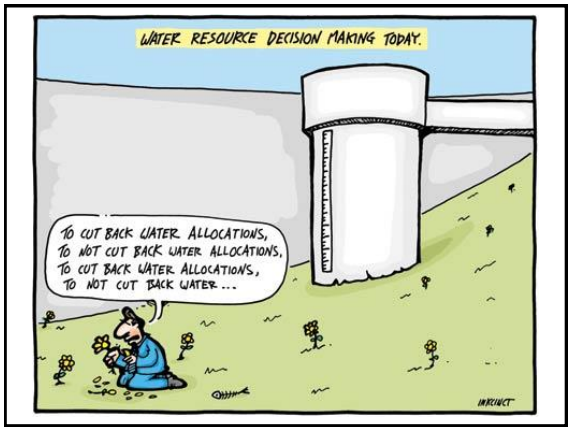
WFA8433-Natural Resource & Conservation Decision Making

Class 2
PrOACT

Housekeeping

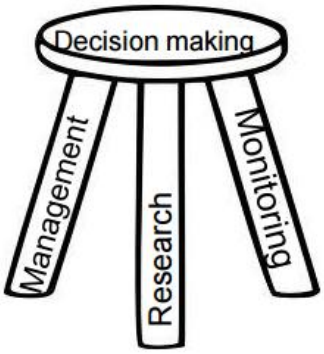
- Suggested readings:
  - Smart Choices Chapters 1-7
  - Nichols interview
- Assignment(s): None
- Group work: None, will assign groups next week
- Email out class link and update with content as course goes on…



Last class review

- Rationale for using a decision making process
- Some preliminary terminology
- Applications & failures of research to meet management
- Solutions
- Sold yet?

A Central Program



We all make decisions

We all make complex decisions

- Go to college
- Career path
- Who should we hire
- Should I find a new job?

A simple decision

- Buy a coffee
- It will cost me money
- The amount is certain
- Clear cut decision

A decision making process

Keep in mind

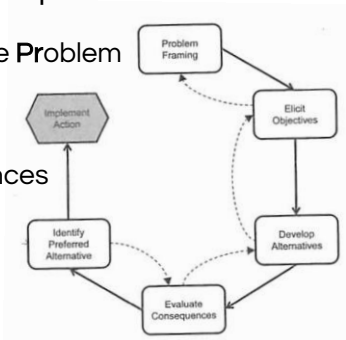
- A good decision does not guarantee a good result
- Folks can be lucky…
- A good decision does increase the odds of success that satisfies your objectives

8 Keys to effect decision making

1. Work on the right decision problem
2. Specify your objectives
3. Create imaginative alternatives
4. Understand the consequence
5. Grapple with tradeoffs
6. Clarify uncertainties
7. Think about risk tolerance
8. Consider linked decisions

A structured process: PrOACT

1. Defining the **Pr**oblem
2. **O**bjectives
3. **A**ctions
4. **C**onsequences
5. **T**radeoffs



Case Study: Choosing a Mortgage

- Your bank offers you two possible 30-yr fixed rate mortgages: 5.25%, or 4.25 % with 2 points.
- Which do you choose?

- Problem: Choose a mortgage
- Objectives: Maximize proceeds less costs
- Actions: Choice between two 30-yr fixed rate mortgages
- Consequences: Use financial formulas (model) to calculate costs and proceeds at time of sale
- Trade-offs: Directly compare consequences (only 1 objective here)

	Mortgage 1	Mortgage 2
Rate	0.0525	0.0425
Term	30	30
Points	0	2
Purchase price	$250,000	$250,000
Down payment	$50,000	$50,000
Loan	$200,000	$204,000
Monthly rate	0.004375	0.003541667
# of payments	360	360
Payment	$1,104.41	$1,003.56
Yrs in house	3	3

	Mortgage 1	Mortgage 2
Total payments	$39,758.67	$36,128.07
Balance	$191,076.51	$193,228.90
Sale price	$300,000	$300,000
Proceeds	$108,923.49	$106,771.10
Proceeds less costs	$19,164.82	$20,643.03

Pretty clear cut.
But what about uncertainty?
We will learn how to tackle that in the course

A decision making process

- What makes a decision good, is <u>the process</u> by which it was generated, not the ultimate outcome
- You can fully control the process by which the decision was made, and establish a process that is expected to perform better than any other process

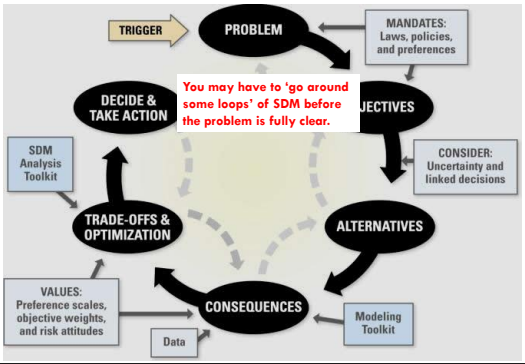
A decision making process

- Decision processes that are
- Deliberative, thorough, robust to uncertainty (that is, more likely to achieve the objectives)
- Transparent, explicit, able to be documented, replicable (that is, more likely to be accepted by others)

PROBLEM

The most important step

Problem framing



Problem Definition Steps

- 1) Defining problems as decisions
- 2) Solving the right problem
- 3) Careful framing of the problem
- 4) Develop a problem statement
- 5) Revise as needed

Solving the right problem

- Is the problem, as stated, within our ability to solve? Is it tractable? Intractable Problems:
  - Have already been decided; out of 'our' control
  - Require a greater level of investment than available
    - Time,
    - Personnel
    - Budget, etc
  - Failure is highly probable unless we re-define the problem so that it is within our ability to solve

Who is the Decision Maker?

- Who is ultimately responsible?
  - Single decision maker?
  - Multiple decision makers
  - Delegated authority
- Stakeholders are not decision makers

Framing the problem: essential elements of the decision

1. Trigger
2. Action
3. Frequency & timing
4. Scope
5. Constraints
6. Uncertainty
7. Problem class

Trigger

- What triggered the problem?
- Why does a decision need to be made?

Action

- What is the decision?
- What action needs to be taken?
- What action needs to be taken now? (no action is a decision)

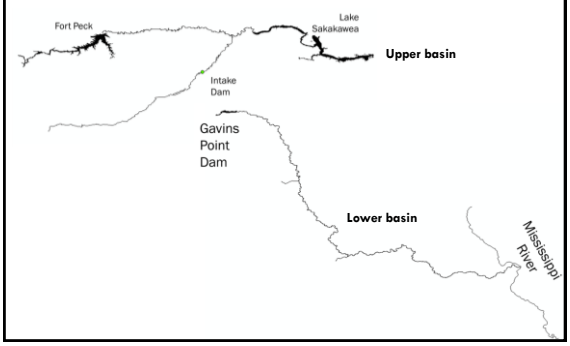
Frequency and timing

- When and how often will the decision be made?
  - One time?
  - Sequential?
- Are other decisions linked to this one?

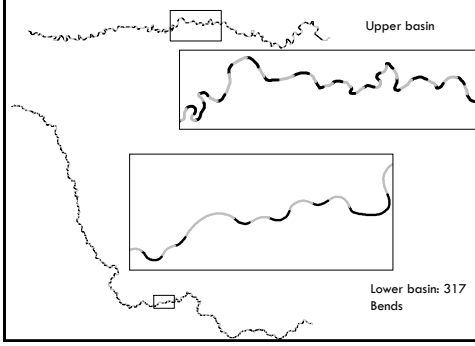
Scope

- How large, broad, complicated is the problem/decision?
  - Spatial extent
  - Spatial grain

Spatial extent



Spatial grain



Constraints

- Legal, financial, political, 'minimum performance'. Perceived or real constraints? Be creative

"Within authorized purposes…"

Within decision authority…"

Uncertainty

- What degree of uncertainty is present?
- Can it be ignored?

Problem Class

Characterizing the type of problem helps determine what decision making tool(s) to use.

- Single or multiple objective?
- How critical is uncertainty?

Problem examples

Elements problem statement

1. What is the decision—what kind of action needs to be taken?
2. What triggered this decision; why does it matter?
3. What are the legal context and constraints?
4. Who is the decision maker?
5. What is the decision timing and frequency; are other decisions linked to this one?
6. What is the scope of the problem (how broad or complicated is it)?

Problem examples

Problem: The Independent Science Review of Central Valley Project Improvement Act (CVPIA) Fisheries program identified the need to develop a new comprehensive, science-based approach that explicitly links CVPIA activities with Program objectives. The review also recommended that the framework incorporate uncertainty and allow for integration of new information to improve scientific understanding and increase the effectiveness of CVPIA activities. The project proposes to use a structured decision making approach to develop a framework that allows decision-makers to prioritize CVPIA activities and guide planning of broad scale activities.

What is the decision

Problem examples

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Trigger

Problem examples

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Uncertainty and scope

Problem examples

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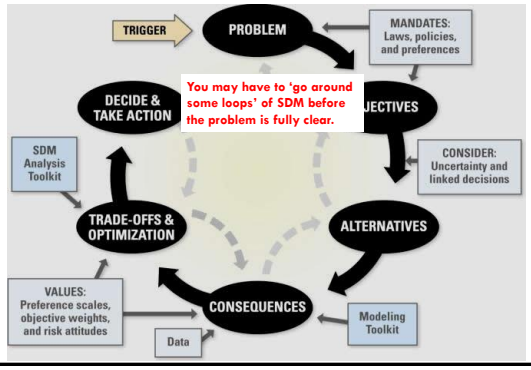
Decision maker

Problem framing



Defining the problem

- Difficult, rarely right on first time

"Extra time to craft a concise yet comprehensive and accurate problem definition pays off…"

"Think outside the box and think creatively"

– Smart Choices

Trigger

- Accepted to Mississippi State University
- Problem: ????????

Constrained problem-too narrow

- Find a place to rent
  - Alternatives: apartment, house
- Find shelter
  - Alternatives: buy a house, buy a condo, buy an RV, Buy land and a tent, rent an apartment rent a townhouse, hotel room

Trigger

- Triggers can bias your thinking about the problem…

Do keep in mind there is no law that says you have to wait for trigger…

Cahaba shiner

Importance of identifying problem: Cahaba Shiner (*Notropis cahabae)*recovery planning case study

Federally Listed species

Distribution limited to 15 miles of Cahaba River in central Alabama

Urbanizing watershed, south Birmingham AL

One very small refuge, Cahaba River National Wildlife Refuge, no staff

Cahaba Shiner (*Notropis cahabae)*recovery planning case study

Initial problem identification

Population endangered
- small population size
- restricted distribution
- increased threats from urban development
  - lower water quality
  - degraded habitats

Potentially leads to actions….
- population enhancement (stocking)
- improve water quality
- restore habitats

Cahaba Shiner (*Notropis cahabae)*recovery planning case study

Initial process failed to properly identify problem

Direct control by decision-makers limited
- Cahaba refuge very small portion of shiner range
- Most threats associated with upstream human activities on private lands (no direct management authority)

Other considerations
- Heavy reliance on cooperating agencies (state, local municipal)
- Public cooperation essential
- Goodwill is very important

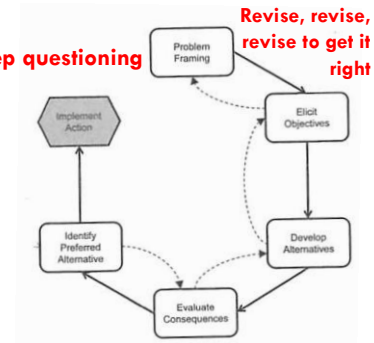
Cahaba Shiner (*Notropis cahabae)*recovery planning case study

Second look at problem identification

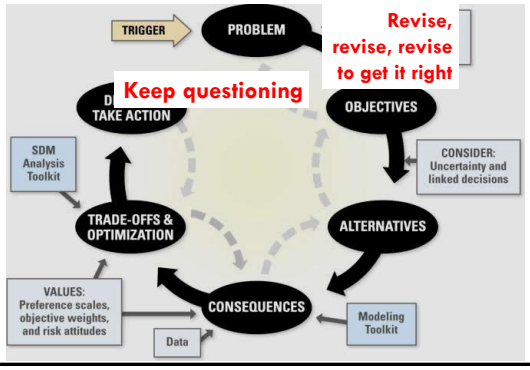
Inability to manage the Cahaba River
- Most actions on private lands within regulations
- Regulations and public resource management by state and local entities
- Management depends on cooperation/collaboration

Potentially leads very different actions….
- create better working relationships
- build credibility with the public
- educate the public on the issues

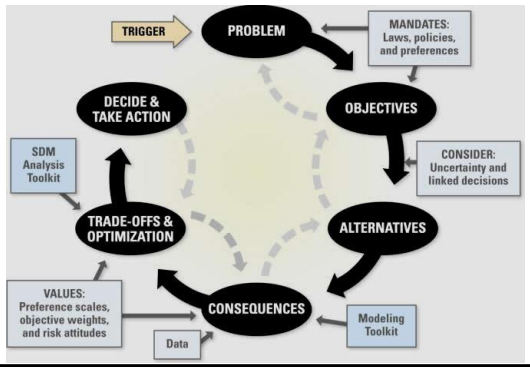
Problem framing



Problem framing



Elicit Objectives



Why are objectives important?

- Objectives are the basis for making a decision
- Vary by problem…
- Guide information
- Explain choices

Pitfalls

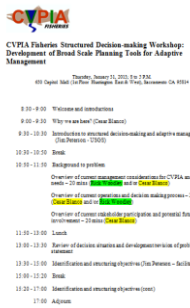
- Unspecified –too narrow
- Biased to tangibles-cost…
- Hidden models-"already know what is needed"
- Hidden objectives

How do we deal with these?

- Wear them down
- Keep probing
  - Why is this important
  - Why….
  - How do we achieve this?

A typical agenda of a workshop

- Structuring objectives

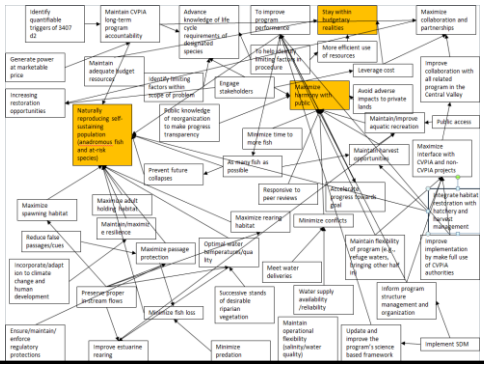


CVPIA Fisheries Structured Decision-making Workshop: Development of Broad Scale Planning Tools for Adaptive Management

Thursday, January 26, 2012, 8:30 AM
430 Capitol Mall (1st Floor Huntington East & West), Sacramento, CA 95814

8:30 – 9:00 Welcome and introductions
9:00 – 9:30 Why we are here? (Cesar Blanco)
9:30 – 10:30 Introduction to structured decision-making and adaptive management (Tim Peterson – USGS)
10:30 – 10:50 Break
10:30 – 11:30 Background to problem
Overview of current management considerations for CVPIA and future needs – 20 mins (Erin Wheeler and/or Cesar Blanco)
Overview of current constraints and decision making process – 20 mins (Cesar Blanco and/or Erin Wheeler)
Overview of current stakeholder participation and potential future involvement – 20 mins (Cesar Blanco)
11:30 – 13:00 Lunch
13:00 – 13:30 Review of decision situation and development/revision of problem statement
13:30 – 15:00 Identification and structuring objectives (Tim Peterson – facilitator)
15:00 – 15:20 Break
15:20 – 17:00 Identification and structuring objectives (cont.)
17:00 Adjourn

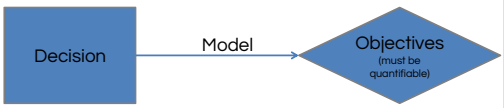
The objectives network…



Objective: To develop a transparent prototype decision model that (1) integrates large scale CVPIA program elements into a single science-based framework; (2) explicitly links restoration activities to ecological/environmental objectives; and (3) can be used to identify and prioritize large scale restoration activities based on programmatic objectives and constraints.

Identify and Structure Objectives

Why emphasize objectives?



Everything depends on your objectives

Everything depends on your objectives

Everything depends on your objectives

Why do we need to identify & structure objectives?

We already know our objectives

We all want to do what's right

We have the same objectives

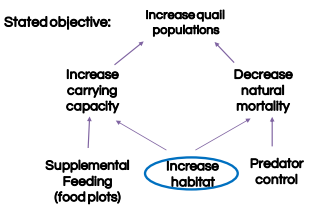
and on and on and on…

Why do we need to identify and structure objectives?

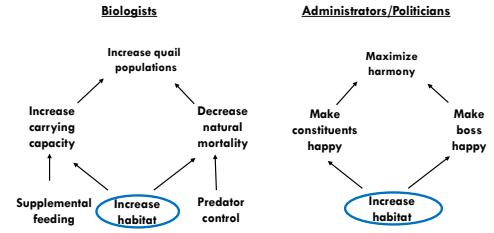
Minimizes misunderstanding
Focuses efforts things that matter most to the decision-maker

Case study: Bobwhite Quail Initiative

GA DNR program for improving quail populations on private lands
Initial focus, maximum effort in 3 counties



An alternative perspective



Result: eliminate monitoring, expand program to set aside lands additional counties

Basic types of objectives

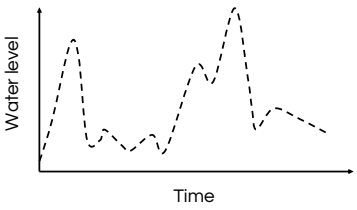
Fundamental objectives: what the decision-maker really wants to accomplish.

Means objectives: the things that need to be accomplished to realize the fundamental objective

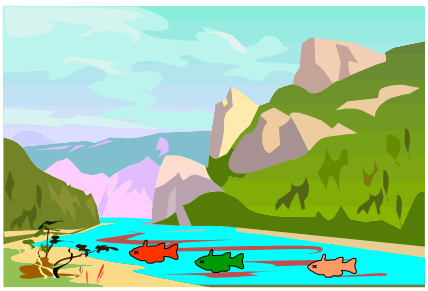
The importance of identifying and structuring objectives common sticking point

Confusing fundamental and mean objectives

Stated (fundamental) objective of stream fishery manager:
Natural Hydrologic Regime

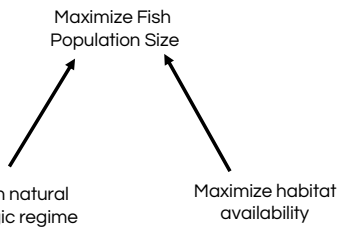


Possible outcome: The flow regime is natural but….
all the fish are dead



Would the fishery managers be happy with the outcome???

Means objectives (sometimes) help realize the fundamental objective



Means objectives often are hypotheses about system dynamics

More common problems

Dismissing potential objectives due to perceived conflicts

Dismissing potential objectives due to perceived lack of information or complexity

Please leave your model at the door

Values (objectives) masquerading as facts or process

More common problems

Tunnel vision
status quo bias

Decision-makers too close to the problem

Objectives Jargon

Maximize = more of something

Minimize = less of something

Structuring objectives

Identify and organizing fundamental and means objectives.

Three very important phrases

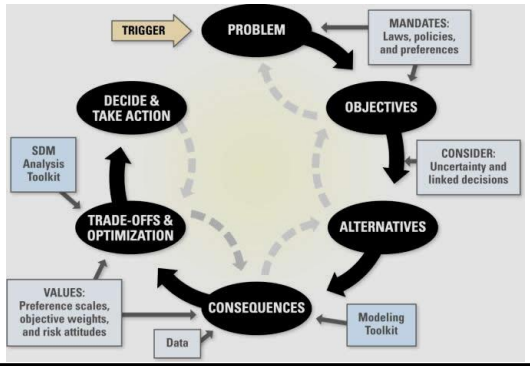
Why Is That Important?

How can you / I achieve that?

What do you / I mean by that?

>>>>>> Clarity is essential <<<<<<<

Alternatives



Identifying decision alternatives

What actions can be taken
sometimes **limited- legal mandates, restrictions within the authority of decision maker**

Better to think creatively

Better to develop exhaustive list of alternatives
-then pare down

Often emerge as means objectives

You can never select an alternative you have not identified

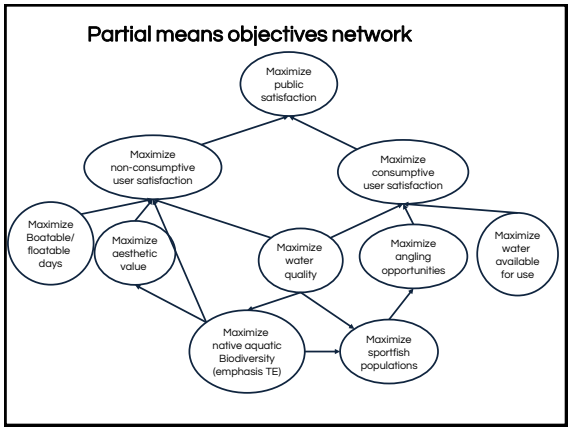
Structured Decision Making Process

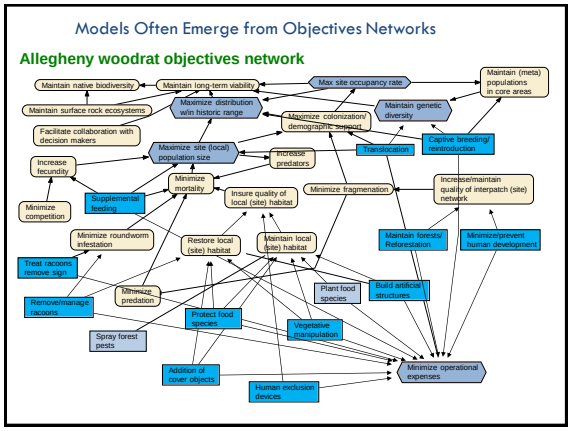
Step 1: Identify the problem / decision situation

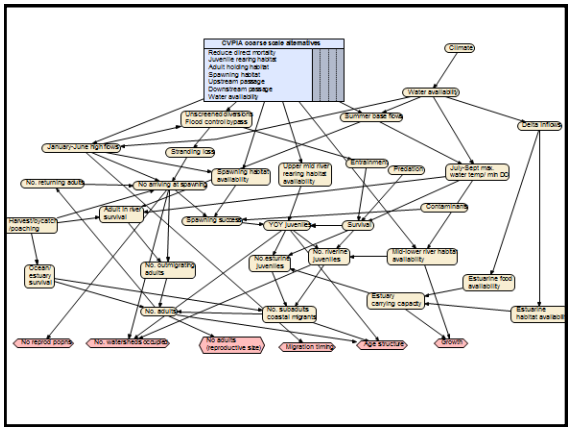
Step 2: Identify and Structure Objectives

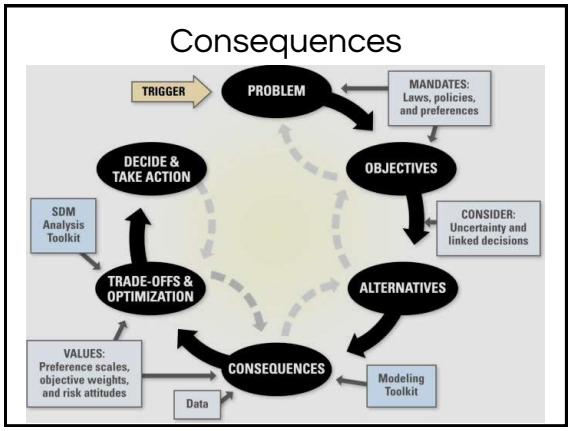
Step 3: Identify decision alternatives

These 3 steps = most difficult aspects of SDM









Consequences

- How does alternatives meet your objectives
- Can deal with uncertainty
  - Probabilities
  - Model forecasts
- Lots of human dimensions here
  - How to value objectives?

Consequences

- Example- Objective to maximize biodiversity….
- How to value?
  - Number of species
  - Density of species
  - Biomass?
  - Others????
- Up to decision makers for values

Consequences

Criteria (weight)	Objective 1			Objective 2		
	Excavate	Dredge	Consolidate	Retention pond	Sub-impoundment	Sediment dikes
Applicability (0.1)	5	3	2	4	5	2
Efficacy (0.1)	5	4	1	5	5	3
Reliability (0.1)	5	4	2	2	3	2
Feasibility (0.1)	3	4	5	5	3	5
Affordability (0.3)	3	2	5	4	3	3
Value-added (0.1)	2	2	1	4	5	4
Safety (0.1)	5	5	4	5	5	3
Durability (0.1)	5	5	1	5	5	5
Unweighted mean	4.1	3.6	2.6	4.3	4.3	3.4
Weighted mean	3.9	3.3	3.1	4.2	4.0	3.3

Tradeoff Vs. Prioritizing,Ranking

372 RANKING WILDLIFE HAZARDS TO AVIATION

Ranking the hazard level of wildlife species to aviation

Richard A. Dolbeer, Sandra E. Wright, and Edward C. Cleary

Lower Columbia Estuary Partnership

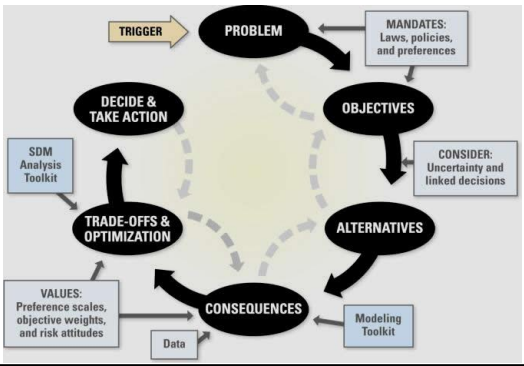
Restoration Priorit

Abstract Aircraft collisions with birds and other wildlife are a serious economic and safety problem. However, all wildlife species are not equally hazardous to aviation. In implementing programs to reduce wildlife hazards, airport operators need guidance on the relative risk posed by various species so that management actions can be prioritized by the most hazardous species. Our objective was to rank various wildlife species as to their relative hazard to aircraft. We selected 21 species or species groups (e.g., gulls [*Larus* spp.]) for which there were ≥17 strike reports in the Federal Aviation Administration's (FAA) Wildlife Strike Database for civil aircraft in the United States, 1991–1998. We ranked the 21 groups for relative hazard to aircraft based on the percentage of strikes causing damage, major damage, and an effect-on-flight. Deer (Cervidae, primarily *Odocoileus virginianus*), vultures (Cathartidae), and geese (Anserini, primarily *Branta canadensis*) were

Evaluating Consequences

- Add hoc prioritization is common
- Varying magnitudes
- Conflicting objectives
- Multi-attribute
- Values objectives, link to decision

Tradeoffs



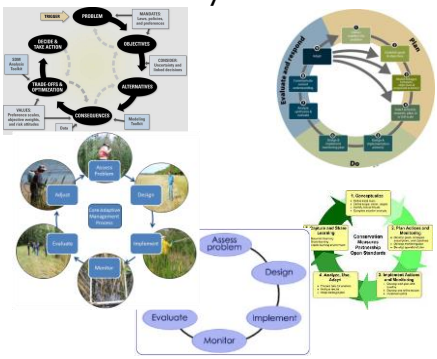
Tradeoffs

- Use values of consequences to evaluate decision alternatives
- If lucky, no brainer, one alternative is obviously best
- More likely… several close alternatives

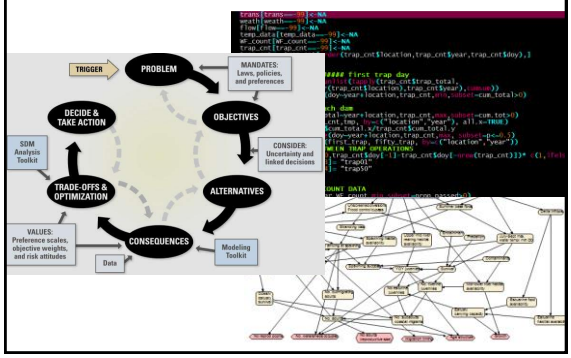
Tradeoffs

- Lots of technical bits here
- Optimization decision that maximizes the utility (quantification of objectives)
- Tools:
  - Bayesian decision networks
  - Monte Carlo simulation
  - Genetic algorithms
  - Integer programming
  - Stochastic dynamic programming

Folksy to Formal



To a formal process…



A management decision is an irrevocable commitment of resources!