

## Module A — Why Structured Decision Making?

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What is structured decision making (SDM) and why do we need it? We'll explore these questions and others in this introductory module. At the end of this module, you'll be able to:

- Recognize what a decision is
- Discriminate between descriptive and prescriptive decision making
- Be able to articulate the motivation for prescriptive decision making
- Understand the acronym PrOACT and how it provides a structure for decision making
- Understand how SDM, ARM, JFF, and CR are related and when SDM is appropriate to use.

### Case Study: Understory Management

Let's begin by examining a representative natural resource management situation, and illustrate the principles of SDM. Consider understory management in a ponderosa pine forest, like at Coconino National Forest in Arizona. Periodically, managers use actions like a prescribed burn to help achieve their objectives. What actions should be taken, and when?

#### Objectives

- Fundamental
  - Maintain healthy populations of native vertebrates and invertebrates in understory of ponderosa pine forest
- Means
  - Maintain open canopy pine stand with appropriate understory vegetation

#### Actions

- Alternative actions
  - Prescribed understory fire
  - Mechanical thinning of understory
- Timing
  - How frequently?
  - Under what conditions?

## **Why Structured Decision Making?**

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#### Models

- Predict
  - How basal area and vegetation composition change as a function of time and treatment
  - How native animal communities change as a function of habitat conditions
- These models might be mental, conceptual, or quantitative
  - But should explicitly link actions to objectives

#### Optimal Solution

- Found by integrating
  - Objectives
  - Actions
  - Models
- Identify the action and its timing that best achieve the objectives
- An optimal solution might call for, say, thinning whenever the basal area exceeds 85 ft<sup>2</sup>/ac

#### What is Structured Decision Making?

“A formalization of common sense for decision problems which are too complex for informal use of common sense.” (Ralph Keeney, 1982)

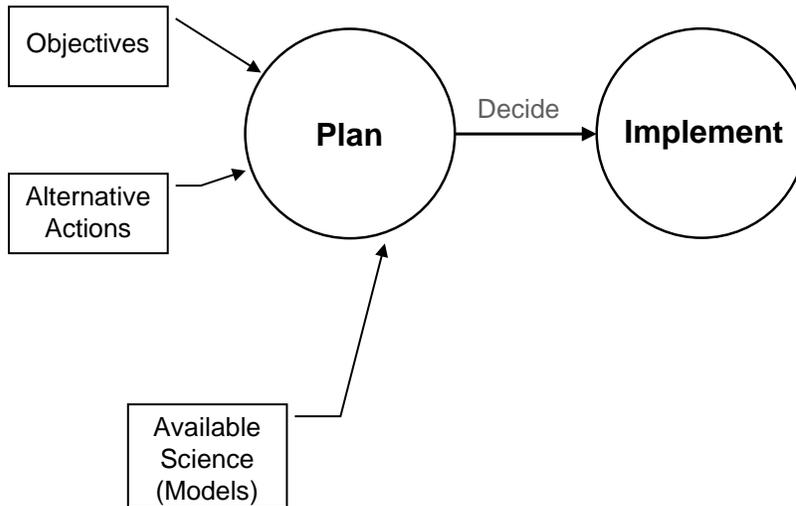
#### Prescriptive vs. Descriptive Decision Making

- **Prescriptive decision making**
  - A rational framework for how people should make decisions, and techniques to aid them in doing so
  - This is the focus of this course
- **Descriptive decision making**
  - How people actually do make decisions
  - Considers tendencies, biases, limitations, etc.



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### Case Study: Choosing a Mortgage

- Your bank offers you two possible 30-yr fixed rate mortgages: 5¼ %, or 4¼ % with 2 points. Which do you choose?

In this financial example,

- 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		Mortgage 1	Mortgage 2
<b>Rate</b>	0.0525	0.0425	<b>Total payments</b>	\$39,758.67	\$36,128.07
<b>Term</b>	30	30	<b>Balance</b>	\$191,076.51	\$193,228.90
<b>Points</b>	0	2	<b>Sale price</b>	\$300,000	\$300,000
<b>Purchase price</b>	\$250,000	\$250,000	<b>Proceeds</b>	\$108,923.49	\$106,771.10
<b>Down payment</b>	\$50,000	\$50,000	<b>Proceeds less costs</b>	\$19,164.82	\$20,643.03
<b>Loan</b>	\$200,000	\$204,000			
<b>Monthly rate</b>	0.004375	0.003541667			
<b># of payments</b>	360	360			
<b>Payment</b>	\$1,104.41	\$1,003.56			
<b>Yrs in house</b>	3	3			

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- OK, that was easy. Why?
  - Simple set of actions
  - Single, clear objective
  - System dynamics known with certainty
  - Choice of best action transparent
  
- But what if
  - One of the choices is a 1-yr ARM? Or, in fact, there is a bewildering array of choices from many lenders?
  - You don't know how long you'll be in the house?
  - You have other objectives or constraints (e.g., monthly payment needs to be less than \$1000)?

### **What makes decisions hard?**

- Sometimes you don't know all the possible actions
- The objectives may be complex or contradictory, or in dispute
- The system dynamics may be poorly known
- Even knowing all the other components, the solution (optimization) may be difficult to figure out

### **Structured Decision Making**

- Is a formal method for analyzing a decision, by breaking it into components
- Helps identify where the impediments to a decision are, to focus effort on the right piece
- Provides a wide array of analytical tools for dealing with particular impediments
- Two key elements:
  - Problem decomposition
    - Break the problem into components, separating policy from science
    - Complete relevant analyses
    - Recompose the parts to make a decision
  - Values-focused
    - The objectives (values) are discussed first, and drive the rest of the analysis
    - This is in contrast to our intuitive decision-making, which usually jumps straight to the alternatives

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What makes a good decision?

- Think back to your choice of a place to live
  - Was it a good decision?
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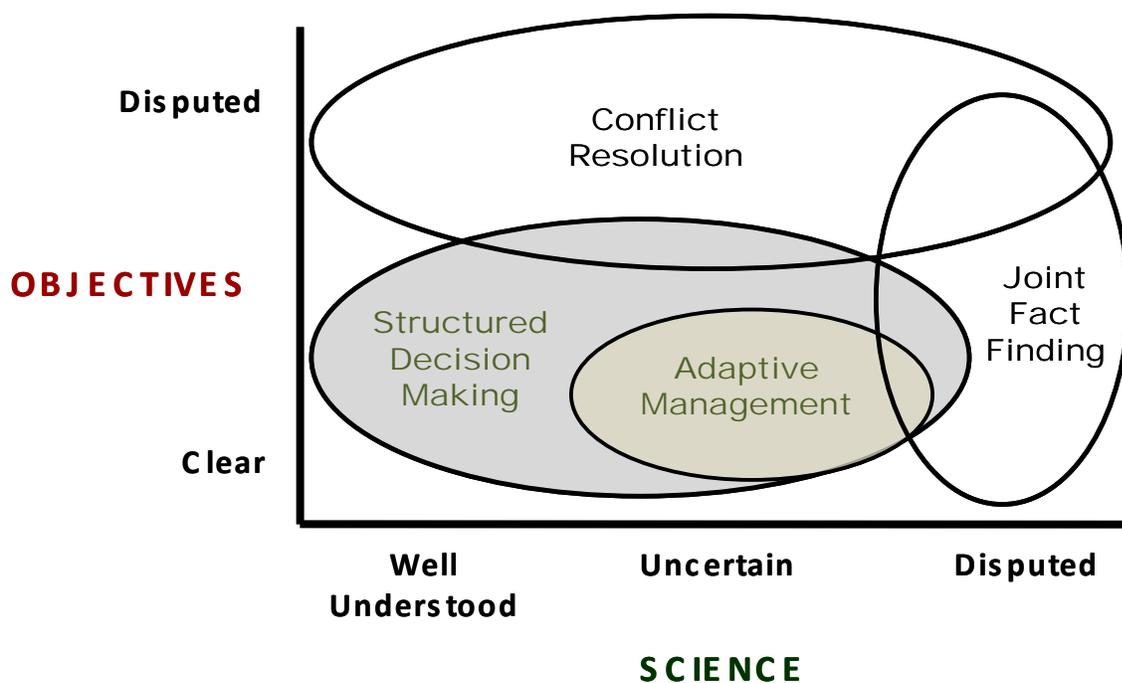
Prescriptive Decision Making

- What makes a decision good is the process 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 Way of Thinking

- Structured decision making is, more than anything, a mental discipline
  - A commitment to a rigorous way of analyzing decisions
- It does not, necessarily, require a lot of time or money
  - The investment depends on the problem at hand

When is SDM Appropriate?



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#### **Who can use SDM?**

- We've taught it to
  - Kindergarten classes (choosing lunch items)
  - 2<sup>nd</sup>-5<sup>th</sup> grade student council (how to run a fundraiser)
  - High school students (making life choices)
  - Professionals (managing natural resources)

#### **What decisions is SDM good for?**

- Tiny ones
  - 1 person at their desk, an hour
  - Fine-tuning an impoundment drawdown schedule
- Little ones
  - Field office, days to weeks
  - Bull trout Section 7 workload allocation
- Middle-sized ones
  - Regional problems, months of analysis
  - R4/R5 coordinated monitoring of migratory birds
- Big ones
  - National scope, years
  - Waterfowl harvest regulations, Major listing decisions

#### **Benefits of SDM**

- 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)

# Why Structured Decision Making?

## *An Overview of Structured Decision Making*

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