Decision Making in Waterfowl Conservation

Experiential Learning Through Rapid Prototyping

NAWMP Workshop
Grand Rapids, MI
September 30,2010

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Why structured decision making?

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

R. Keeney

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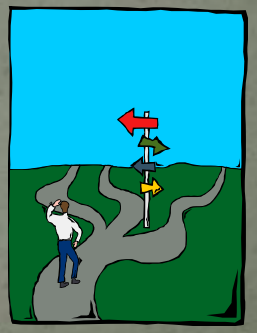
A smart approach to decision making…

- 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



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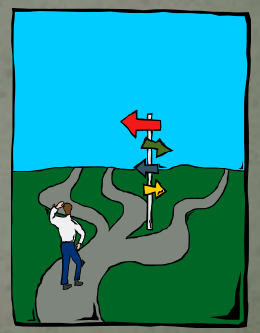
A smart approach to decision making…

- 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



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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.

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5 elements of smart decisions*

- Problem definition
- Objectives
- Alternatives
- Consequences
- Tradeoffs

* Hammond et al. 1999. Smart Choices

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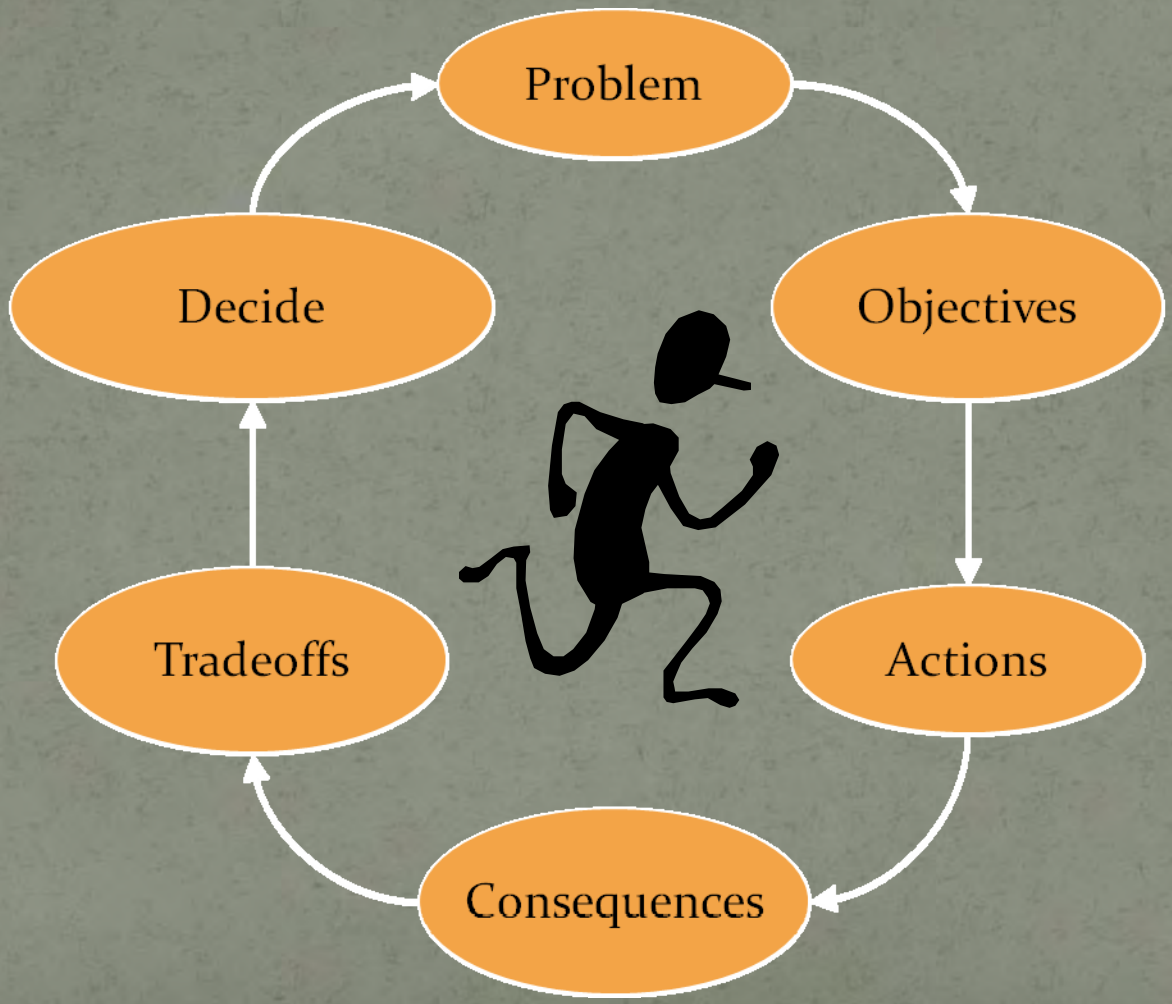
Rapid prototyping for structured decisions



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Rapid protoyping

- 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

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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

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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?

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General questions?

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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!

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I. Fundamental objectives: an example

- Manatee conservation
  - Regional persistence
  - Statewide persistence
  - Cold-related die-offs
- Cost
  - Start-up
  - Maintenence
- Regulatory burden
  - No-entry areas
  - Restricted-use areas
  - Travel time for boats
  - Lost property values
- Social benefits
  - Eco-tourism income
  - # Viewers

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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

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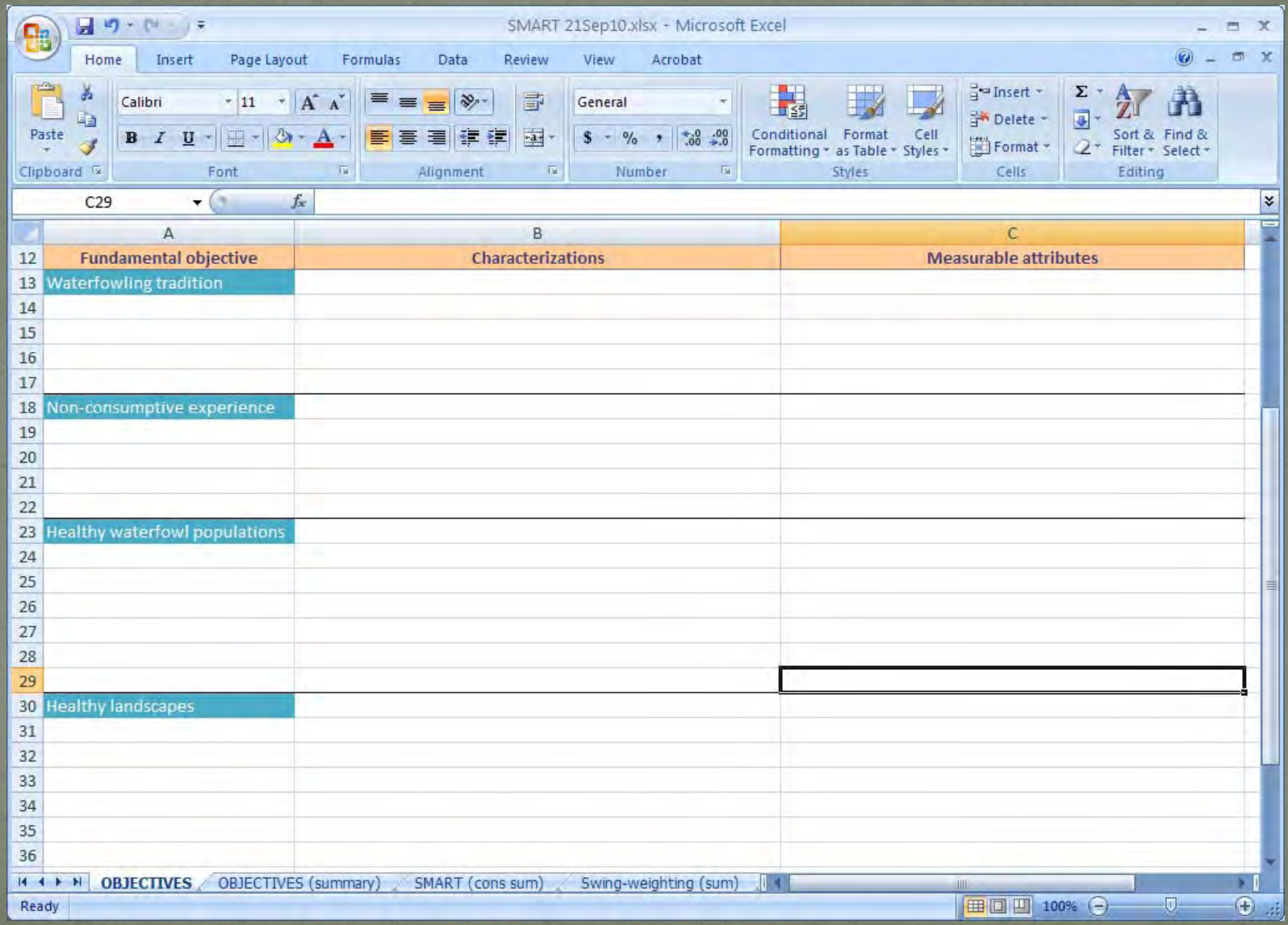
I. Fundamental objectives



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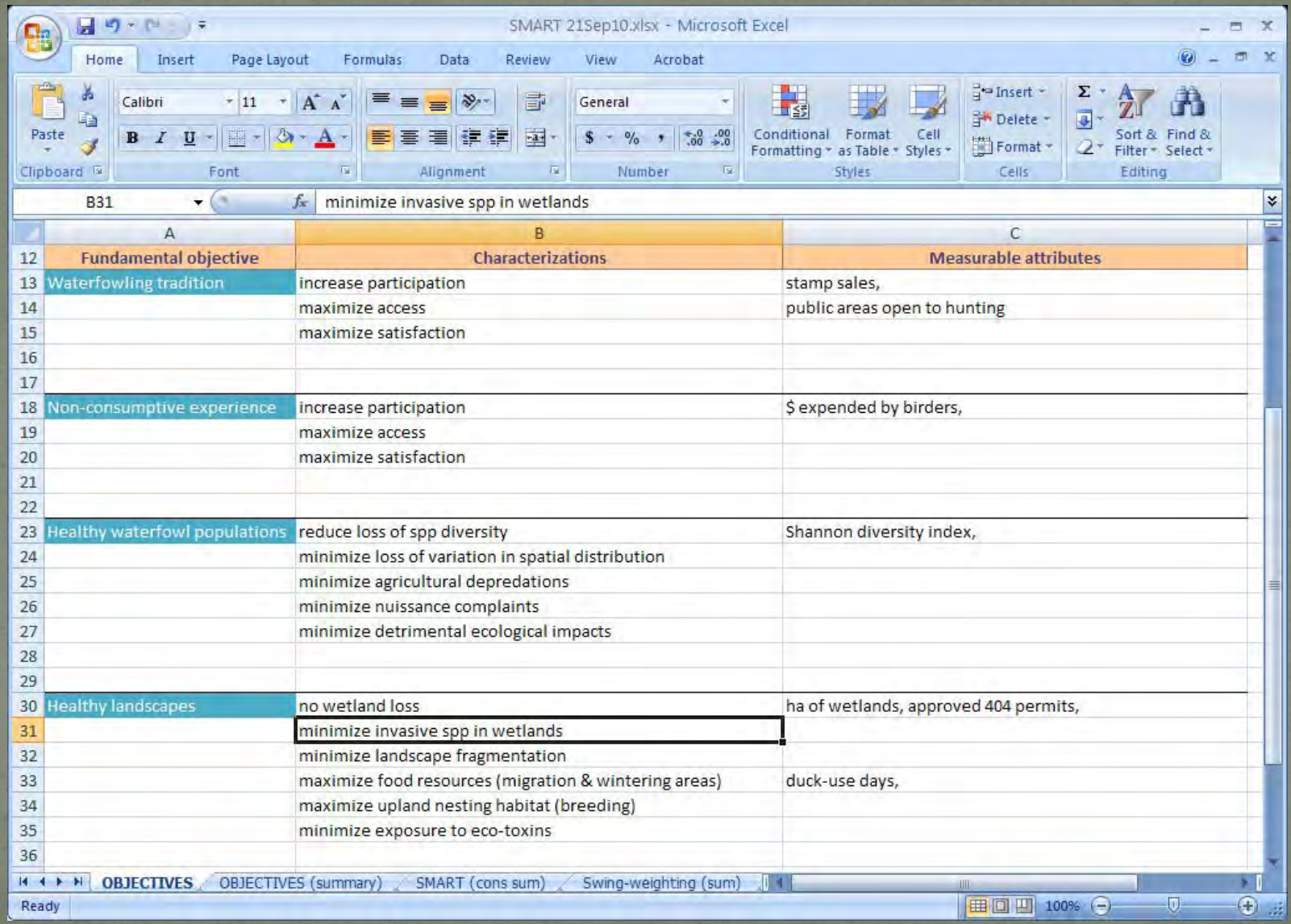
I. Fundamental objectives



	A	B	C
12	**Fundamental objective**	**Characterizations**	**Measurable attributes**
13	Waterfowling tradition	increase participation	stamp sales,
14		maximize access	public areas open to hunting
15		maximize satisfaction	
16			
17			
18	Non-consumptive experience	increase participation	$ expended by birders,
19		maximize access	
20		maximize satisfaction	
21			
22			
23	Healthy waterfowl populations	reduce loss of spp diversity	Shannon diversity index,
24		minimize loss of variation in spatial distribution	
25		minimize agricultural depredations	
26		minimize nuissance complaints	
27		minimize detrimental ecological impacts	
28			
29			
30	Healthy landscapes	no wetland loss	ha of wetlands, approved 404 permits,
31		minimize invasive spp in wetlands	
32		minimize landscape fragmentation	
33		maximize food resources (migration & wintering areas)	duck-use days,
34		maximize upland nesting habitat (breeding)	
35		minimize exposure to eco-toxins	
36			

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9:45-10:15 Group Exercise

OBJECTIVES

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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

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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

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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)

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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)

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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)

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Turning Point...

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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)

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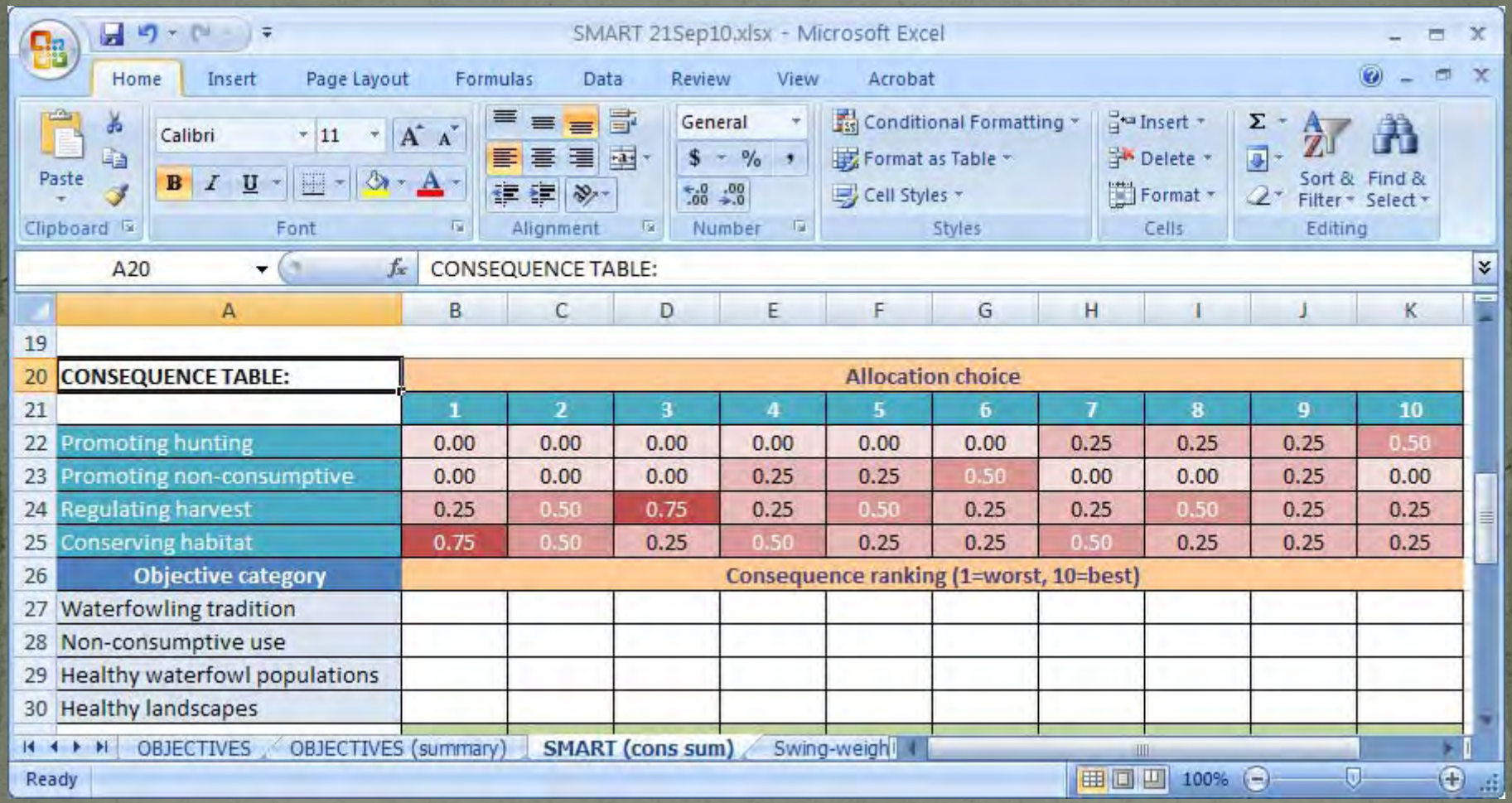
II. Consequences



	A	B	C	D	E	F	G	H	I	J	K
19											
20	**CONSEQUENCE TABLE:**	**Allocation choice**									
21		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
22	Promoting hunting	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.50
23	Promoting non-consumptive	0.00	0.00	0.00	0.25	0.25	0.50	0.00	0.00	0.25	0.00
24	Regulating harvest	0.25	0.50	0.75	0.25	0.50	0.25	0.25	0.50	0.25	0.25
25	Conserving habitat	0.75	0.50	0.25	0.50	0.25	0.25	0.50	0.25	0.25	0.25
26	**Objective category**	**Consequence ranking (1=worst, 10=best)**									
27	Waterfowling tradition										
28	Non-consumptive use										
29	Healthy waterfowl populations										
30	Healthy landscapes										

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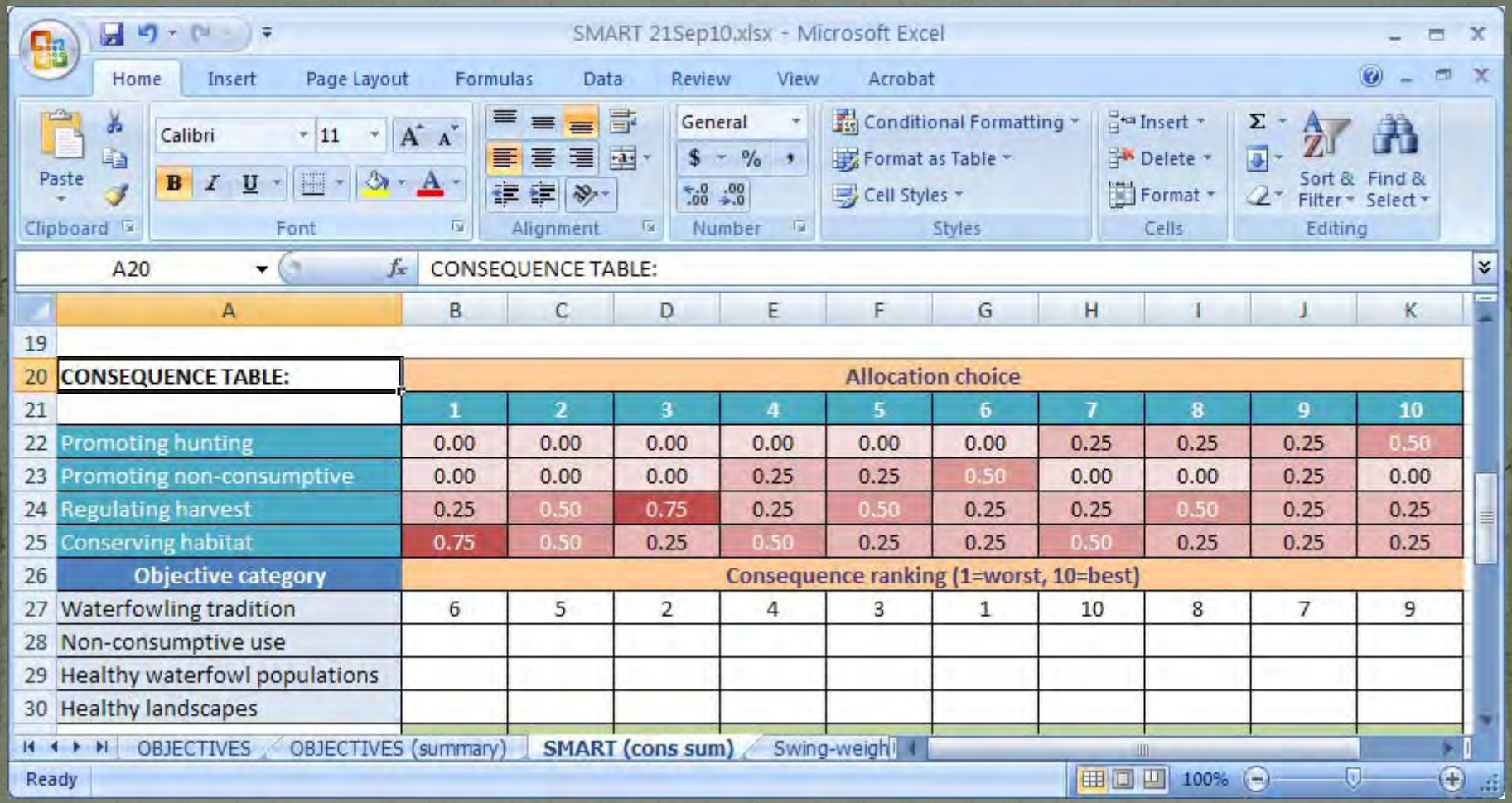
II. Consequences



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22	Promoting hunting	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.50
23	Promoting non-consumptive	0.00	0.00	0.00	0.25	0.25	0.50	0.00	0.00	0.25	0.00
24	Regulating harvest	0.25	0.50	0.75	0.25	0.50	0.25	0.25	0.50	0.25	0.25
25	Conserving habitat	0.75	0.50	0.25	0.50	0.25	0.25	0.50	0.25	0.25	0.25
26	**Objective category**	**Consequence ranking (1=worst, 10=best)**									
27	Waterfowling tradition	6	5	2	4	3	1	10	8	7	9
28	Non-consumptive use										
29	Healthy waterfowl populations										
30	Healthy landscapes										

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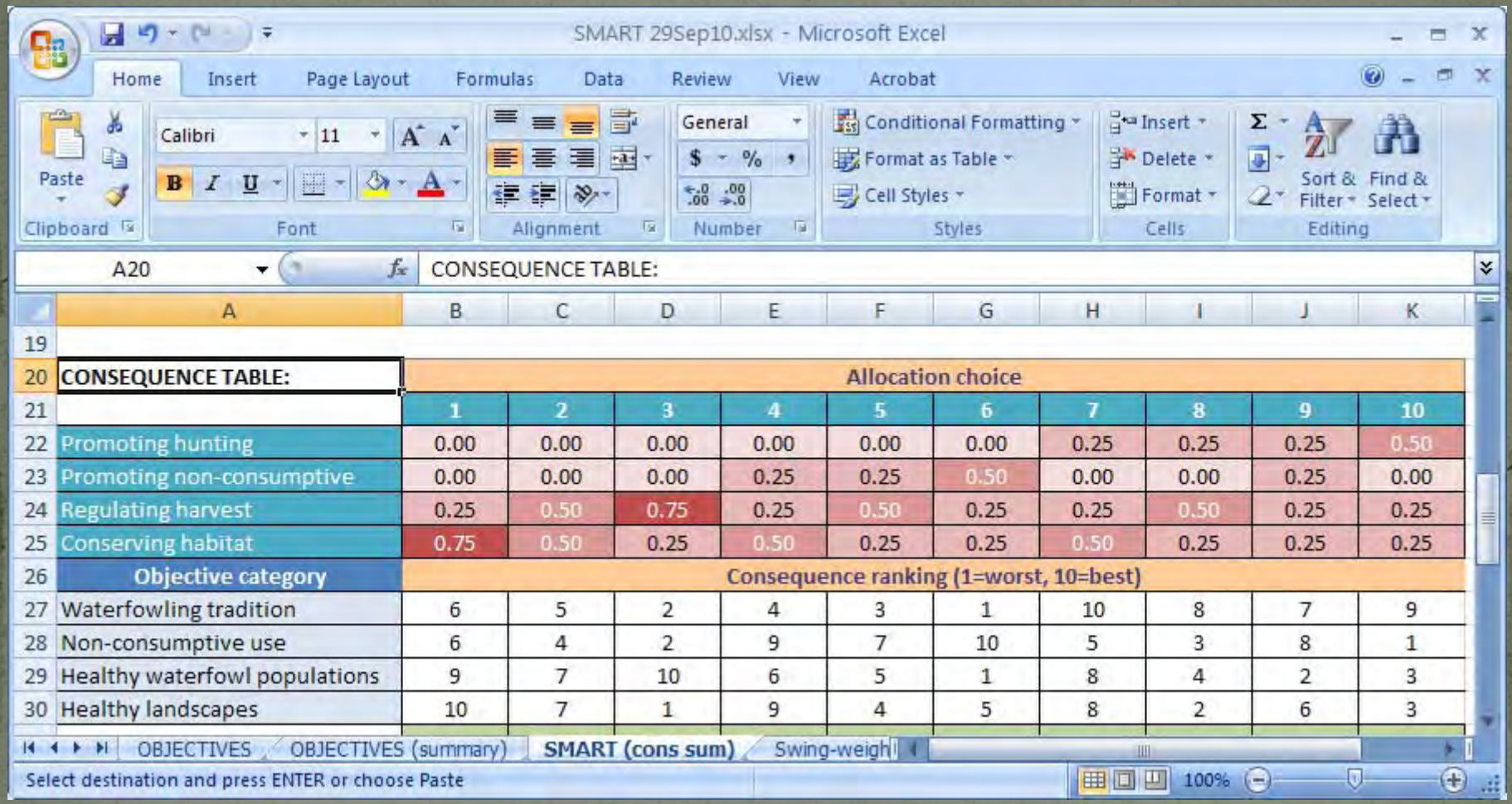
II. Consequences



	A	B	C	D	E	F	G	H	I	J	K
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22	Promoting hunting	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.50
23	Promoting non-consumptive	0.00	0.00	0.00	0.25	0.25	0.50	0.00	0.00	0.25	0.00
24	Regulating harvest	0.25	0.50	0.75	0.25	0.50	0.25	0.25	0.50	0.25	0.25
25	Conserving habitat	0.75	0.50	0.25	0.50	0.25	0.25	0.50	0.25	0.25	0.25
26	**Objective category**	**Consequence ranking (1=worst, 10=best)**									
27	Waterfowling tradition	6	5	2	4	3	1	10	8	7	9
28	Non-consumptive use	6	4	2	9	7	10	5	3	8	1
29	Healthy waterfowl populations	9	7	10	6	5	1	8	4	2	3
30	Healthy landscapes	10	7	1	9	4	5	8	2	6	3

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Scoring Consequences

25 min

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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)

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II. Swing weighting

	A	B	C	D	E
1	**SWING-WEIGHTING:**				
2	objective swung	consequences	rank	score	weight
3	(benchmark: worst-case)	everything sucks	1	0	
4	hunting	high hunter #'s, everything else sucks			
5	viewing	lots of viewers, everything else sucks			
6	pops	lots of ducks, everything else sucks			
7	landscapes	great landscapes, everything else sucks			

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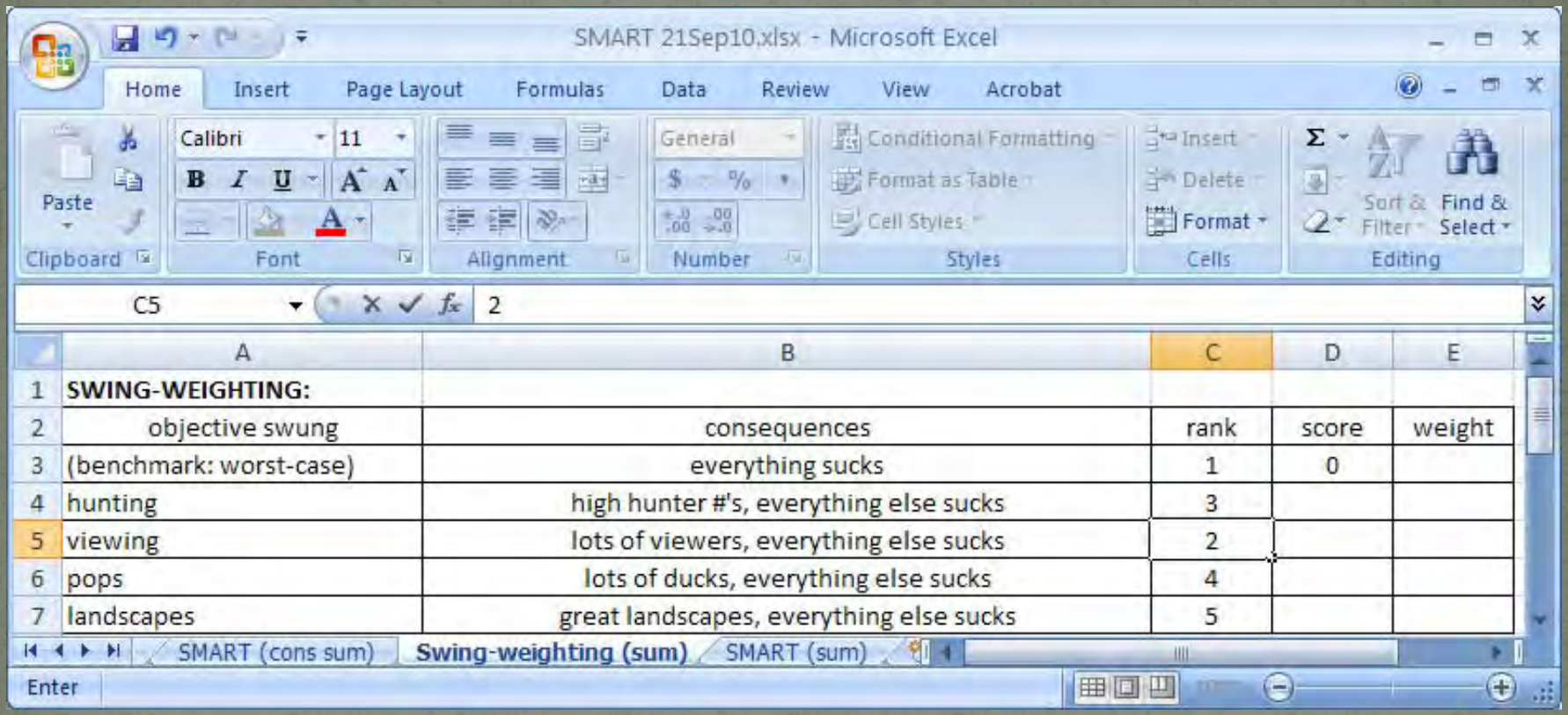
II. Swing weighting



	A	B	C	D	E
1	**SWING-WEIGHTING:**				
2	objective swung	consequences	rank	score	weight
3	(benchmark: worst-case)	everything sucks	1	0	
4	hunting	high hunter #'s, everything else sucks	3		
5	viewing	lots of viewers, everything else sucks	2		
6	pops	lots of ducks, everything else sucks	4		
7	landscapes	great landscapes, everything else sucks	5		

SMART (cons sum) | **Swing-weighting (sum)** | SMART (sum)

Enter

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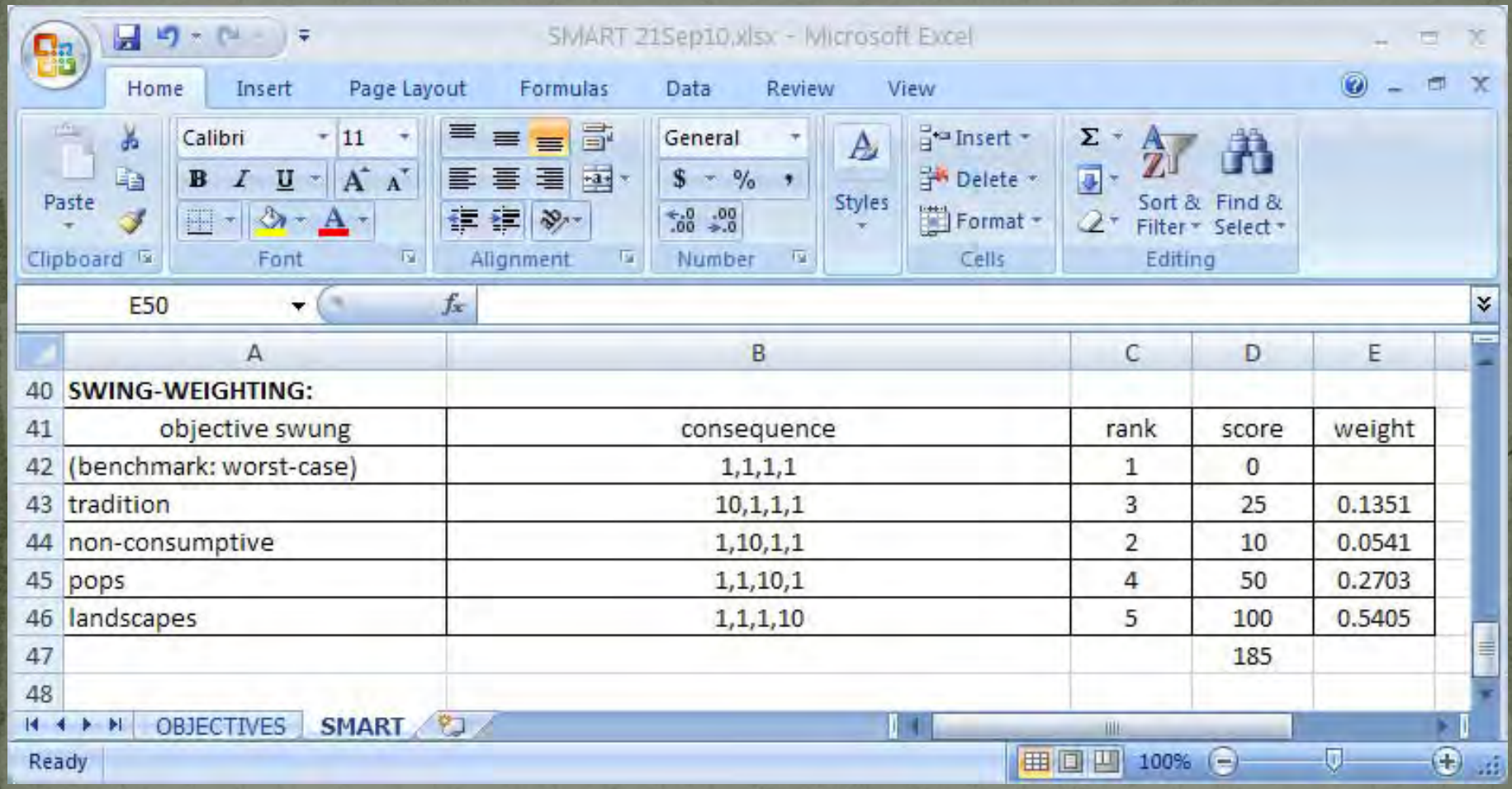
II. Swing weighting



	A	B	C	D	E
40	**SWING-WEIGHTING:**				
41	objective swung	consequence	rank	score	weight
42	(benchmark: worst-case)	1,1,1,1	1	0	
43	tradition	10,1,1,1	3	25	0.1351
44	non-consumptive	1,10,1,1	2	10	0.0541
45	pops	1,1,10,1	4	50	0.2703
46	landscapes	1,1,1,10	5	100	0.5405
47				185	
48					

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LUNCH

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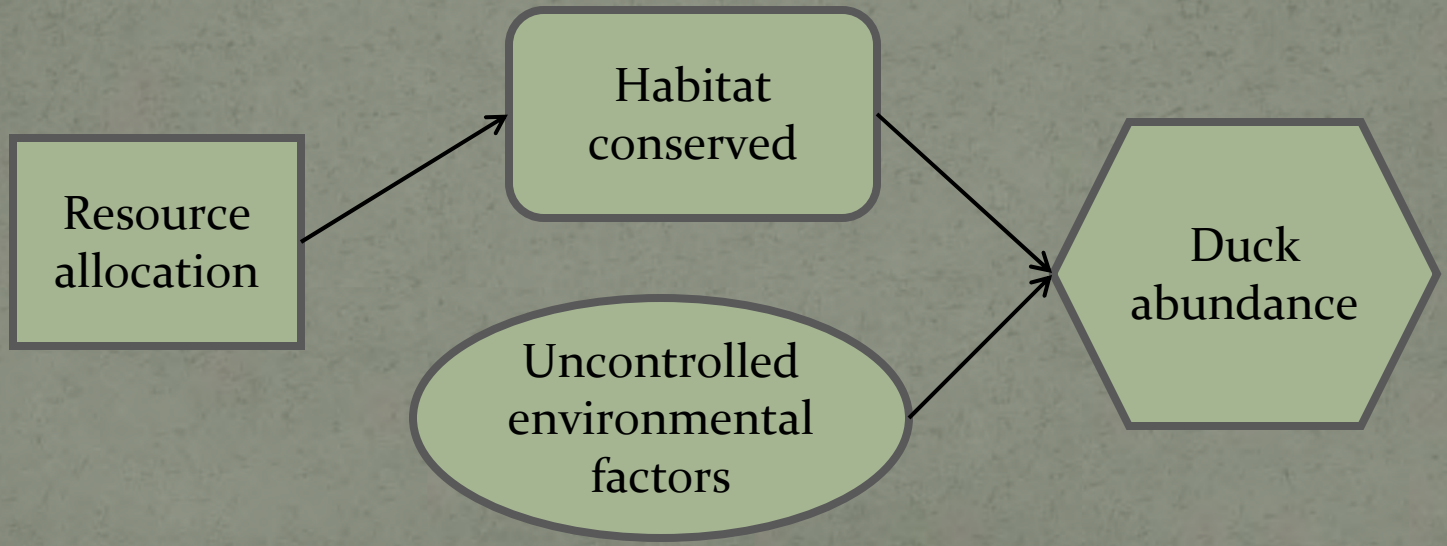
II. Consequences cont'd: influence diagrams

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



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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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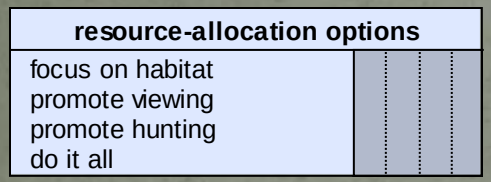

waterfowl watching utility

healthy landscapes utility

healthy populations utility

hunting tradition utility

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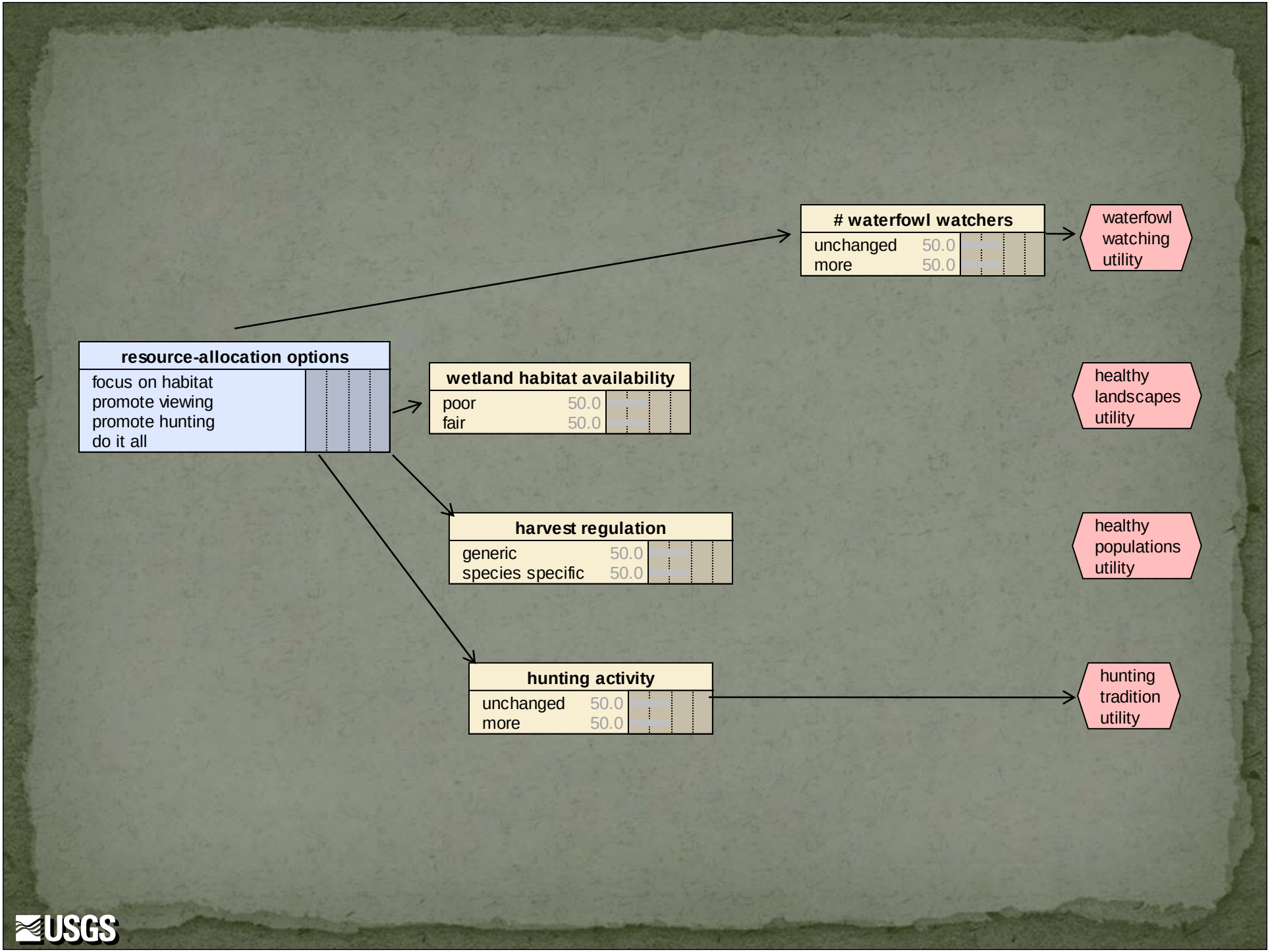
resource-allocation options
focus on habitat
promote viewing
promote hunting
do it all
waterfowl watchers
unchanged 50.0
more 50.0
waterfowl watching utility
wetland habitat availability
poor 50.0
fair 50.0
healthy landscapes utility
harvest regulation
generic 50.0
species specific 50.0
healthy populations utility
hunting activity
unchanged 50.0
more 50.0
hunting tradition utility
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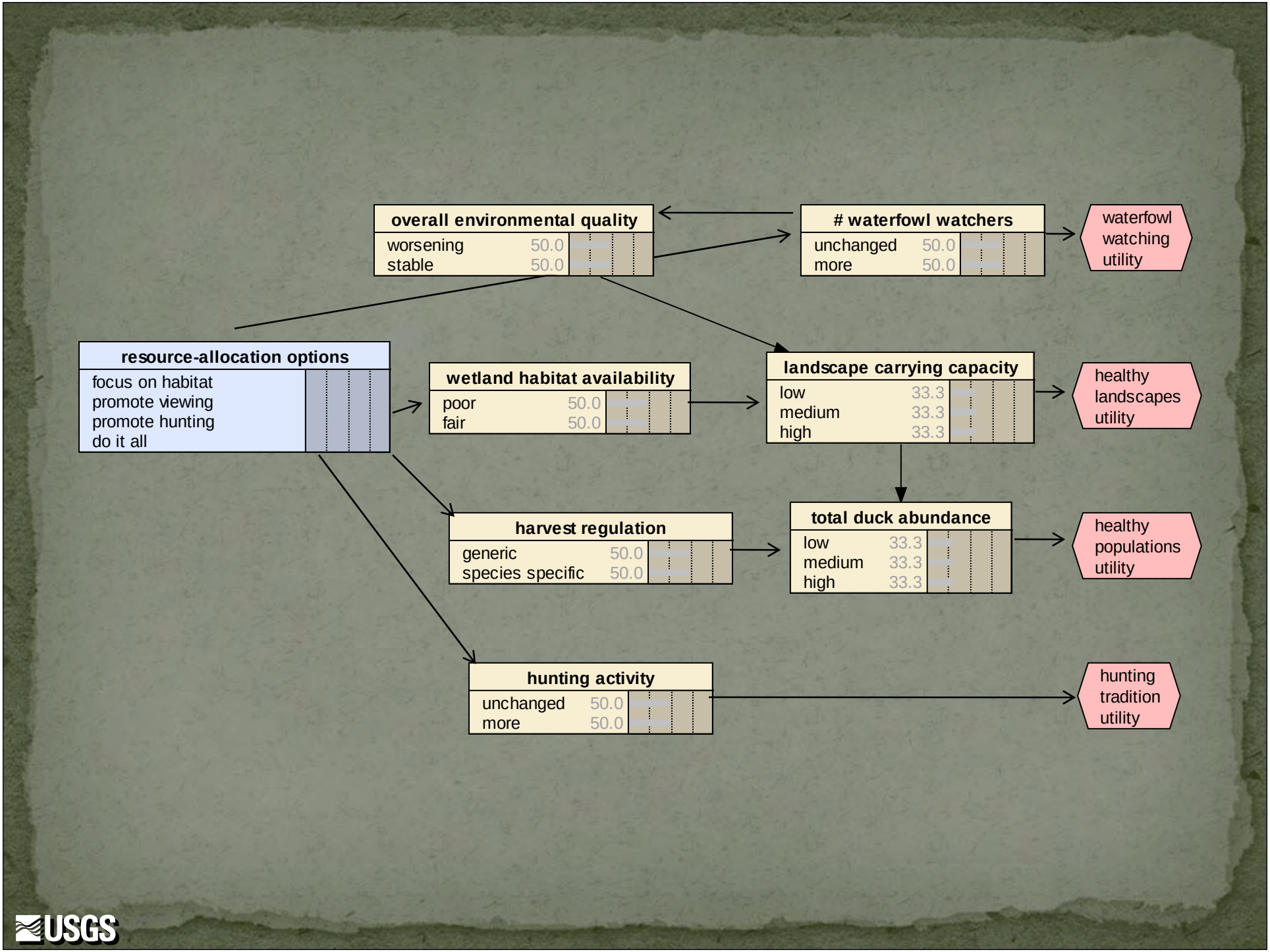
overall environmental quality
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waterfowl watchers
unchanged 50.0
more 50.0
waterfowl watching utility
resource-allocation options
focus on habitat
promote viewing
promote hunting
do it all
wetland habitat availability
poor 50.0
fair 50.0
landscape carrying capacity
low 33.3
medium 33.3
high 33.3
healthy landscapes utility
harvest regulation
generic 50.0
species specific 50.0
total duck abundance
low 33.3
medium 33.3
high 33.3
healthy populations utility
hunting activity
unchanged 50.0
more 50.0
hunting tradition utility
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Netica example…

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BREAK

2:30-2:45

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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)

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Synthesis

starts at 3:45

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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)?

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Exercise results

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Extra stuff…

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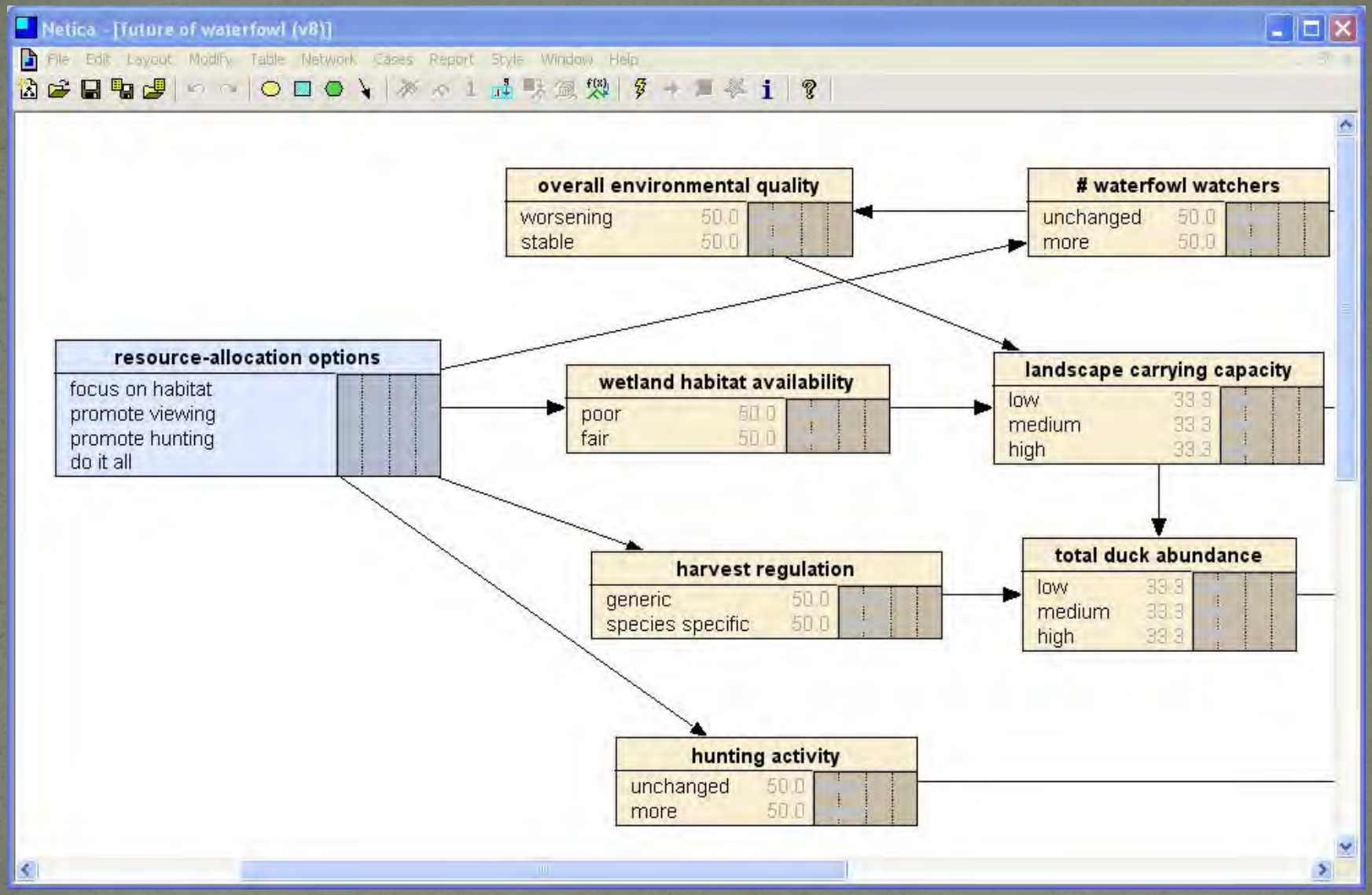
Netica - [future of waterfowl (v8)]
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overall environmental quality
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hunting activity
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more 50.0

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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

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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

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Conservation: a joke of a science?*

- 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.

Failure to set unambiguous objectives

Failure to consider other alternatives

Failure to consider uncertainty

* Adapted from Shea et al., 1998, TREE

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