Decision Making in Waterfowl Conservation

Experiential Learning Through Rapid Prototyping

NAWMP Workshop
Grand Rapids, MI
September 30, 2010
Why structured decision making?

“A formal application of common sense for situations too complex for the informal use of common sense.”

R. Keeney
A smart approach to decision making...

- Focuses on what is valued
- Uses creativity to develop and explore alternative choices
- Encourages the gathering and application of relevant information (including expert opinion)
- Is logical and consistent
- Considers uncertainty in outcomes
A smart approach to decision making...

- Does not necessarily make the decision problem(s) simpler
- Does not necessarily make the decision(s) easier
- But it should increase the probability of a good outcome
Decision opportunities often arise from identification of a problem

- Resources dedicated to conservation are not optimally allocated among landscapes.
- Too much time is spent setting annual regulations.
- We should adopt a shoulder strategy for mallards and pintails.
- Monitoring and evaluation needs to be enhanced.
- Federal activities to conserve waterfowl and their habitats have declined.
- State and provincial activities to conserve waterfowl and their habitats have declined.
- Too few resources are directed towards understanding waterfowl hunters.
- Federal agencies are less attentive to waterfowl science and monitoring/evaluating.
5 elements of smart decisions*

- Problem definition
- Objectives
- Alternatives
- Consequences
- Tradeoffs

* Hammond et al. 1999. Smart Choices
Rapid prototyping for structured decisions

- Problem
- Decide
- Objectives
- Tradeoffs
- Actions
- Consequences
Rapid prototyping

- Get around the track quickly the first time
  - Address all the elements of the PrOACT process
  - Use placeholders & guesses and keep going

- Revisit the decision problem
  - Did you articulate the problem correctly?
  - Is the abstraction working? (i.e., Provide clarity? Bring attention to informational needs? Identify gaps in knowledge? Suggest a way forward?)

- Rapid prototyping is low-risk, high-return
  - It doesn’t matter if you get it wrong; you can start over with little loss
Purpose of today’s exercise

- Demonstrate how the objectives drive formulation of a decision framework (i.e., value-focused thinking)
- Show how actions are linked to outcomes, which then are valued based on the objectives
- Demonstrate how to predict outcomes
- Show how we can build on Round I to:
  - describe and weight fundamental objectives
  - express causal relationships (i.e., predict outcomes)
  - better understand how to frame up important decision problems/opportunities facing waterfowl management
**Syllabus**

I. Fundamental objectives (30 min)
   - What is meant by the objective?
   - What are possible attributes by which progress could be measured?

II. Weighting objectives and predicting consequences (60 min)
   - Individual assignment of weights via Turning Point
   - Group swing-weighting
   - Ranking alternatives with respect to each objective (consequences)

III. Lessons learned, insights, issues of governance (60 min)
   - Applicability of the PrOACT process? Insights about nature of decisions or decision-making in waterfowl conservation?
   - How do we begin to think about institutional arrangements for shared decision making?
General questions?
I. Fundamental objectives

- Work in groups

- Discuss *only* the objective given to your group (repeat after me...)

- Ask: What do we mean by this objective? What aspects of this objective are important?

- Ask: How might I measure success? (don’t be constrained by what is currently being measured or what is deemed feasible)

- Don’t get side-tracked by means objectives (i.e., those that are related to the fundamental objective by cause & effect)

- Record your responses on the spreadsheet provided and give to Ginny

- You will be allowed no more than 30 minutes; make every minute count!
I. Fundamental objectives: an example

Manatee conservation
  - Regional persistence
  - Statewide persistence
  - Cold-related die-offs

Cost
  - Start-up
  - Maintenance

Regulatory burden
  - No-entry areas
  - Restricted-use areas
  - Travel time for boats
  - Lost property values

Social benefits
  - Eco-tourism income
  - # Viewers
I. Fundamental objectives: an example

Regulatory burden

- No-entry areas
- Restricted-use areas
- Travel time for boats
- Lost property values
- # acres posted as no entry
- # acres posted as no-wake zones
- Additional # boat-hours to navigate regulated areas
- Meters of shoreline in private property impacted by regulated areas
I. Fundamental objectives

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
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</thead>
<tbody>
<tr>
<td>Fundamental objective</td>
<td>Characterizations</td>
<td>Measurable attributes</td>
</tr>
<tr>
<td>Waterfowl hunting tradition</td>
<td></td>
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<tr>
<td>Non-consumptive experience</td>
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<td>Healthy waterfowl populations</td>
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<td>Healthy landscapes</td>
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I. Fundamental objectives

<table>
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<tr>
<th>Fundamental objective</th>
<th>Characterizations</th>
<th>Measurable attributes</th>
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<tbody>
<tr>
<td>Waterfowling tradition</td>
<td>increase participation</td>
<td>stamp sales,</td>
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<tr>
<td></td>
<td>maximize access</td>
<td>public areas open to hunting</td>
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<tr>
<td></td>
<td>maximize satisfaction</td>
<td></td>
</tr>
<tr>
<td>Non-consumptive experience</td>
<td>increase participation</td>
<td>$ spent by birders,</td>
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<td>maximize access</td>
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<tr>
<td></td>
<td>maximize satisfaction</td>
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<td>Healthy waterfowl populations</td>
<td>reduce loss of species diversity</td>
<td>Shannon diversity index,</td>
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<td></td>
<td>minimize loss of variation in spatial distribution</td>
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<td></td>
<td>minimize agricultural deprivations</td>
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<td>minimize nuisance complaints</td>
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<td></td>
<td>minimize detrimental ecological impacts</td>
<td></td>
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<tr>
<td>Healthy landscapes</td>
<td>minimize invasive species in wetlands</td>
<td>ha of wetlands, approved 404 permits,</td>
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<td></td>
<td>minimize landscape fragmentation</td>
<td></td>
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<tr>
<td></td>
<td>maximize food resources (migration &amp; wintering areas)</td>
<td>duck-use days,</td>
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<td></td>
<td>maximize upland nesting habitat (breeding)</td>
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<td></td>
<td>minimize exposure to eco-toxins</td>
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9:45-10:15 Group Exercise

OBJECTIVES
A decision problem for today

- **Problem:** How to allocate resources among 4 waterfowl conservation activities: (1) regulating harvest; (2) conserving habitat; (3) promoting hunting; and (4) promoting waterfowl viewing

- **Objectives**
  - Perpetuate waterfowl hunting (“tradition”)
  - Sustain opportunities for the public to view and enjoy waterfowl
  - Maintain healthy waterfowl populations
  - Conserve landscapes
A decision problem for today

• Actions
  • 10 different allocation options among the 4 activities
  • Constraint: minimal amounts of resources have to be allocated to harvest regulation and habitat conservation

• Consequences
  • Using expert opinion (in the spirit of rapid prototyping)
  • Using development of influence diagrams & Bayesian belief networks to help focus empirical assessments

• Tradeoffs
  • Reconciled through direct elicitation of weights for the 4 fundamental objectives
  • Also derived through a process called swing-weighting
What the exercise is...

- A real-world problem
- Over-simplified
- A way to show how we can develop a shared perception of a decision problem
- A way to clearly distinguish mgmt objectives (what values?) from science (what outcomes?)
- A useful way to demonstrate an integrated / coherent decision-making framework (we think)
What the exercise is not...

- The answer to a real-world problem
- How we might really weight the multiple objectives
- A characterization of what might really be “known” about some causal relationships (outcomes)
- Necessarily an accurate description of the alternative actions available (even if the problem statement is correct)
II. Objective weights & consequences

• (1) Working as individuals, score the fundamental objectives in terms of importance via Turning Point (10 min)

• (2) Continue working as individuals; rank each allocation alternative with respect to each objective; i.e., what are the consequences? (25 min)

• (3) In groups, assign weights to objectives using the swing-weighting technique; turn in worksheet to Ginny (25 min)
Turning Point...
II. Objective weights & consequences

- (1) Working as individuals, score the fundamental objectives in terms of importance via Turning Point (10 min)

- (2) Continue working as individuals; rank each allocation alternative with respect to each objective (25 min)
  - Use worksheet provided
  - 1 = worst alternative with respect to achieving an objective, 10 = best
  - Don’t over-think; use your intuition
  - Turn in worksheet to Ginny

- (3) In groups, assign weights to objectives using the swing-weighting technique; turn in worksheet to Ginny (25 min)
## II. Consequences

<table>
<thead>
<tr>
<th>Objective category</th>
<th>Allocation choice</th>
<th>Consequence ranking (1=worst, 10=best)</th>
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<tr>
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<td>1</td>
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<tr>
<td>Promoting hunting</td>
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<td>0.00</td>
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<td>Promoting non-consumptive</td>
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<td>0.00</td>
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<td>Regulating harvest</td>
<td>0.25</td>
<td>0.50</td>
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<td>Conserving habitat</td>
<td>0.75</td>
<td>0.50</td>
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### SMART (cons sum) / Swing-weight
II. Consequences

![Image of Excel table]

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<tr>
<td>Non-consumptive use</td>
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<td>Healthy waterfowl populations</td>
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<td>Healthy landscapes</td>
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Scoring Consequences

25 min
II. Objective weights & consequences

• (1) Working as individuals, score the fundamental objectives in terms of importance via Turning Point (10 min)

• (2) Continue working as individuals; rank each allocation alternative with respect to each objective (25 min)
  • Use worksheet provided
  • \(1 = \text{worst alternative with respect to achieving an objective, } 10 = \text{best}\)
  • Don’t over-think; use your intuition
  • Turn in worksheet to Ginny

• (3) In groups, assign weights to objectives using the swing-weighting technique; turn in worksheet to Ginny (25 min)
II. Swing weighting

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<td>rank</td>
<td>score</td>
<td>weight</td>
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<tr>
<td>(benchmark: worst-case)</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>hunting</td>
<td>high hunter #’s, everything else sucks</td>
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<tr>
<td>viewing</td>
<td>lots of viewers, everything else sucks</td>
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<tr>
<td>pops</td>
<td>lots of ducks, everything else sucks</td>
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<td></td>
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<tr>
<td>landscapes</td>
<td>great landscapes, everything else sucks</td>
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<td>objective swung</td>
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<tr>
<td>3</td>
<td>(benchmark: worst-case)</td>
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<tr>
<td>4</td>
<td>hunting</td>
<td>high hunter #’s, everything else sucks</td>
<td>3</td>
<td></td>
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<tr>
<td>5</td>
<td>viewing</td>
<td>lots of viewers, everything else sucks</td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>6</td>
<td>pops</td>
<td>lots of ducks, everything else sucks</td>
<td>4</td>
<td></td>
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<tr>
<td>7</td>
<td>landscapes</td>
<td>great landscapes, everything else sucks</td>
<td>5</td>
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<td>objective swung</td>
<td>consequence</td>
<td>rank</td>
<td>score</td>
<td>weight</td>
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<td>(benchmark: worst-case)</td>
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<td>1</td>
<td>0</td>
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185
LUNCH
II. Consequences cont’d: influence diagrams

- Influence diagrams
  - Link actions to objectives
  - Use nodes and arrows to represent causal relationships
- Round I objectives hierarchies

![Diagram showing resource allocation leading to habitat conservation, which in turn affects duck abundance and is influenced by uncontrolled environmental factors.]

Resource allocation → Habitat conserved → Duck abundance → Uncontrolled environmental factors
Bayesian belief networks

- BBNs have some important advantages over most other modeling approaches:
  - Can be represented graphically, facilitating communication
  - Can be constructed and amended interactively with input from non-modelers
  - Can be used for both data-rich and data-poor applications

- BBNs are increasing being used for decision-making in natural resource management
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<td>focus on habitat</td>
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<tr>
<td>promote viewing</td>
</tr>
<tr>
<td>promote hunting</td>
</tr>
<tr>
<td>do it all</td>
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resource-allocation options

- focus on habitat
- promote viewing
- promote hunting
- do it all

wetland habitat availability

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harvest regulation

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hunting activity

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</thead>
<tbody>
<tr>
<td>availability</td>
<td>50.0</td>
<td>50.0</td>
</tr>
</tbody>
</table>

# waterfowl watchers

- unchanged
- more

waterfowl watching utility

healthy landscapes utility

healthy populations utility

hunting tradition utility
Netica example...
BREAK

2:30-2:45
III. Insights; institutional issues

- Lessons learned and insights gained from the exercises
  - By group (10 min)
  - Report out (10 min total)

- Was the problem framed in a useful manner?
- Did the abstraction work? i.e.,
  - Provide clarity?
  - Bring attention to informational needs?
  - Identify gaps in knowledge?
  - Suggest a way to better inform decisions?
III. Insights; institutional issues

- Institutional organization & arrangements necessary for coherent decision making in waterfowl conservation (25 min)

- Start with today’s allocation problem. Ask “does the current institutional arrangement allow us to make this sort of decision?” If not, what would have to change?

- Think about other issues. What would have to change institutionally, if anything, to address them? E.g.,
  - How would we decide the appropriate balance between harvest opportunity and meeting NAWMP population goals?
  - How would we efficiently allocate habitat funding among regions?
  - How would a campaign designed to promote hunting be administered?
  - How should we decide the most appropriate approach to the problem of multi-stock harvest management?

- Report out (15 min total)
Synthesis

starts at 3:45
Putting it all together...

- What do we mean by the objectives?

- What is the sense of the workshop participants about relative emphasis on the 4 objectives?

- What is the collective opinion about the consequences of the allocation alternatives relative to the objectives?

- What is the optimal allocation decision (for the purpose of this exercise)?
Exercise results
Extra stuff...
Bayesian belief networks

- Don’t deal well with the dimension of time
  - So it really is a 1-time decision, or
  - We have to think about average or equilibrium conditions

- May be difficult to parameterize (when more than 2 causal factors affecting an outcome)

- Are only 1 of many possible ways to represent (model) consequences resulting from a decision
Decisions are hard because...

- The objectives (and their relative importance) may be complex or in dispute
- There are multiple decision makers
- It’s not clear what the alternative are
- The consequences may be uncertain
- The decision context itself is not well defined
There were 3 ecologists trapped and starving in the boreal winter – a conservation biologist, a pest-control scientist, and a fisheries expert.

A moose appeared on the horizon and came thundering towards them – 1000 kg of warm edible flesh. Each scientist drew on his or her expertise and dealt with the moose using all their respective discipline’s wisdom:

- The conservation biologist couldn’t decide on an objective. He died wondering whether the moose’s existence was more important than his own.
- The pest-control scientist knew that the moose had to be killed – the only question was with what – poison or a biological control? He opted for the environmentally friendly biological control and released a wolf, which turned around and ate him.
- The fisheries expert used the wrong model. Based on her prior knowledge of elk, she predicted that more moose would be coming, so she starved in anticipation of a herd that never appeared.

* Adapted from Shea et al., 1998, TREE