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Week 3:

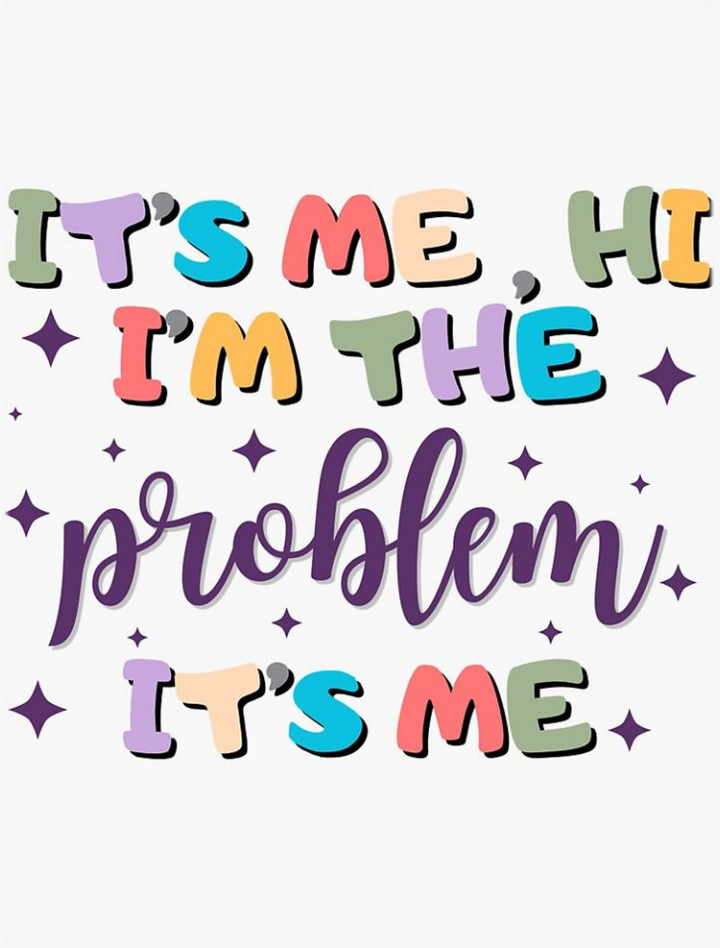
Objectives Step of PrOACT

Instructor: Brielle K Thompson

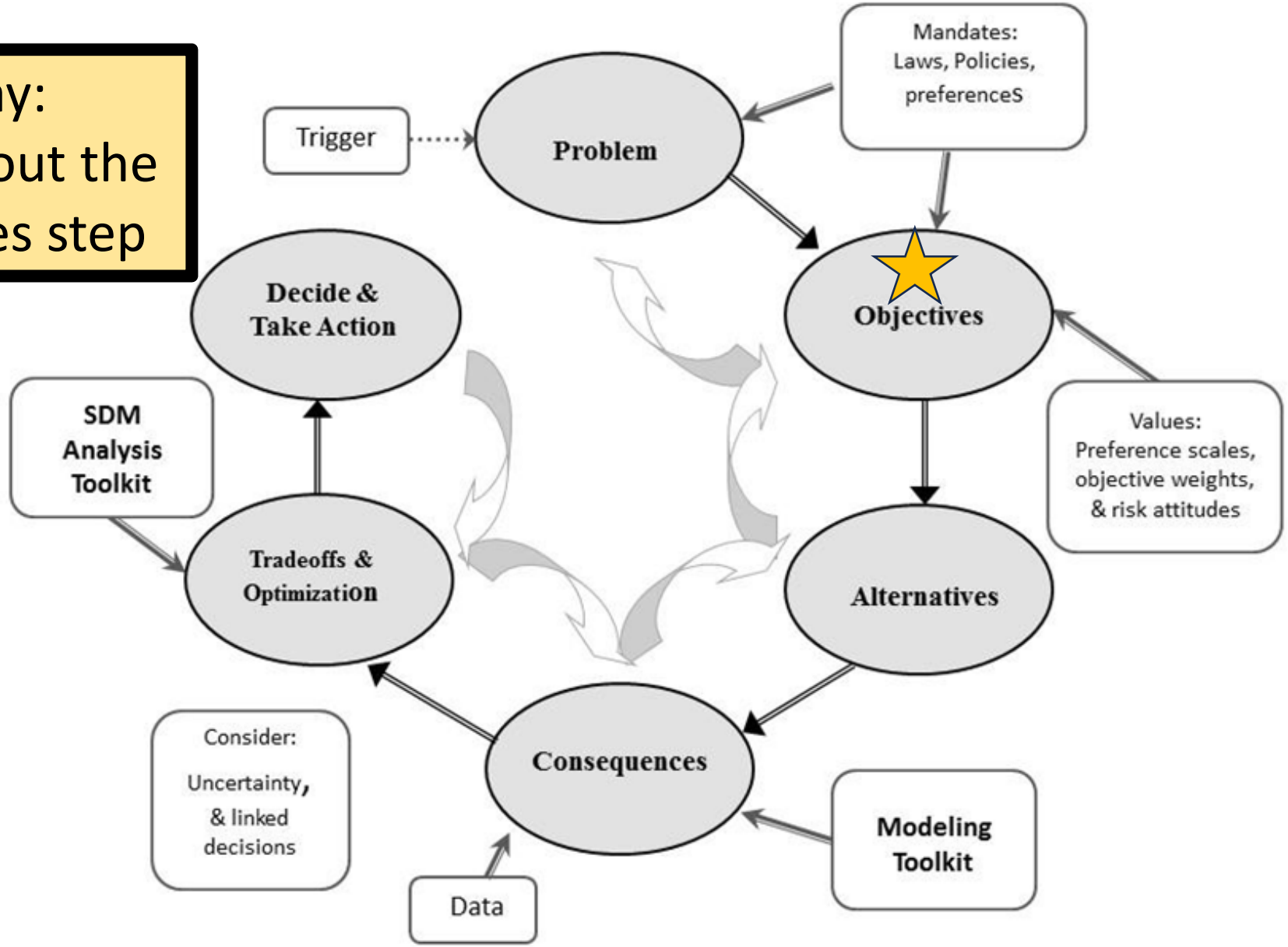
Course: NAT_R 8001 Decision Analysis for Research and Management of Natural Resources

Review of last week

- Discussed the problem framing step of SDM
- Elements of problem framing
  1. ID the decision maker(s)
  2. ID other key players
  3. Consider legal and regulatory context
  4. Consider decision structure
  5. Consider the type of analysis required
  6. Revise as needed
- Learned about the template:
  - "Decision Maker (**D**) is trying to do **X** to achieve **Y** over time **Z** and in place **W** considering **B**."



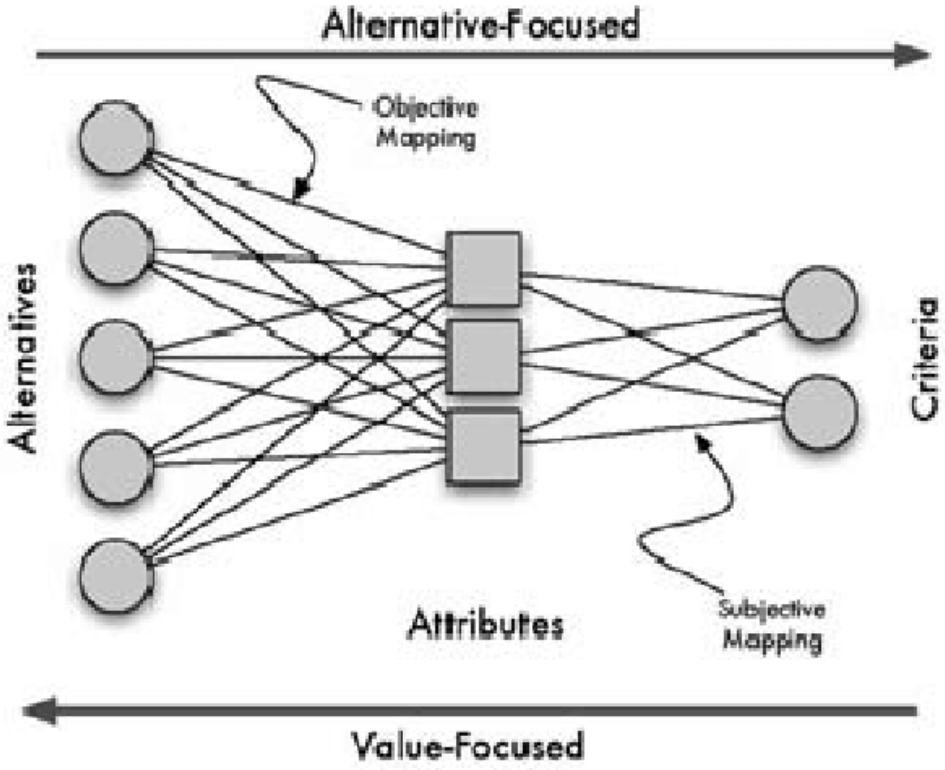
Today:
Learn about the objectives step



Source: Jean Fitts Cochrane

Recall: Values focused vs Alternatives focused thinking:

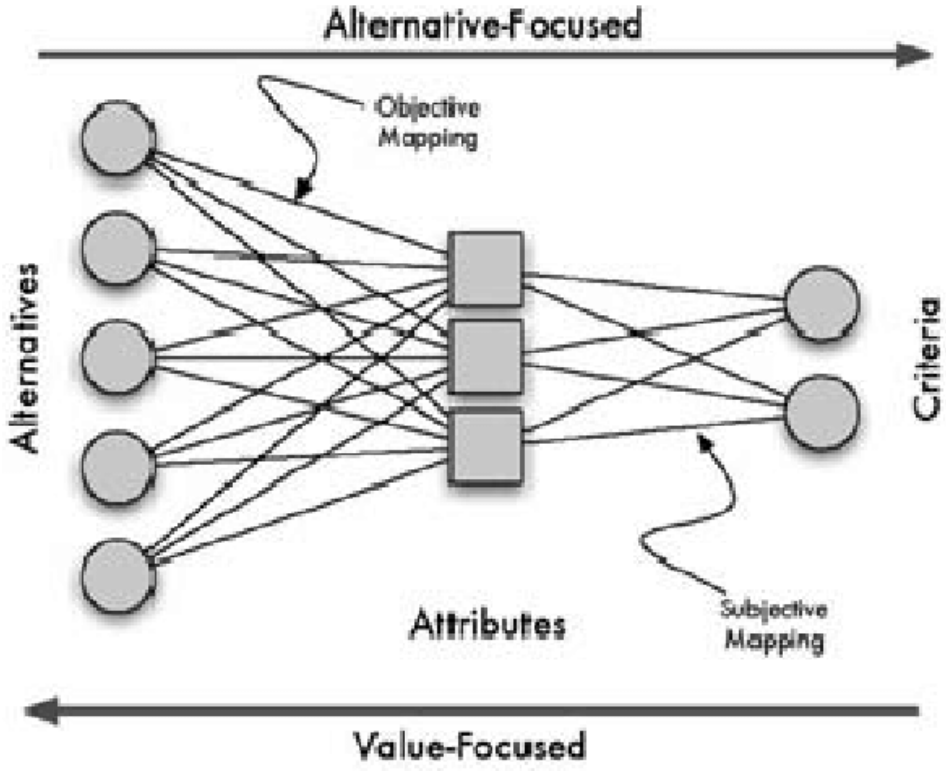
- "Value-focused thinking involves starting at the best and working to make it a reality. **Alternative-focused thinking is starting with what is readily available and taking the best of the lot**" – Keeny 1992
  - In other words: value-focused thinking first decides what you want, then you figure out how to get there



Parnell & West 2008

Recall: Values focused vs Alternatives focused thinking:

- What are the risks of Alternative focused thinking?
  - We tend to limit ourselves to a smaller set of alternatives
  - We may anchor on the first alternative
  - **We solve the wrong problem**



Parnell & West 2008

Values are pieces of an objective

Developed by Brielle Thompson, Alex McInturff, Jean Fitts Cochrane, Angela Matz, Jennifer A. Szymanski, James E. Lyons, Sarah J. Converse, & Michael C. Runge

Management objectives ≠ Research Objectives

- **Research objectives** = “active statement[s] about how the study [or analysis] is going to answer the specific research question[s]” (Farrugia et al., 2010)

- **Management objectives** = “statements of the fundamental interests that could be affected by a decision—the ‘things that matter’ to people” or the things that have intrinsic social and cultural value (Gregory et al., 2012)

Developed by Brielle Thompson, see Aldridge and Colvin 2024

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Management objectives ≠ Alternatives

- Management actions and monitoring activities are often conflated with management objectives
- For example:
  - Statements such as:
    - “We wish to better understand habitat effects on bobwhite quail reproduction” (= research)
    - “We aim to monitor water quality” (= monitoring)
    - “We want to develop bass length limit recommendations” (= management action)
  - These all are not management objectives but describe activities that serve as means of achieving various ends (i.e. management objectives)

See Aldridge and Colvin 2024

Management objectives ≠ Targets

- Target = Desired level of performance towards an objective
  - Example:
    - **Create 1000 jobs is a target** – a specific quantitative level of performance we want to achieve.
    - **Maximize employment** is an objective (employment is the thing we want, more is better than less

What are objectives in decision analysis?

- We make decisions to achieve something
- **Objectives are what we want to achieve**
  - ***Concise statements on what matters***

Medium

Example: I am deciding where to go on vacation.
What objectives are in play for me?

I want to maximize:
- Relaxation
- Fun
- Comfort

I want to minimize:
- Cost
- Travel time

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Why are objectives important?

- Spending time on this step is important because we will:
  - Compare alternatives on the right criteria
  - Develop creative alternatives
  - Know what we want to make predictions about
  - Better explain our decisions

Medium

Yogi Berra is reported to have said, *"If you don't know where you're going, chances are you will end up somewhere else"*

We are surprisingly poor at identifying objectives

1) We often don't know all our objectives:

- Bond et al. (2008) asked MBA students to imagine choosing an MBA program, list their objectives, then check against a master list

  - 4/10 of the final top 10 objectives were absent from the student's first list

Medium

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We are surprisingly poor at identifying objectives

1) **We often don't know all our objectives**
2) **We confuse ends and means:**
   - Example – when deciding about management of an endangered species:
     - Is this the objective?
       - Maximize survival probability of the endangered species
     - Or is this the objective?
       - Maximize probability of persistence of the endangered species

Medium

Pieces of an objective:

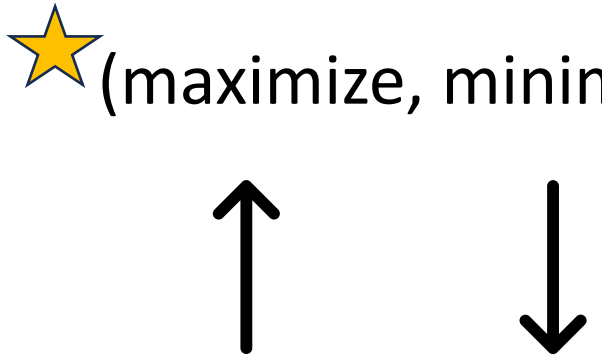
Direction
(maximize, minimize)

+

What is desired

+

Attribute
(the units)



e.g. $

*Maximize/Minimize may be uncomfortable to state (but its useful for optimization purposes). So, as long as the direction is clear we can use other verbs (e.g., increase, decrease, etc.)

Developed by Brielle K Thompson

Process for identifying objectives:

Big picture

1. Articulate goals & concerns
2. Convert goals & concerns to objectives

Specific Steps

3. Structure objectives
4. Create measurable attributes for each objective

Repeat as needed

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Process for identifying objectives:

1. Articulate goals & concerns

To help identify the values that should drive the decision, think about:

- What do you hope to achieve with this decision?
- What concerns will this decision address?
- What's wrong with the current situation?
- How can the current situation be improved?
- What is the best (and worst) possible outcome from this decision?
- If you do make a decision, what do you want to avoid?
- If you don't make a decision, what will happen?
- What does this issue look like from other perspectives?

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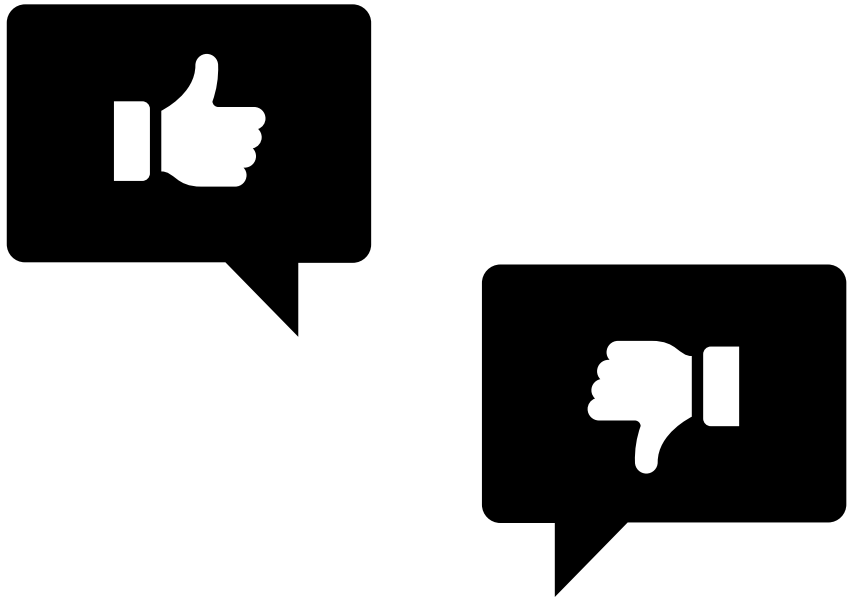
Process for identifying objectives:

1. Articulate goals & concerns

Think of possible solutions

- What do you like and dislike about these solutions?
- What constraints and guidelines are restricting your choices?
- Make goals and concerns distinct and independent



Process for identifying objectives:

Big picture

1. Articulate goals & concerns
2. **Convert goals & concerns to objectives**

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Activity – convert goals to objectives

Convert concerns to objectives:

Hint: direction + what is desired (don't worry about units yet!)

Goal or Concern	***Hope to Achieve***	***Potential Objective***
It's hard to catch bluegills any more	Improve fishing	
Many loons die ingesting lead tackle	Reduce loon mortality and increase loon populations	
Ballast water brings invasive species	Avoid release of invasive species and protect native species	
Certain interest groups feel excluded	Organize an inclusive decision process	
I won't have enough money for this	Reduce cost and manage within budget	

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Activity – convert goals to objectives

Convert concerns to objectives:

Hint: direction + what is desired (don't worry about units yet!)

Goal or Concern	***Hope to Achieve***	***Potential Objective***
It's hard to catch bluegills any more	Improve fishing	Maximize recreational fishing success
Many loons die ingesting lead tackle	Reduce loon mortality and increase loon populations	Maximize persistence of loon populations
Ballast water brings invasive species	Avoid release of invasive species and protect native species	Maximize native invertebrate and fish communities in lakes
Certain interest groups feel excluded	Organize an inclusive decision process	Maximize interest group engagement
I won't have enough money for this	Reduce cost and manage within budget	Minimize cost

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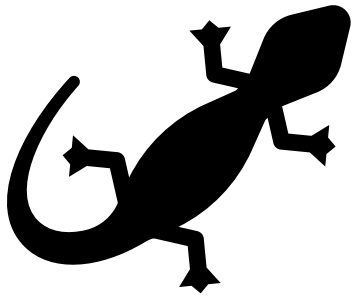
Skills Check Task 1

Lizard example



Consider this decision… (5 min)

- You are the manager of a wildlife refuge
- Developing a management plan for an endangered lizard.
- The species benefits from prescribed fire (though your budget for such activities is limited)
- The species is susceptible to road mortality
- The Refuge receives substantial visitation by bird watchers, some of whom like to travel by car.

TASK 1: Write a list of objectives

Identify your concerns and translate into objectives:

What are you hoping to accomplish?
What do stakeholders want?
What do you or they want to avoid?

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Process for identifying objectives:

Big picture

1. Articulate goals & concerns
2. Convert goals & concerns to objectives

Specific Steps

3. Structure objectives:
   - 3a. Classify and distinguish types of objectives
   - 3b. Create an objectives hierarchy

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Process for identifying objectives:

3a. Distinguish types of objectives

1. **Fundamental**
   - The basic reason for caring about the decision (essential)
2. **Means**
   - Influence the achievement of fundamental objectives (not necessarily essential)
3. **Process**
   - Concern for how the decision is made rather than what decision is made
     - Example- maximize public trust
4. **Strategic**
   - Higher level – objectives covering all decisions made by the organization or person or an agency mandate

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Process for identifying objectives:

3a. Distinguish types of objectives

Fundamental Objectives

How do you know what's fundamental?

- Must be controllable – available alternatives could influence the objective
  - Not too broad or high level to be beyond control with alternatives available for this context
- Must be essential – relevant to selection of alternative
  - Not too narrow and not a means to another objective

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Process for identifying objectives:

3a. Distinguish types of objectives

Means Objectives

Means objectives point to the actions that you can take to influence what matters

TIP: Distinguish fundamental from means objectives

- Fundamental objectives point to what matters
- Distinguish fundamental and means objectives to
  - Correctly weight objectives
  - Separate means from ends (i.e., improving habitat might not be sufficient to improve species status)
  - **Help develop** creative alternatives (focus on the end not the means)

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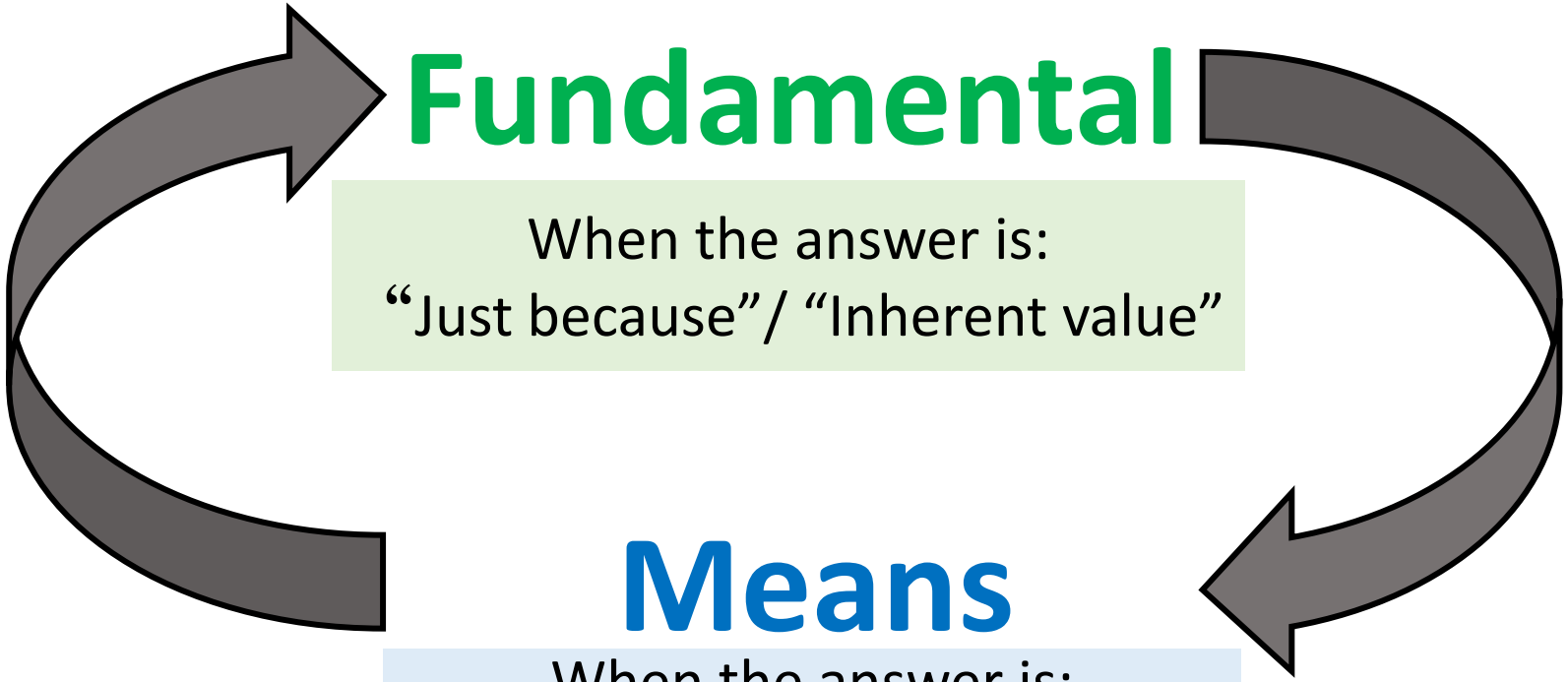
Process for identifying objectives:

3a. Distinguish types of objectives



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Activity – fundamental objective

3a. Distinguish types of objectives

Exercise: Identify the fundamental objective 

Concern	Objectives
1. Ballast water brings invasive species	Minimize ballast dumping
	Minimize invasive species introductions
	Maximize native species
2. You don't have enough money for this	Minimize cost
	Maximize conservation within budget

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Activity – fundamental objective

3a. Distinguish types of objectives

Exercise: Identify the fundamental objective ★

Concern	Objectives
1. Ballast water brings invasive species	Minimize ballast dumping
	Minimize invasive species introductions
	Maximize native species ★
2. You don't have enough money for this	Minimize cost ★
	Maximize conservation within budget

Do not combine objectives!

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Process for identifying objectives:

3a. Distinguish types of objectives

Process Objectives

- *"…especially in public decisions made by government, both what is chosen and how the alternative is chosen are important. In other words, the process of decision-making in these situations matters…" Keeney*

- **Process objectives** relate to *how* the decision is made

- Example: A decision-making process that declares multi-agency collaboration as an objective.

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Process for identifying objectives:

3a. Distinguish types of objectives

Strategic Objectives

- Strategic objectives = objectives that are concerned with the effects of the decision.
  - These objectives have some bearing on decisions, but are unlikely to be fully achieved by any one decision
- Example: Agency Mission is concerned with the effects of this decision…
  - On other, linked opportunities
  - On setting precedents
  - On larger mission, mandate or image

For example (Gregory et al. 2012):

- Maximize public trust and consent
- Execute organization's mandate
- Comply with international trade rules

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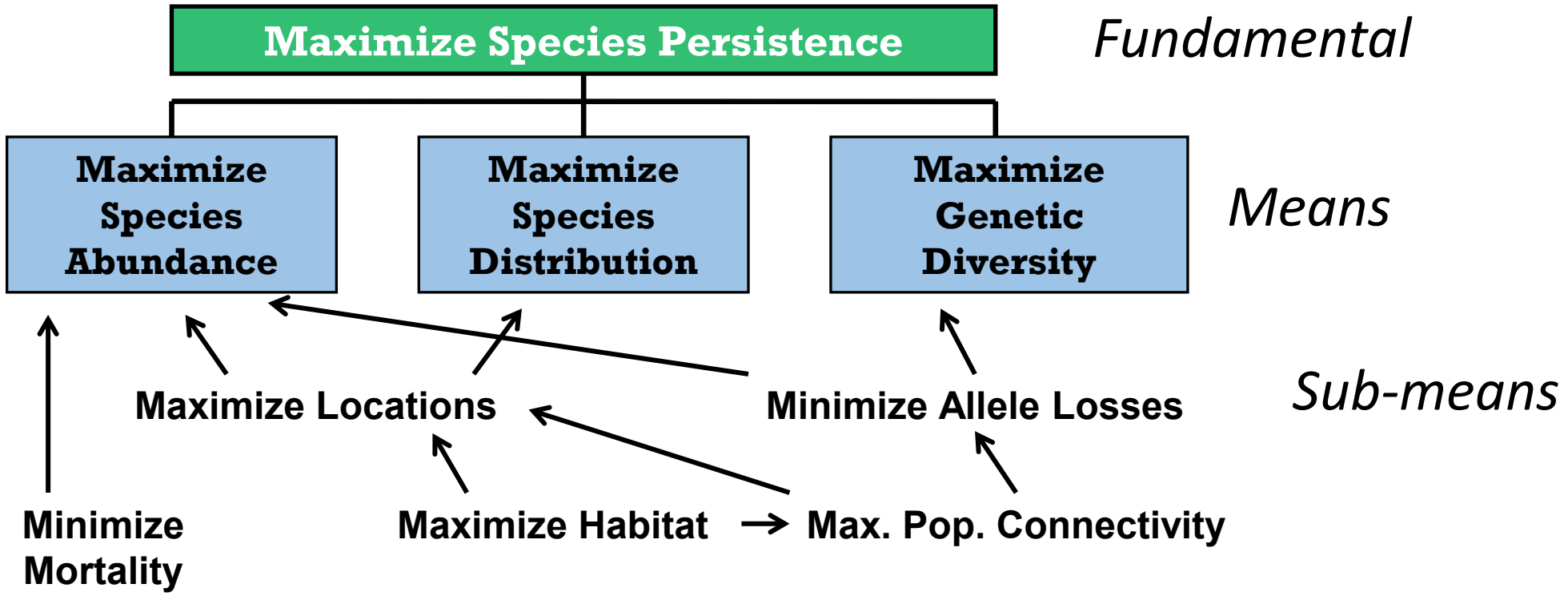
3b. Create an objective hierarchy



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3b. Create an objective hierarchy

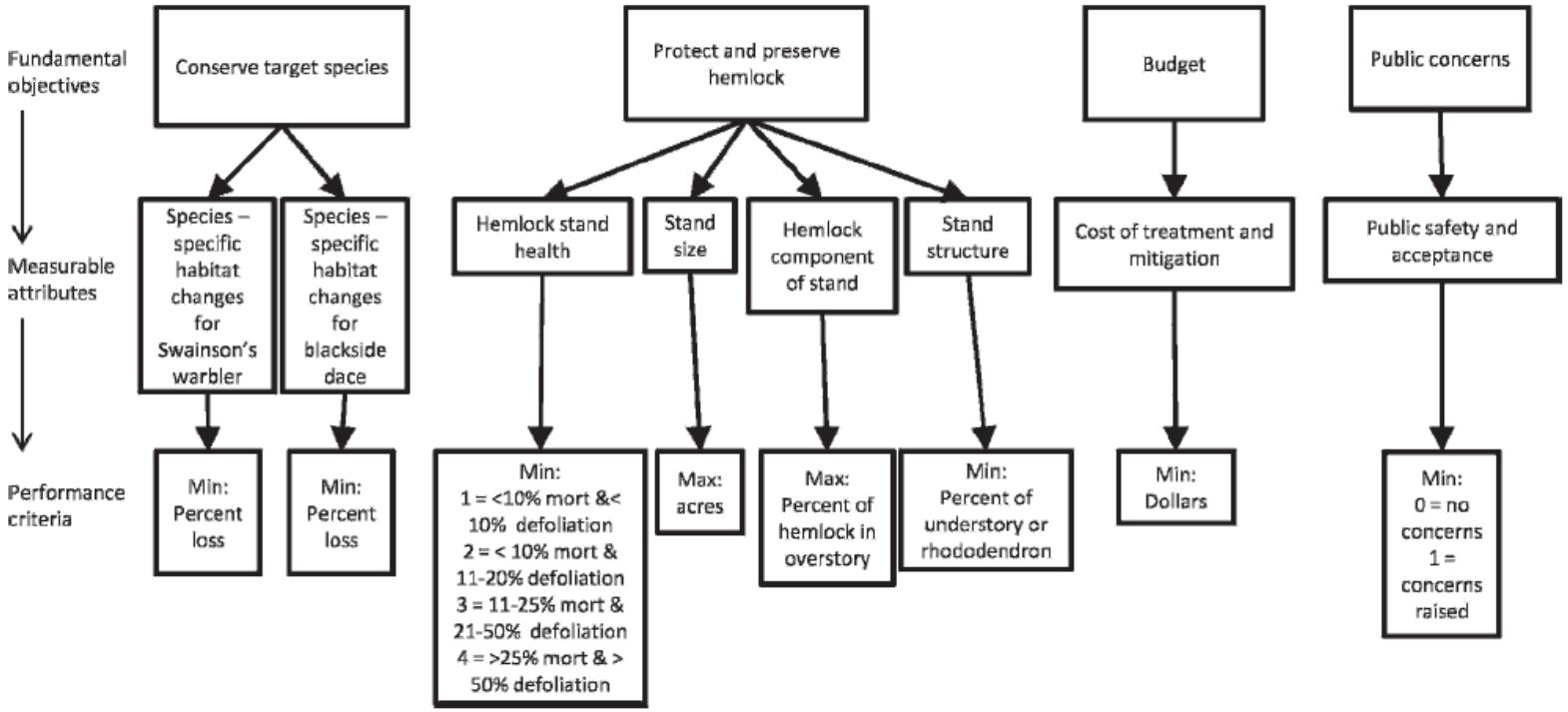

Figure 1. Fundamental objectives, measureable attributes, and performance criteria for protection of hemlocks and conservation of two conservation targets, blackside dace *Phoxinus cumberlandensis* and Swainson's warbler *Limnothlypis swainsonii*. We added a third conservation target, Alleghany [illegible]nts, we want to maximiz[illegible]ration. Mort indicates n[illegible]

DIAGRAM FORMAT

Jou[illegible]ssue 1 | 22

Blomquist, S. M., Johnson, T. D., Smith, D. R., Call, G. P., Miller, B. N., Thurman, W. M., ... & Boomer, G. S. (2010). Structured decision-making and rapid prototyping to plan a management response to an invasive species. *Journal of Fish and Wildlife Management*, *1*(1), 19-32.

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3b. Create an objective hierarchy

Objective	Subobjective	Performance Measure	Desired Direction
Conservation	Probability of meeting recovery plan objectives 1 and 2	Maximize probability	Higher
	Returns in year 2010 and average returns of years 2016 to 2019	Maximize number of fish returning	Higher
	Probability of extirpation by 2036	Minimize probability of extirpation by 2036	Lower
	Percent enhanced fish in 2010 and average percent enhanced fish in years 2016 to 2019	Minimize percent enhanced fish	Lower
Cost	Total costs over 12 years, levelized	Minimize cost	Lower
Catch	Commercial catch in traditional downstream location	Maximize catch	Higher
	Commercial catch available upstream of the Vedder River	Maximize catch	Higher
	Total First Nations food social and ceremonial catch	Maximize catch	Higher
Employment	Employment opportunities	Maximize employment	Higher

TABLE FORMAT

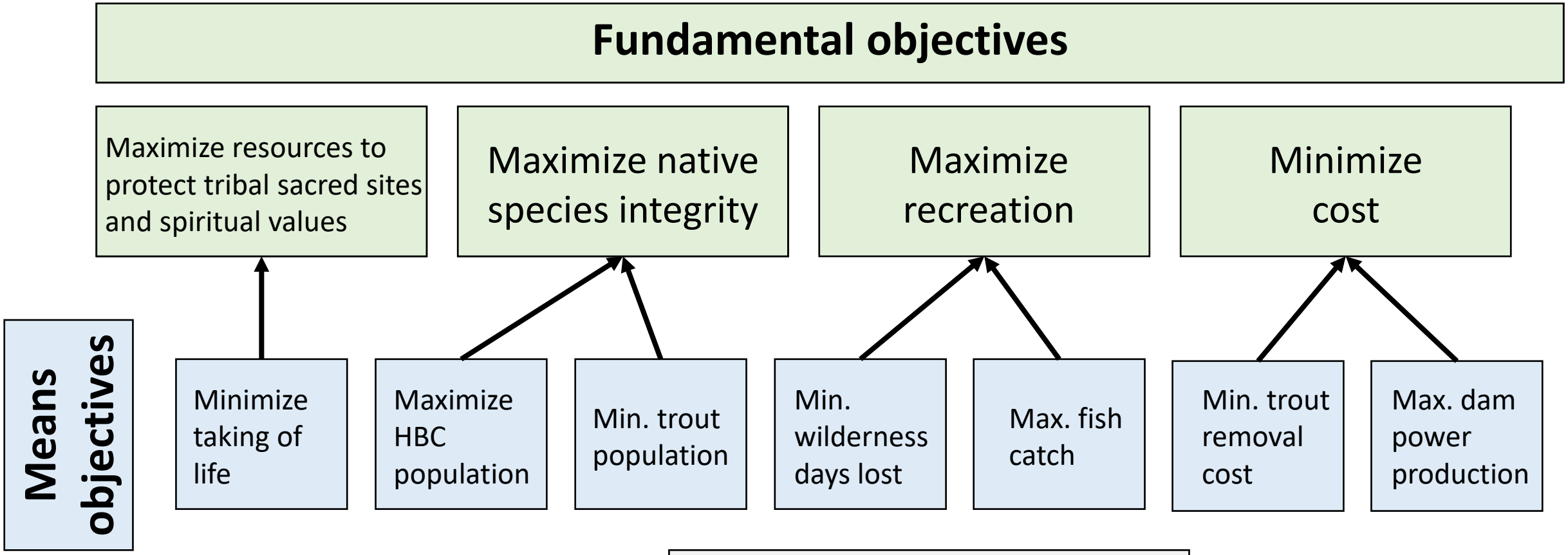
Gregory, R., & Long, G. (2009). Using structured decision making to help implement a precautionary approach to endangered species management. *Risk Analysis*, *29*(4), 518-532.

3b. Create an objective hierarchy

Desired properties of an objective hierarchy

- **Complete**
  - Don’t leave out any areas of concern (objectives)
- **Non-redundant**
  - Redundant objectives can lead to “double-counting”
- **Concise**
  - Focus on the core issues
- **Specific**
  - Consequences are clear; measurable attributes can be readily identified
- **Understandable**
  - Avoid vague and ambiguous terms

EXAMPLE:



Process objectives

- Be respectful of tribal values and rituals

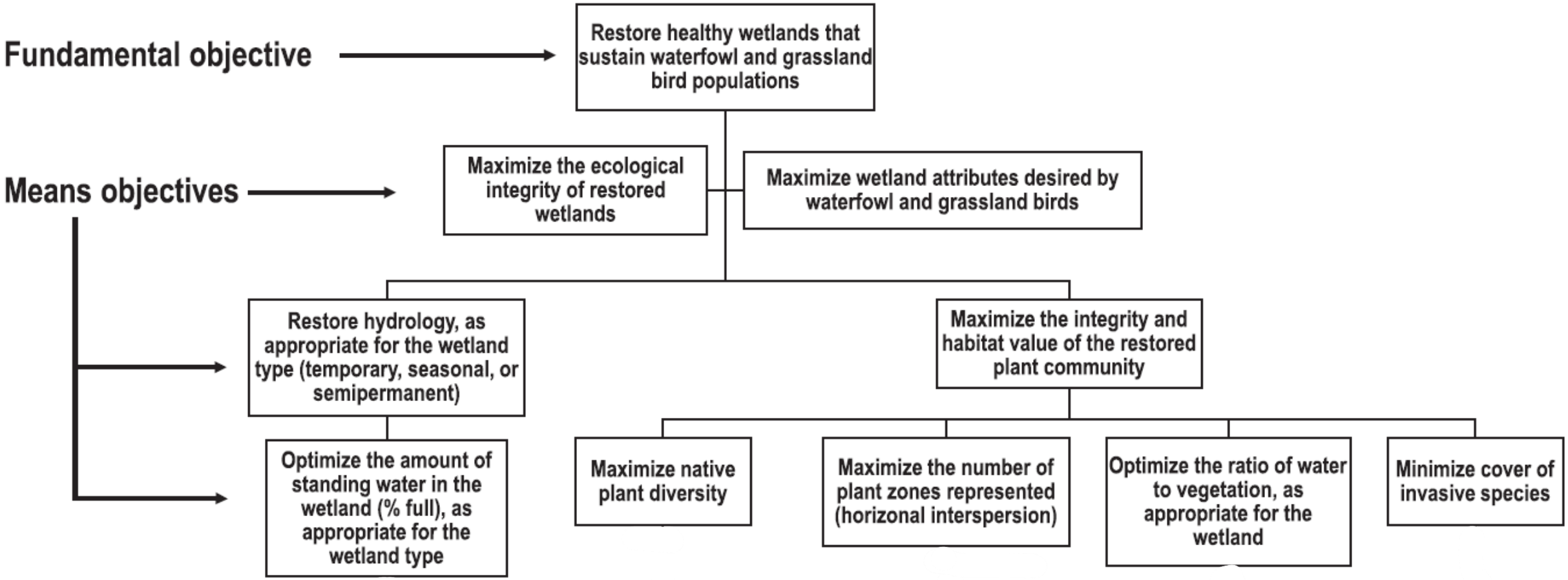
Strategic objectives

-Operate within the authority, capabilities, and legal responsibility of the Bureau of Reclamation

- Follow ESA compliances

Adapted, modified, and simplified from Runge et al. 2011

EXAMPLE:



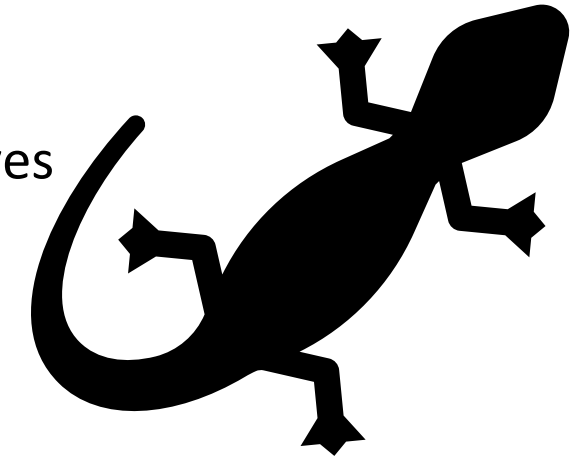
Runge et al. 2020 – Ch 22

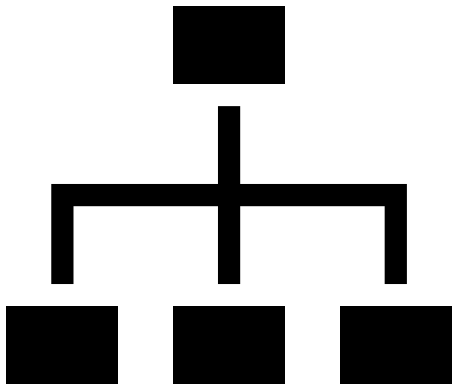
Skills Check Task 2

Lizard example

TASK 2: Generate objectives hierarchy

- Revisit your earlier potential objectives
- Circle your fundamental objectives
  - Identify fundamental/means/process/strategic objectives
- Then draw an objectives hierarchy





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Process for identifying objectives:

Big picture

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Repeat as needed

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⚠ JARGON!! ⚠

These terms are interchangeable:

Measurable attributes

Performance measures

Performance criteria

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Recall Pieces of an objective:

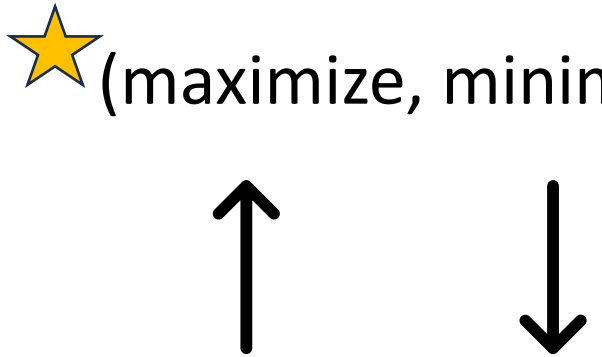
Direction
(maximize, minimize)

+

What is desired

+

Attribute
(the units)



e.g. $

*Maximize/Minimize may be uncomfortable to state (but its useful for optimization purposes). So, as long as the direction is clear we can use other verbs (e.g., increase, decrease, etc.)

Developed by Brielle K Thompson

4. Create measurable attributes (the units)

Attributes measure performance and is used to:

- Predict (in advance of the decision) how a given decision will lead to measurable outcomes
- Compare realized objective outcomes to predicted outcomes after decision implementation

Desired characteristics of measurable attributes:

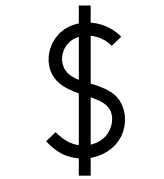
- **Unambiguous -** Clear relationship to fundamental objectives
- **Direct -** Clearly related to the consequences of interest
- **Comprehensive -** Cover full range of possible outcomes
- **Operational -** Suitable information available
- **Understandable-** Readily understood and easily communicated

4. Create measurable attributes (the units)

Attributes measure performance and is used to:

- Predict (in advance of the decision) how a given decision will lead to measurable outcomes
- Compare realized objective outcomes to predicted outcomes after decision implementation

Attribute scales:

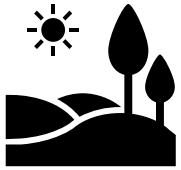


1. Natural scale

- Objective can be directly measured
- Example: $ for cost

2. Constructed scale

- Sliding or relative scale requiring interpretation
- Example: Likert scale (5 = very satisfied…1 = very unsatisfied) *for* fisher satisfaction



3. Proxy scale

- Natural attribute that is highly correlated with the objective, but does not directly measure
- Example: % of natural range preserved *for* species genetic diversity

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4. Create measurable attributes (the units)

Constructed attributes – Example 1

Objective: Minimize Wetland Development Impacts:

Development impacts (scale 0-5)

0	No loss of riparian areas and ≥ 300 acres estuary restored
1	No loss of riparian areas and < 300 acres estuary restored
2	No loss of riparian areas and no loss of estuary
3	Loss of < 300 acres riparian area and < 300 acres of estuary
4	Loss of < 300 acres riparian area and ≥ 300 acres of estuary
5	Loss of ≥ 300 acres riparian area and ≥ 300 acres of estuary

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4. Create measurable attributes (the units)

Constructed attributes – Example 2

Infant APGAR scores :

1. activity and muscle tone
2. pulse (heart rate)
3. grimace response ("reflex irritability")
4. appearance (skin coloration)
5. respiration (breathing rate and effort)

Each is scored on a scale of 0 to 2.

Scores are added for the total APGAR score; > 7 is a healthy baby

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4. Create measurable attributes (the units)

Proxy attributes – Example

Minimize student boredom

→ # of yawns

4. Create measurable attributes (the units)

Example

Objective	Direction	Attribute	
Minimize costs	Minimize (↓)	M$/yr	Natural
Maximize occupancy probability	Maximize (↑)	Probability (0-1)	Natural
Minimize extinction probability	Minimize (↓)	Probability (0-1)	Natural
Maximize hunter satisfaction	Maximize (↑)	Harvest Success Rate (# harvested/# permits)	Proxy

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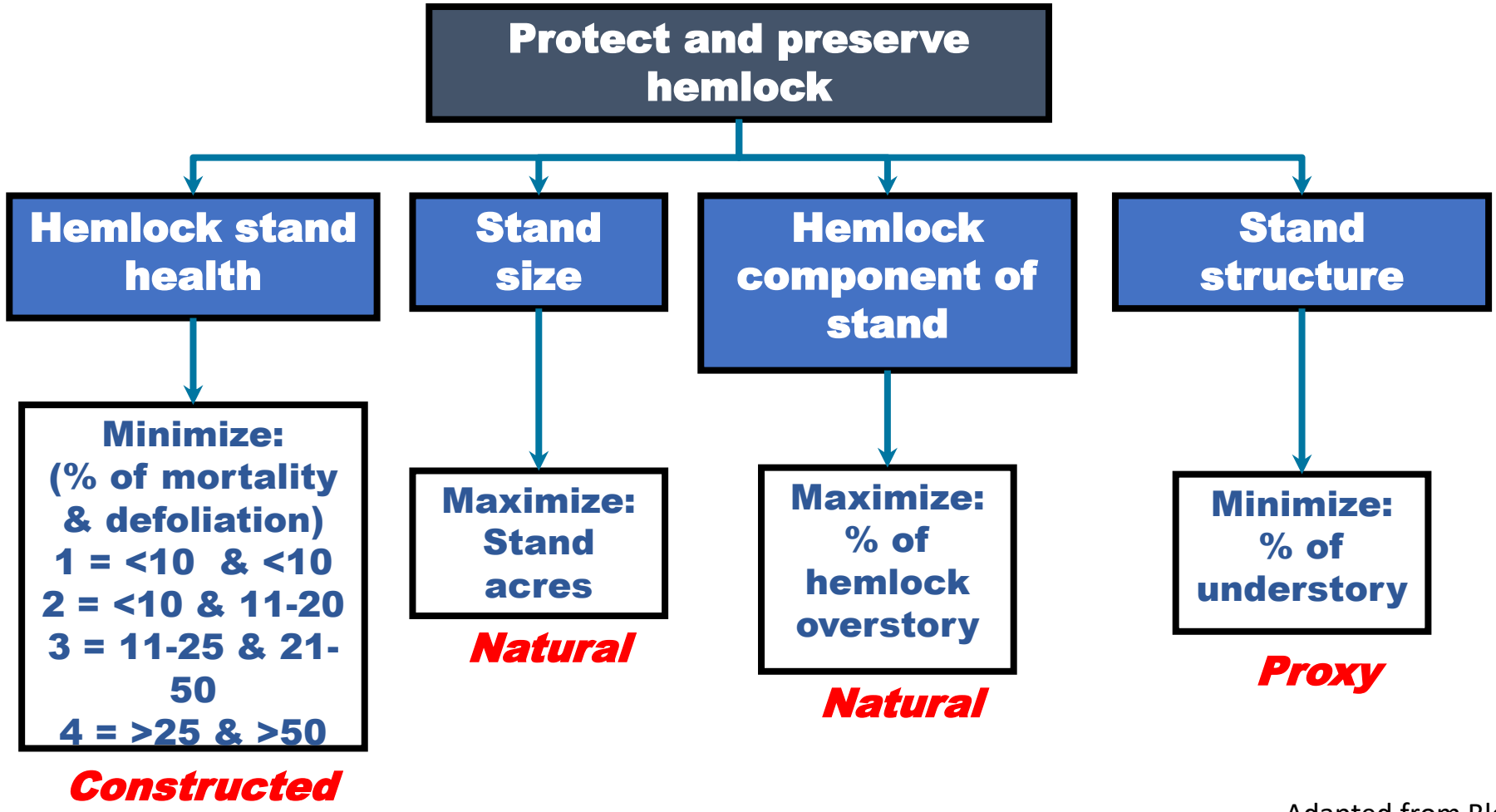
Example - What are the attribute types?



Adapted from Blomquist et al. (2010)

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Activity: Brainstorm **constructed scale** attribute types

For each objective brainstorm **a constructed scale attribute**:

- Group 1: Minimize stakeholder conflict
- Group 2: Maximize recreational satisfaction
- Group 3: Maximize species persistence
- Group 4: Maximize student engagement ☺

Level	Meaning
1	…
2	…
3	…
4	…
…..	….

What are the limitations of your constructed scale attribute?

Activity: Brainstorm **proxy scale** attribute types

Now for these same objectives brainstorm **two proxy attributes**:

- Group 1: Minimize stakeholder conflict
- Group 2: Maximize recreational satisfaction
- Group 3: Maximize species persistence
- Group 4: Maximize student engagement ☺

What are the limitations of your proxy attribute?

What attribute type fits the objectives above better?

EXAMPLE

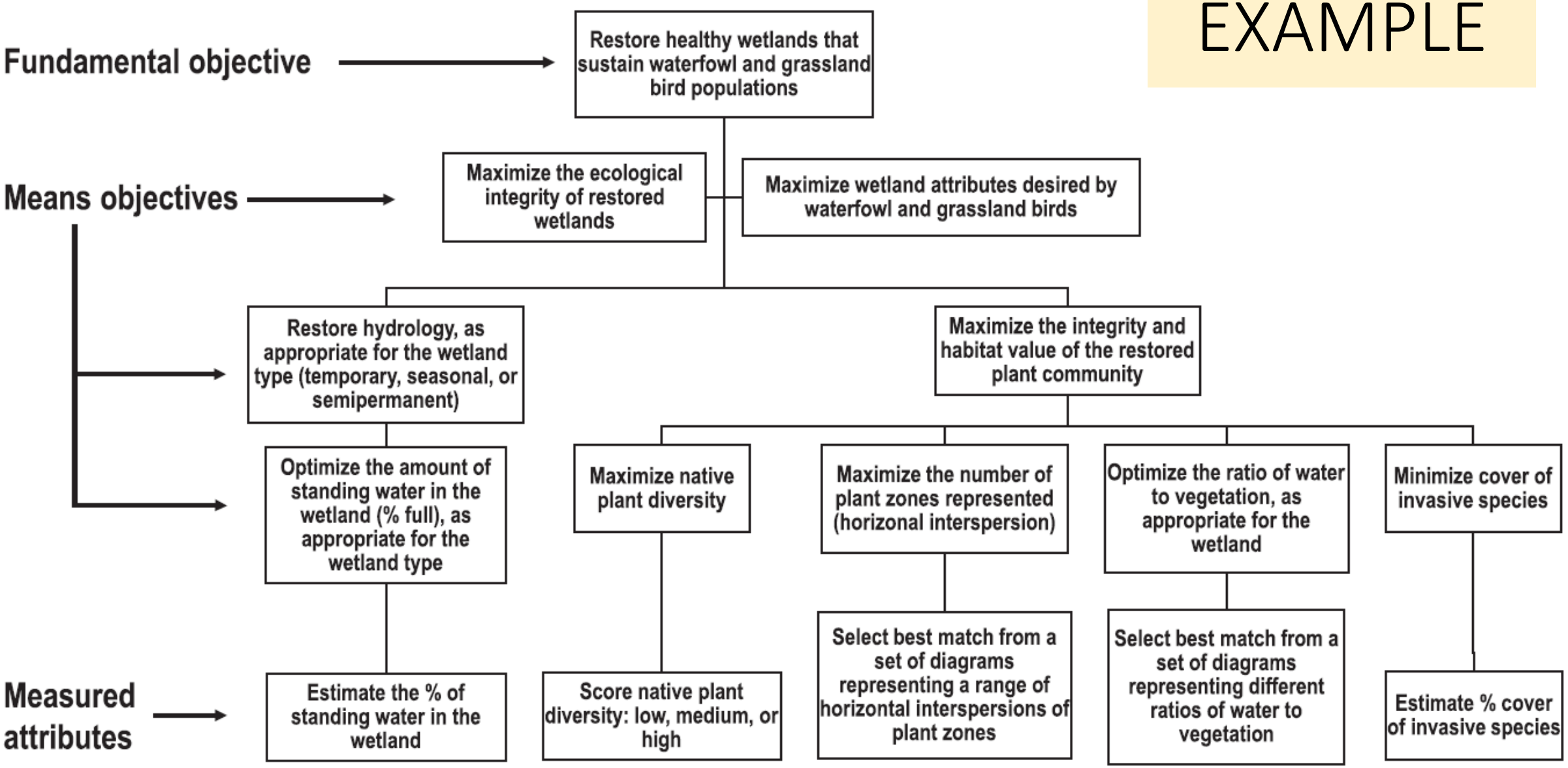

Figure 22.2. Objectives hierarchy and associated measured attributes.

Runge et al. 2020 – Ch 22

Skills Check Task 3-4

Lizard example

TASK 3: Measurable attributes

- Describe measurable attributes for your fundamental objectives and determine attribute type.

TASK 4: Share objectives

- Each group will share your objectives (fundamental/means/strategic/process) and your attributes

Developed by Alex McInturff, Jean Fitts Cochrane, Angela Matz, Jennifer A. Szymanski, James E. Lyons, Sarah J. Converse, & Michael C. Runge

Process for identifying objectives:

Big picture

1. Articulate goals & concerns
2. Convert goals & concerns to objectives

Specific Steps

3. Structure objectives
4. Create measurable attributes for each objective

Repeat as needed

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Repeat as needed:

You may have to go around the SDM track informally before the objectives are fully understood

Experiment with your objectives in a tentative decision process & ask:

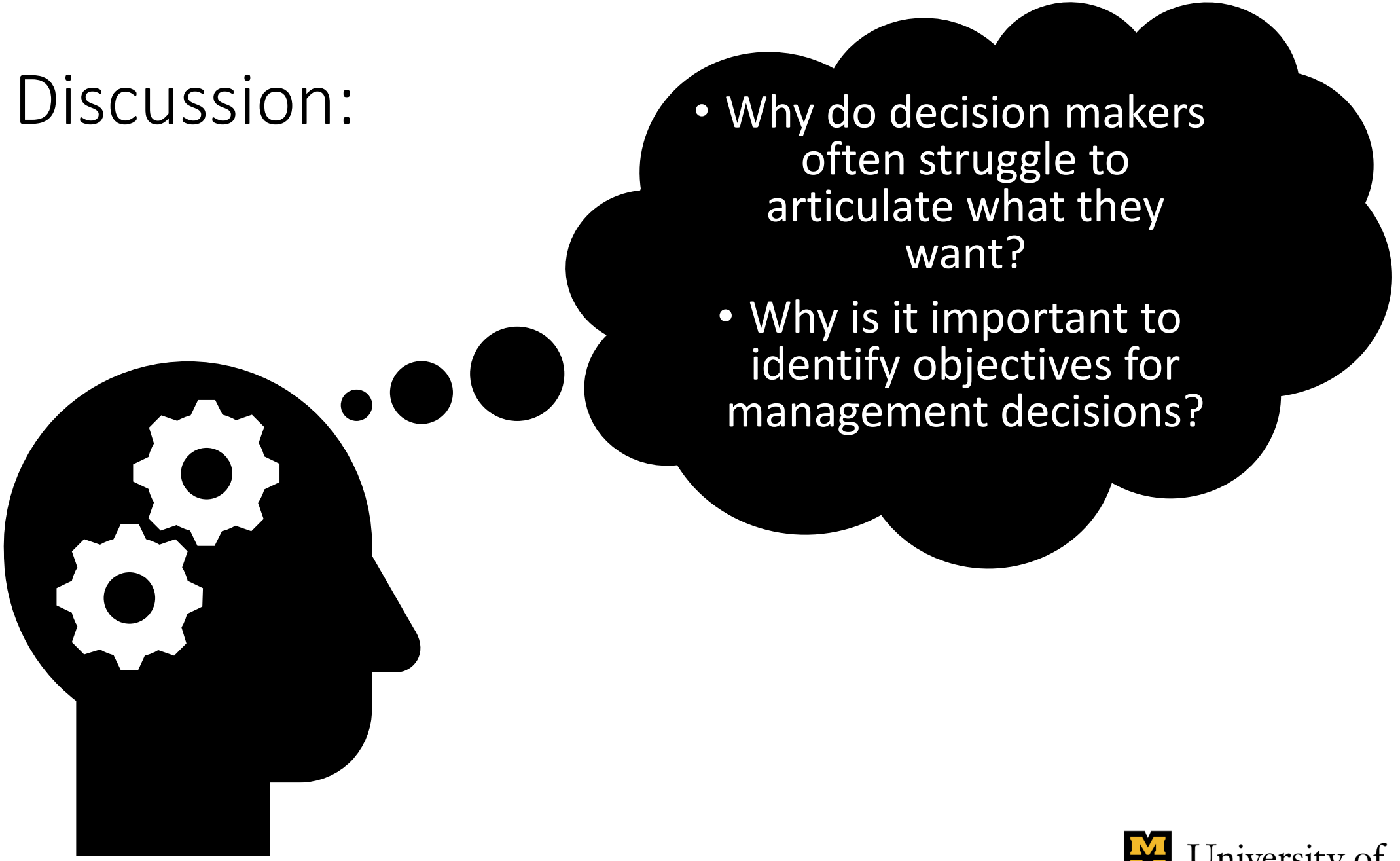
- Can these distinguish among alternatives?
- Are they really distinct and independent?
- Could you be comfortable with a decision reached with these objectives?
- Could you explain your choice to others & the public?
- If not, what's missing?

Activity: think about your decision problem

- For your final project presentation, you will provide a slide of your objectives
  - Can you define some objectives?
  - Can you distinguish fundamental from means?
  - Create a hierarchy?
  - Can you develop measurable attributes?

- **Feel free to go back to your problem framing step!**

Discussion:


• Why do decision makers often struggle to articulate what they want?
• Why is it important to identify objectives for management decisions?

Looking ahead:

Next week: A step of PrOACT

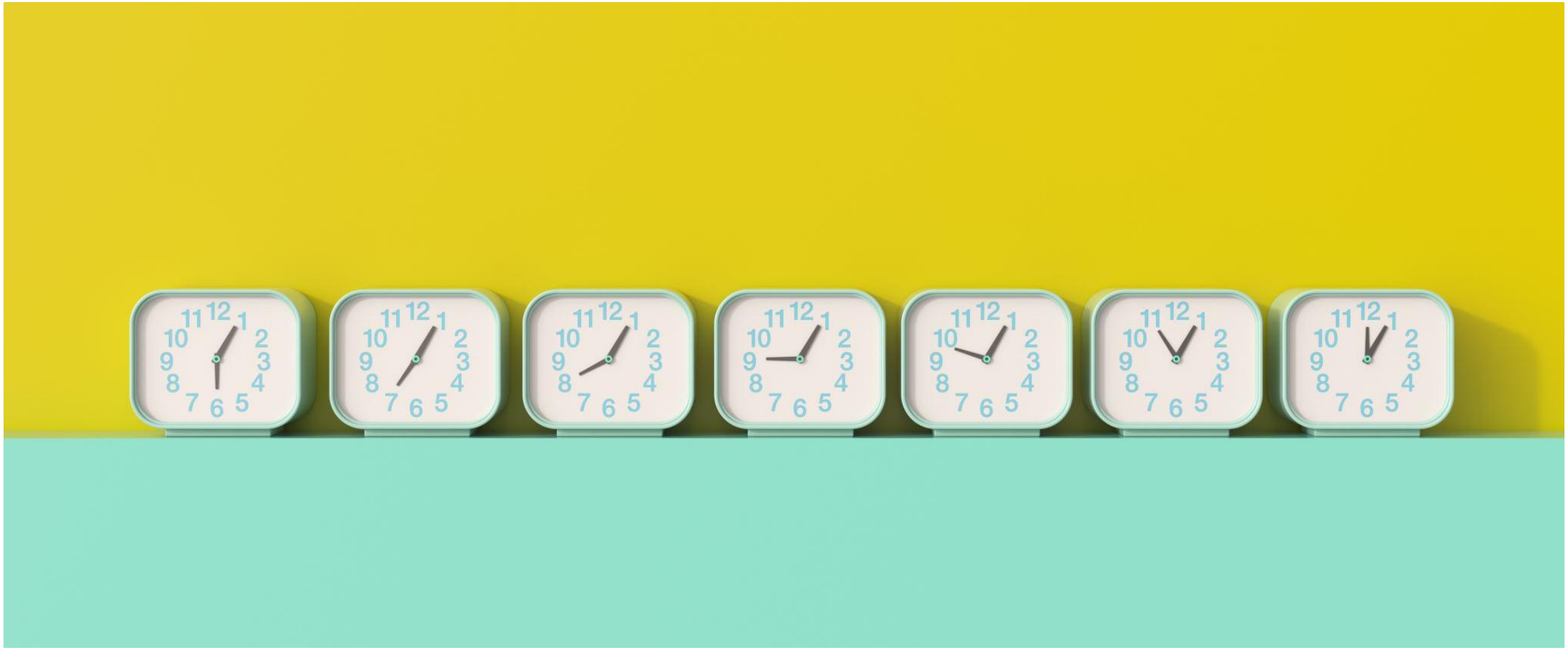
Weekly: Work through a step of the PrOACT process/ learn extra tools

Last week of class:

Elevator pitch of your research project in terms of SDM/PrOACT

Note: Abridged PrOACT story slides with a star on the upper right are good examples to use for your presentation

Extra time activities:



Reading discussion questions (Gregory et al. 2012 Chapter 4)

- What distinguishes a well-defined objective from a vague or ineffective one in SDM?
- Why is it important to separate means objectives from fundamental objectives?
- Why do Gregory et al. caution against setting targets during the objective-setting stage?
- What role do process and strategic objectives play in environmental decision-making?
- Why is it problematic to use ambiguous terms like “naturalness” or “sustainability” as objectives?
- Why do decision makers often struggle to articulate what they want, and how can SDM processes help?

Activity: reverse objective finding

For the following management decisions, identify what the objectives may have been (fundamental, means, process, strategic)

- A refuge installed fencing to reduce deer-vehicle collisions
- A coastal reserve began using drones to monitor nesting seabirds and detect illegal fishing activity
- A lake banned nighttime fishing due to noise complaints from residents
- A national forest implemented a series of controlled burns to reduce wildfire risk and promote native plant regeneration
- A regional water authority decided to lower reservoir levels during the dry season to support downstream fish spawning

Discussion: Was it difficult to move from alternatives → objectives?

Activity: Fundamental vs Means sorting

In groups identify whether the objective below is Fundamental or **Means**

- Maximize turtle species persistence
- Improve habitat quality
- Reduce road mortality
- Increase stakeholder engagement
- Maximize public trust
- Enhance monitoring efforts
- Minimize cost
- Maximize recreational access

Problem:
Native turtles are victims of roadkill at a popular refuge

Concerns:
Native turtles, cost, public trust

Activity: Fundamental vs Means sorting

In groups identify whether the objective below is Fundamental or **Means**

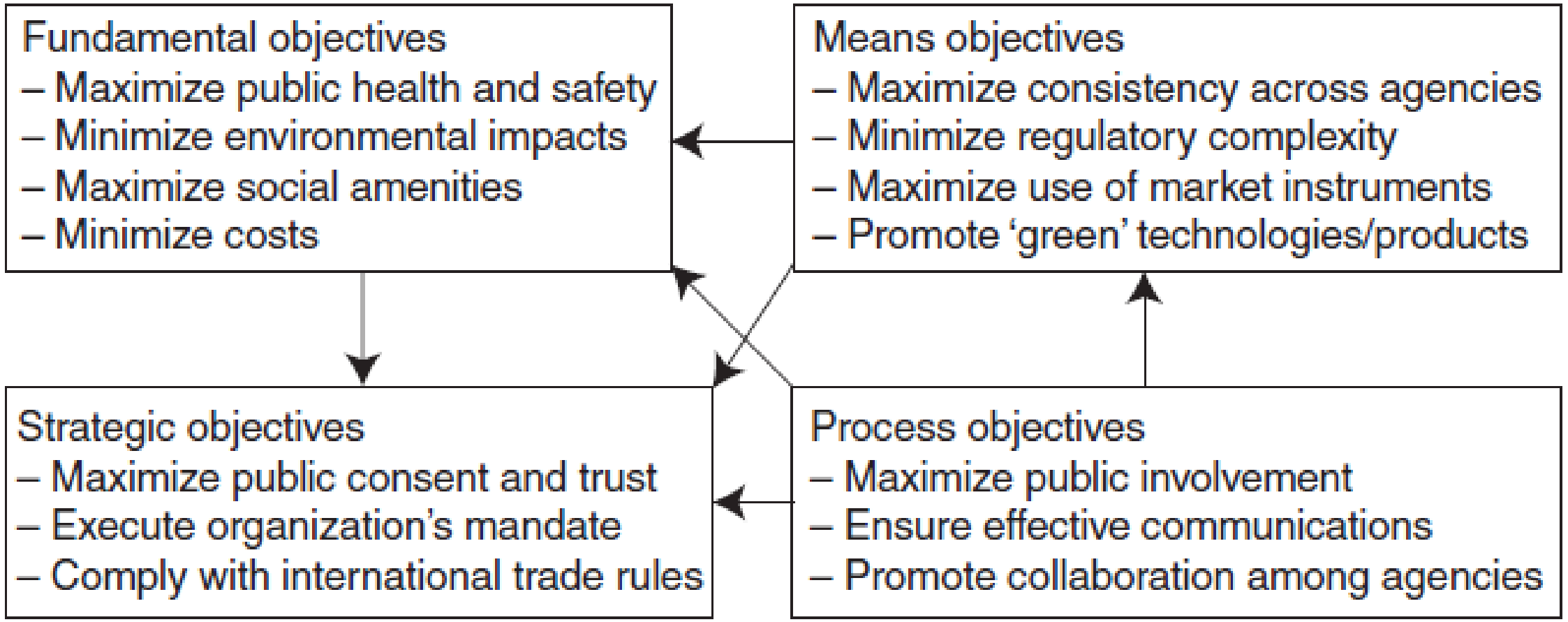
- Improve water quality
- Maximize biodiversity
- Enhance public education about conservation
- Maximize native fish species persistence
- Restore native vegetation
- Increase stakeholder participation

Problem:

Recreational fishing is harming native fish recovery

Concerns:

Native fish and plants, public involvement



Gregory et al. 2012 Chapter 4