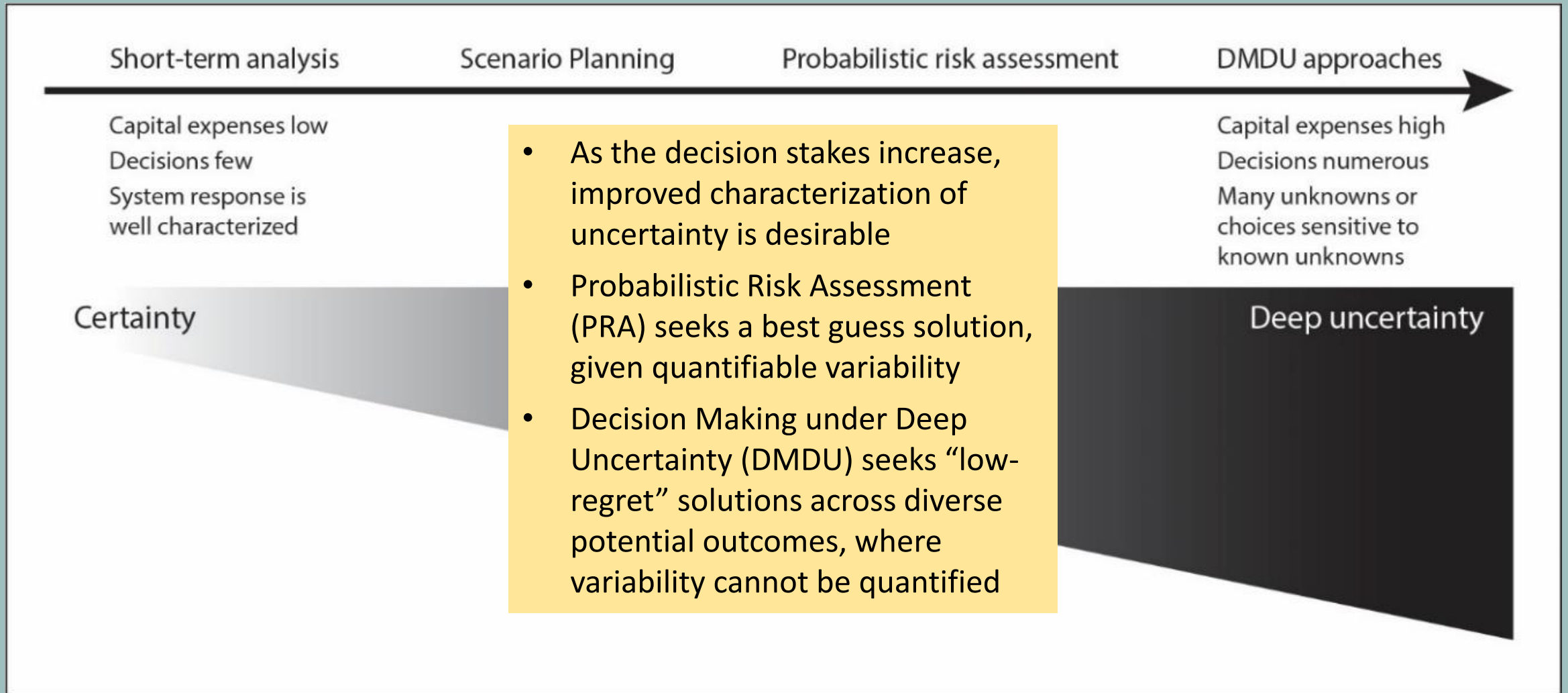
# Elements of DMDU Techniques

1. Stakeholder engagement from beginning to end
2. Structured (parsimonious) scenario development
3. Optimization modeling OR Modeling of pre-selected options
4. Stress-testing recommended actions to characterize regret
5. Dynamic adaptive planning



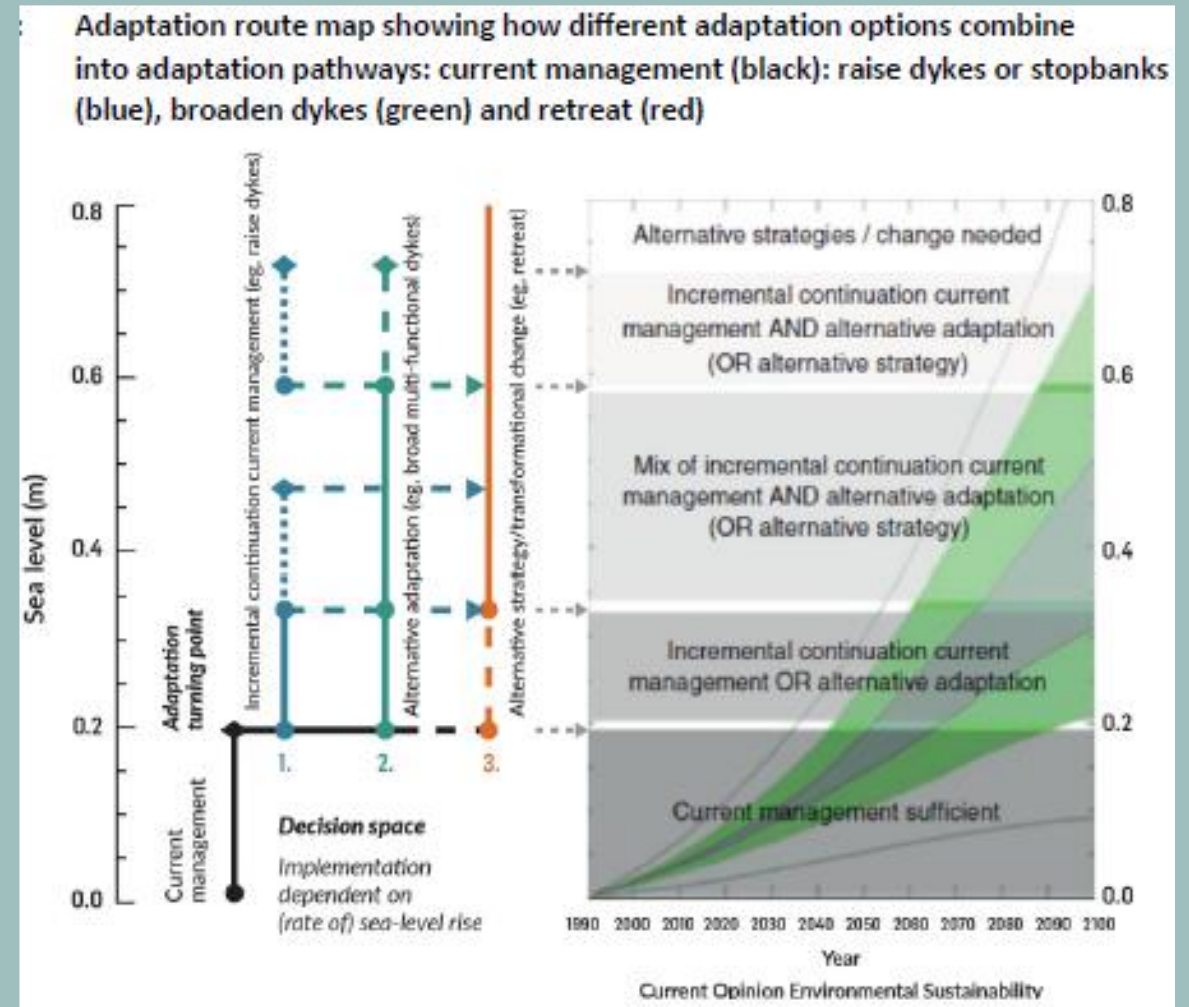


# When to use DMDU



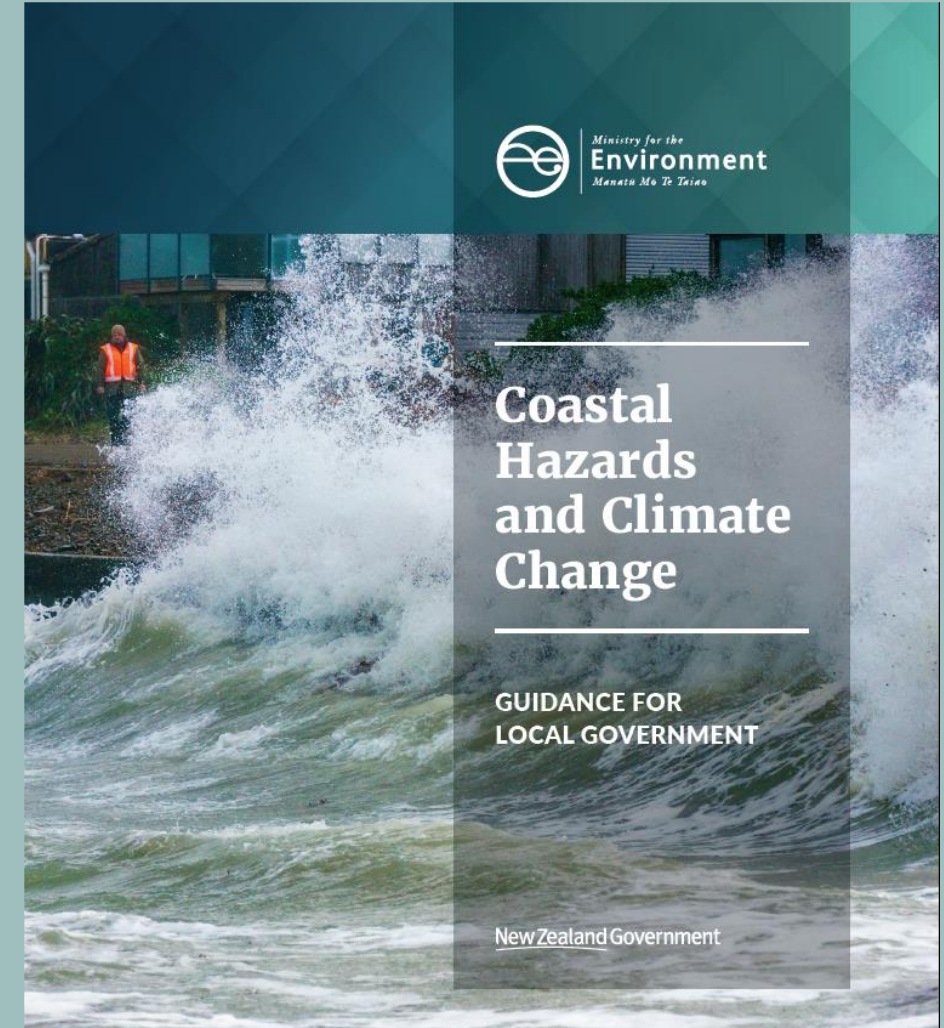
# Potential Benefits of Applying DMDU

- Avoid unanticipated or unintended consequences with low-regret solutions
  - Systematic and deliberate exploration of potential decision outcomes
- Decrease risk mitigation costs by using risk triggers to determine timing/sizing of actions
  - Most beneficial when decision stakes justify the substantial investment in data and models



# Recommendations

- Include elements of DMDU where risk-based planning is already used (e.g., Marine Strategy Evaluation)
- Explore potential applications of DMDU to inform coastal planning
- Apply DMDU to design monitoring programs
- Develop guidelines and data to enable systematic scenario development
- Consider whether there are other promising areas of DMDU application within NOAA





# Potential next steps

- Initiate a broader discussion within NOAA to identify potential application
- Identify research needed to develop guidance on application within NOAA





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