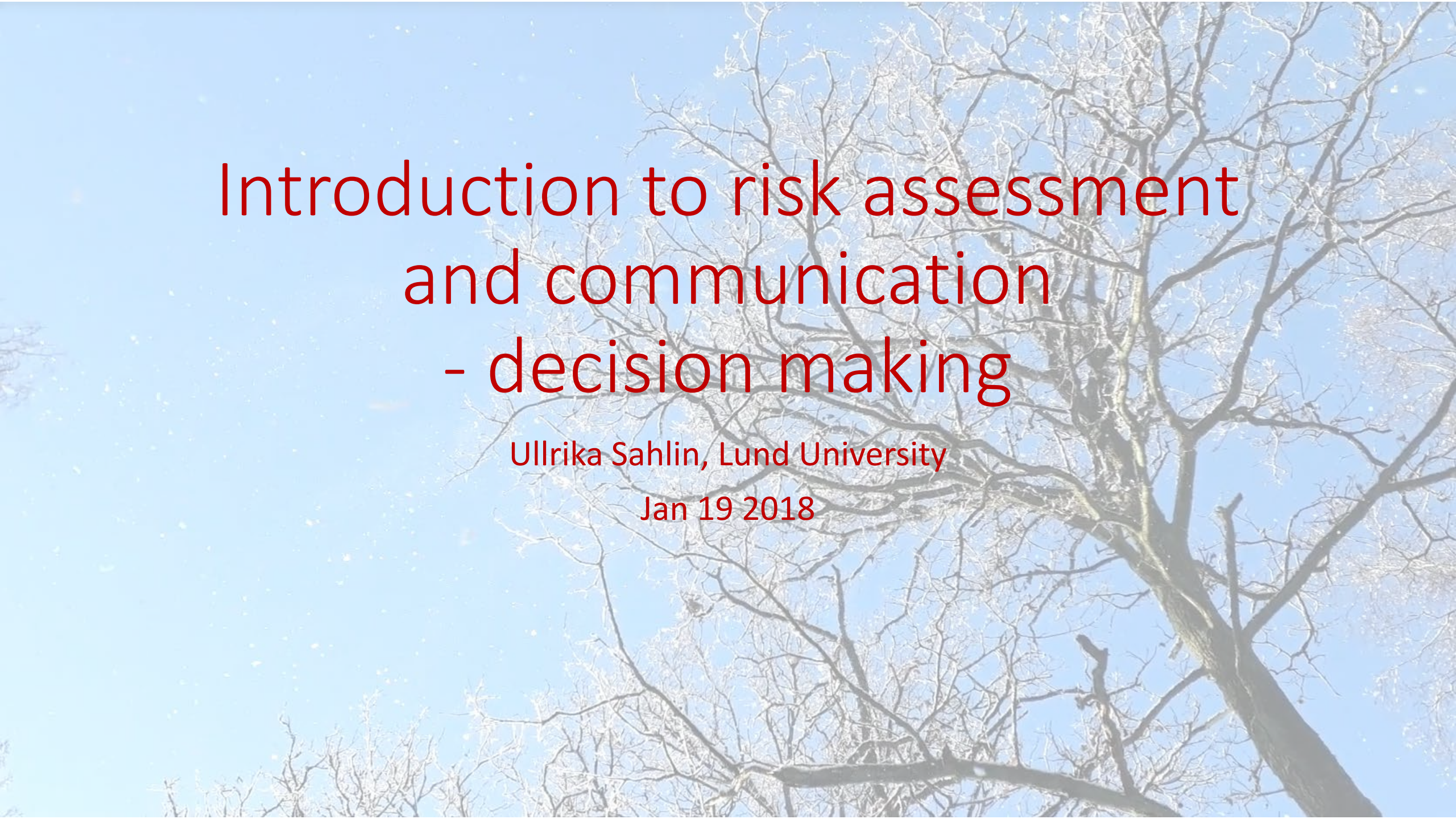

Introduction to risk assessment and communication - decision making

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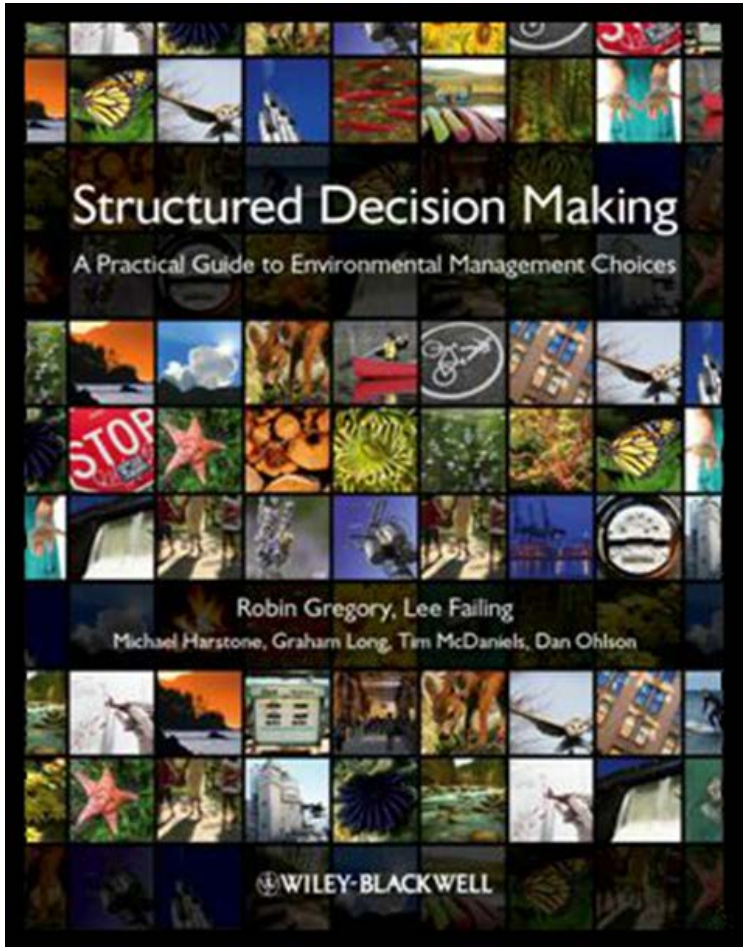
Jan 19 2018

1. Identify the problem (i.e., the decision to be made)
2. Formulate objectives
3. Develop management alternatives
4. Estimate consequences associated with each alternative
5. Evaluate trade-offs and select preferred alternatives
6. Monitor and allow for learning



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Kiker et al (2005). Application of Multicriteria Decision Analysis in Environmental Decision Making. Integrated Environmental Assessment and Management.

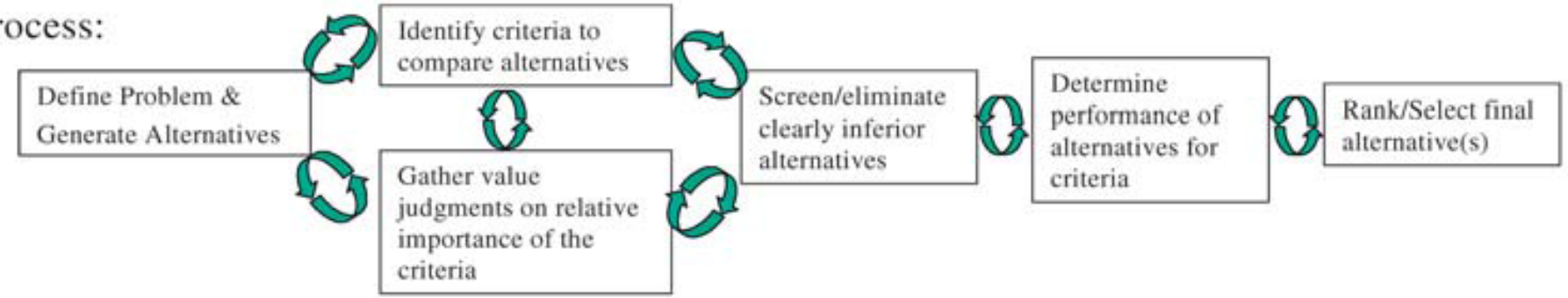
People:

Policy Decision Maker(s)

Scientists and Engineers

Stakeholders (Public, Business, Interest groups)

Process:



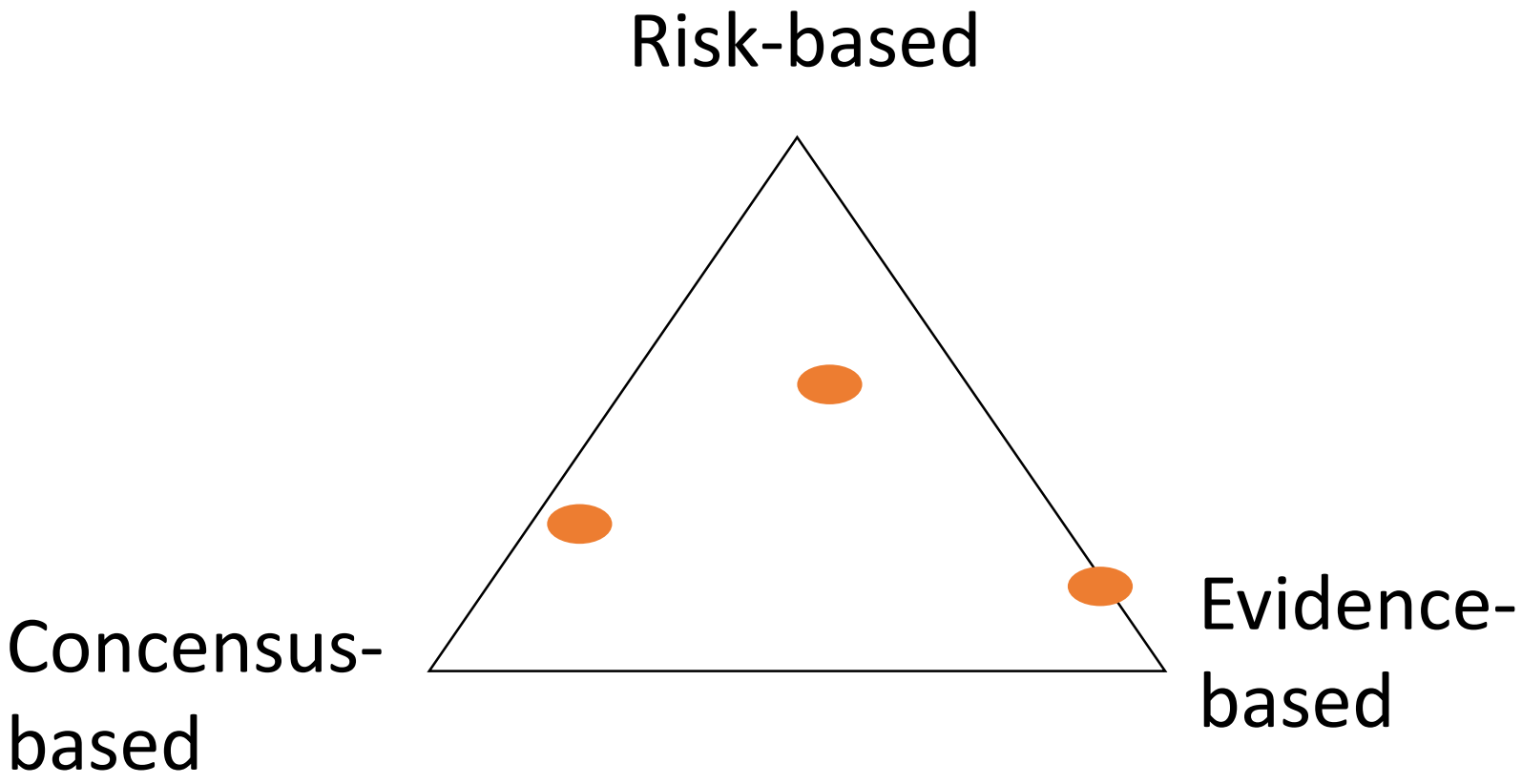
Tools:

Environmental Assessment/Modeling (Risk/Ecological/Environmental Assessment and Simulation Models)

Decision Analysis (Group Decision Making Techniques/Decision Methodologies and Software)

Kiker et al (2005). Application of Multicriteria Decision Analysis in Environmental Decision Making. Integrated Environmental Assessment and Management.

Types of decision making



Vareman, N. and Sahlin, U. (2014). SRA

Decision frameworks for risk management

- Optimal decision making – maximize expected utility
  - Suitable when uncertainty is well charactersed and cause-effect relations well understood
  - Require uncertainty in utility characterised by a single probability distribution

Lempert, R. J., & Collins, M. T. (2007). Managing the risk of uncertain threshold responses: Comparison of robust, optimum, and precautionary approaches. Risk Analysis, 27(4)

Decision frameworks for risk management

- Precautionary decision making
  - Take steps to prevent future harms, even when the causal chain between action and outcome is unclear and uncertain
  - In practice – e.g. set a treshold on a parameter and make sure that it is not exceeded
- Robust decision making
  - Trade some optimal performance for less sensitivity to assumptions
  - Seek satisficing over a wide range of futures
  - Keep options open

Lempert, R. J., & Collins, M. T. (2007). Managing the risk of uncertain threshold responses: Comparison of robust, optimum, and precautionary approaches. Risk Analysis, 27(4)

Types of decision problems

Type	What is needed
Choosing a single preferred alternative	An informed, transparent and broadly supported solution to a policy or planning problem
Developing a system for repeated choices	A system for efficient, consistent and defensible decisions that are likely to be repeated
Making linked choices	A way to separate decisions into higher and lower order choices, or what to decide now and later
Ranking	A way to put actions or times in order of importance or preference, according to clear criteria
Routing	Grouping of actions or items into different categories, so they can be evaluted approriately. This is often a preliminary action to more detailed assessment

Gregory, R., Failing, L., Harstone, M., Long, G., McDaniels, T., & Ohlson, D. (2012). Structured decision making: a practical guide to environmental management choices: John Wiley & Sons.

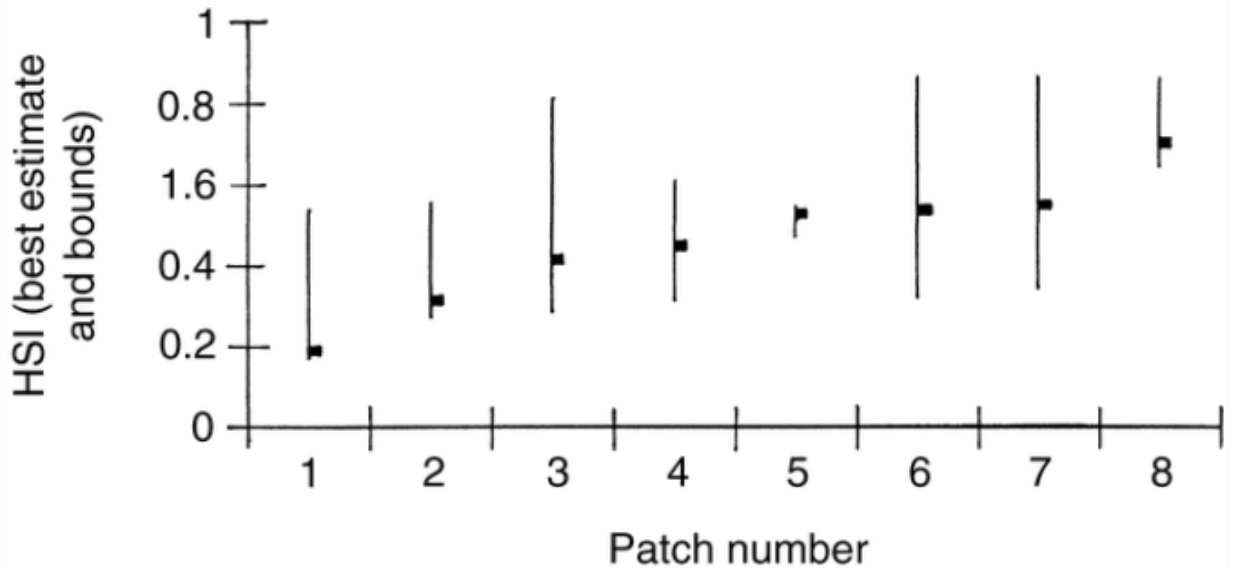
Types of decision problems

- 1 DM
- 1 DM against a stochastic nature
- 2 DM
- 1 DM against N DMs

Decision theories

- How do people make decisions (descriptive)
- How should they do decisions (normative)
- How should they do a decision in a specific context (prescriptive)

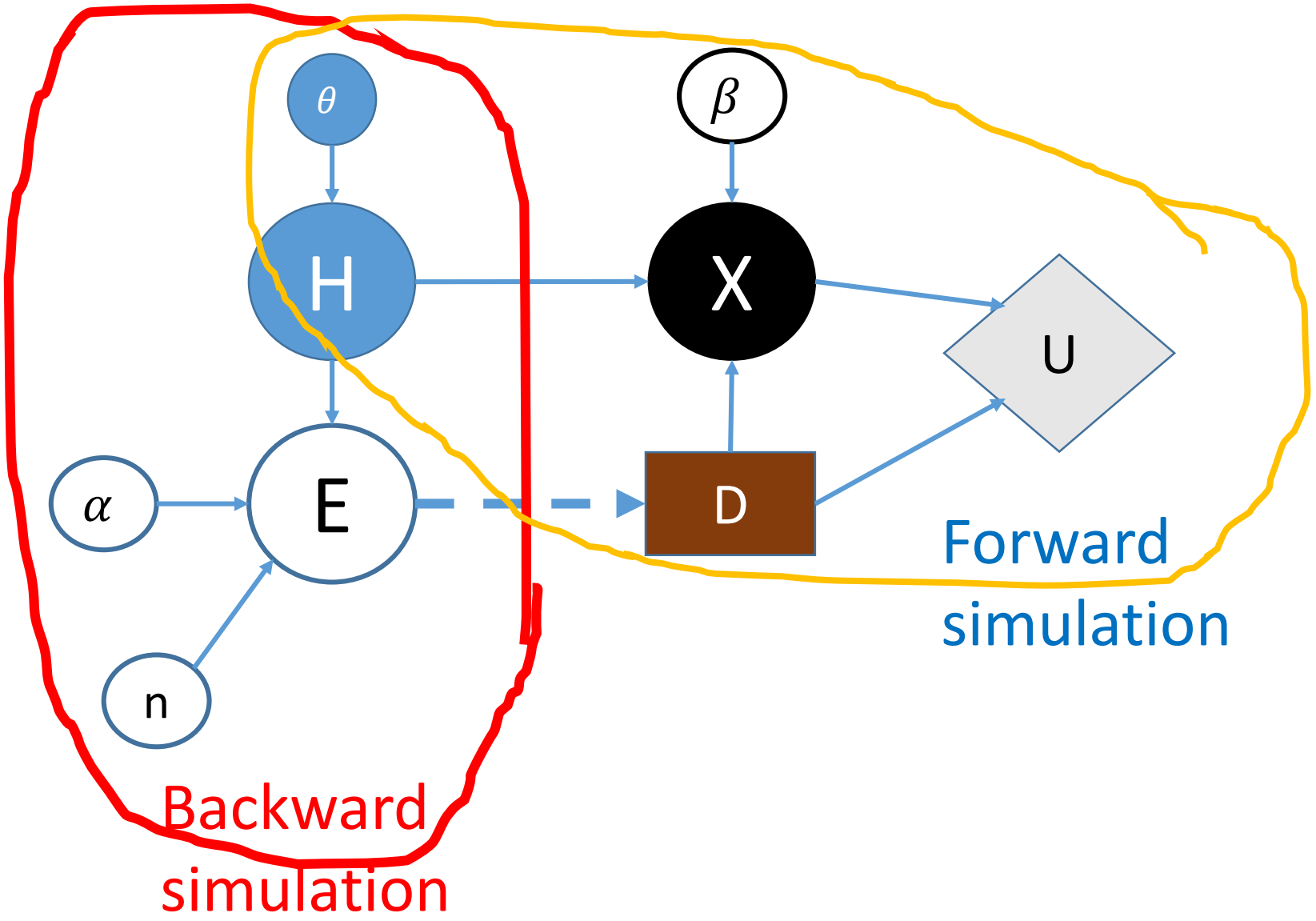
Prioritization under uncertainty



- Which patch should be prioritized for conservation?
- What if we need to eliminate a patch, which one should we take?

Ecological Applications
Volume 11, Issue 1, pages 70-78, 1 FEB 2001 DOI: 10.1890/1051-0761(2001)011[0070:SRBOHS]2.0.CO;2
http://onlinelibrary.wiley.com/doi/10.1890/1051-0761(2001)011[0070:SRBOHS]2.0.CO;2/full#i1051-0761-11-1-70-f05

Decision making with learning & forecasting



H: CURRENT STATE

E: OBSERVATION

D: DECISION

X: FUTURE STATE

U: UTILITY/CONSEQUENCE ON OBJECTIVES