


**Frameworks for evaluating interventions:
Structured decision making
and adaptive management**

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Interventions to Increase the Resilience of Coral Reefs
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Outline

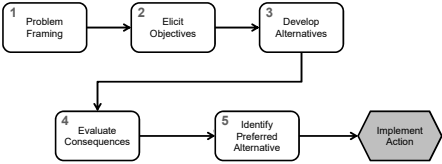
- Structured decision making
 - Structuring decisions
 - Risk decisions
 - Information decisions
- A structured framework for coral interventions
- Adaptive management



Structured Decision Making

Insights from the field of
Decision Analysis


Elements of a Decision



```


    graph LR
      1[1 Problem Framing] --> 2[2 Elicit Objectives]
      2 --> 3[3 Develop Alternatives]
      3 --> 4[4 Evaluate Consequences]
      2 --> 4
      4 --> 5[5 Identify Preferred Alternative]
      5 --> IA{{Implement Action}}
    
```

Runge MC. 2011. An introduction to adaptive management for threatened and endangered species. *Journal of Fish and Wildlife Management* 2:220-233.

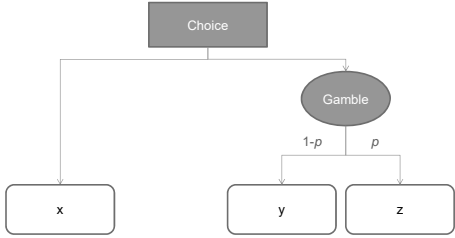


Decision Analysis

- The emphasis on structuring, alone, is valuable
 - Especially, early articulation of objectives
- Large set of tools to help analyze a decision (step 5), including
 - Multi-criteria Decision Analysis
 - * Risk Analysis
 - * Value of Information
- The tools often help clarify the underlying cognitive tasks of different types of decisions




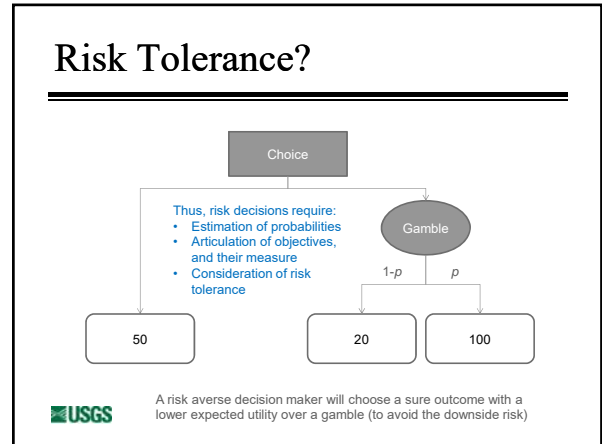
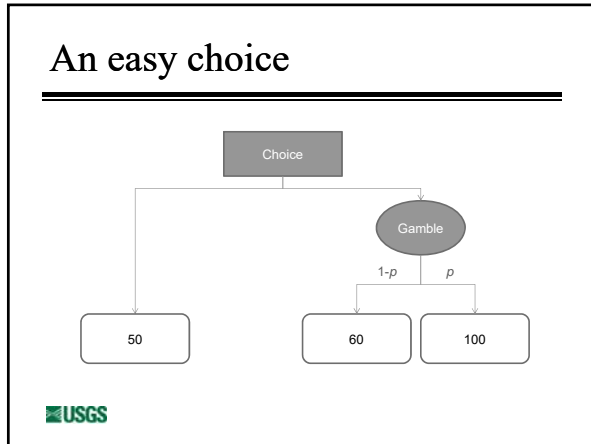
Decisions with Risk



```

    graph TD
      Choice[Choice] --> x[x]
      Choice --> Gamble((Gamble))
      Gamble -- 1-p --> y[y]
      Gamble -- p --> z[z]
    
```

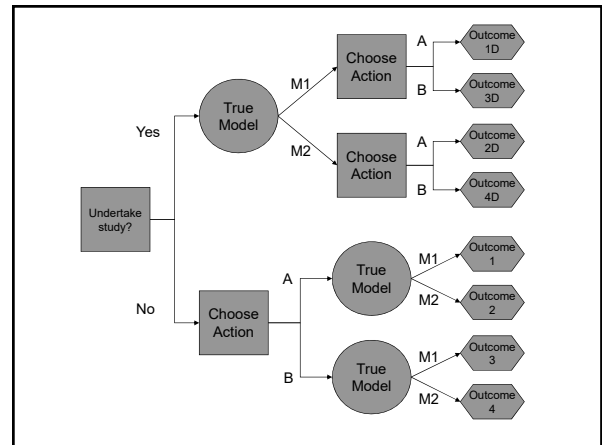




Value of Information

- What if you could reduce uncertainty before having to commit to a decision?
 - Might that information lead you to different decisions?
 - How much could that improve the expected outcomes?

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A Structured Framework for Evaluating Coral Interventions

Managing multiple objectives, uncertainty, and risk


Interventions as a decision

- Objectives
 - Ecosystem function provided by coral
 - Conserve endemic coral biodiversity
 - Ecosystem services
 - Fishing
 - Tourism
 - Coastal protection
 - Costs of management
 - ...and more...


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Interventions as a decision

- Alternatives
 - Coarsely: To employ novel interventions or not
 - But the nuances are significant
 - Which interventions and where?
 - Early intervention, or later intervention when some of the uncertainties are resolved?
 - Could there be a phased approach?




A framework for intervention



Supporting the decision


- The chosen path will depend on
 - The probabilities (p_1 , p_2 , and p_3)
 - The relative importance of the objectives
 - The decision makers' risk tolerance
- The focus of this committee
 - Estimating the risks & benefits (p_1 , etc.)
 - But is the decision framework fully mapped?



Adaptive Management


One-off decisions

Runge MC. 2011. An introduction to adaptive management for threatened and endangered species. Journal of Fish and Wildlife Management 2:220-233.



Adaptive Management

Source: Runge (2011)



Adaptive Coral Management?

- Would it be possible to implement novel interventions incrementally?
 - Learning from the system itself and adapting future interventions
- Considerations
 - Opportunity cost of delay (for learning)
 - Reversibility of actions
 - Speed of learning



Questions?