Theme 2
Setting Priorities and Making Informed Decisions
Module 8
Managing for Ecosystem Services
Learning objectives

After completing this module, you will be able to:

1. Identify the ways the biophysical ecosystem supports and controls ecosystem services.

2. Apply a seven-step process to identify management objectives and actions to sustain the highest priority ecosystem services.
Key questions

• How would we approach framing ecosystem services here in the local watershed?
• How do the structural and functional attributes of the ecosystem control those ecosystem services?
• What specific steps might we follow to frame management actions to sustain selected ecosystem services?
Determining management objectives

- We offer 7 steps for setting management objectives to achieve those goals.
- Encouraging good practices and sharing costs and benefits among stakeholders involves harnessing values and clarifying rewards of ecosystem services.
Steps to identify & evaluate ecosystem services for management

Step 1: What are societal priorities for ecosystem services?

Step 2: What ecosystem functions are needed to deliver those services?

Step 3: What ecosystem structure is needed to deliver those functions?

Step 4: Map the landscape to identify ecosystem structures

Step 5: Plan management actions to change landscape structures

Step 6: Evaluate the risk of bad landscape transformations from a management action

Step 7: Design monitoring and evaluation to assess ecosystem service delivery
Step 1: What are societal priorities?

- Select services necessary for quality of life and income generation (e.g., for land or water managers, off-site or downstream beneficiaries)
- Identify ecosystem services following four core ecosystem processes:
  - Water cycling
  - Mineral cycling
  - Solar energy flow
  - Biological growth
Module 8: Managing for Ecosystem Services
Societal priorities

- Identify priority provisioning and cultural services
- Identify the regulating services that maintain them
- Determine desired value and range (minimum and maximum acceptable values)
- Incorporate local ecological knowledge, views of Indigenous and native people
- Explicitly identify and address the gender-based knowledge and needs
- Ecosystem services may be delivered at different scales than management is practiced
- Example: Carbon offsets are valuable components of financial planning for an ecosystem. Benefits are realized at the global scale over decades; practices are conducted at local scale over years
Societal priorities

- Watersheds are hydrologically defined
- Understand local hydrology in this step
- Critical: where and how is water delivered, how does hydrology change along waterways and with land use, and how do ecosystem services require different water quantities and qualities?
- Recognize the ecosystem itself is a stakeholder
- … and we never have complete knowledge
Example: Water for provisioning services

- Water for irrigation $X \text{ m}^3$ per day for $Y$ days
- Soil moisture for crops or trees $X\%$ humidity for $Y$ days
- Water for livestock and wildlife $X$ litres per day
- River flow or lake volume (e.g., aquaculture, transport) $X \text{ m}^3$ per day
- Public water supply $X$ people, $Y$ liters per day
- In-stream flow quality for downstream & ecosystem needs
Step 2: Ecosystem functions needed to deliver those services

- Determine necessary function to achieve the four ecosystem processes
- Will differ among ecosystem services
- Watershed specific; must account for variation in climate, topography, soils
- Must prioritize and, therefore, there will be tradeoffs
Step 3: What ecosystem structure supports those functions?

- Ecosystem structure is physical, can be altered by management
- Describe and measure structure to influence processes (i.e., ecosystem function)
Describe ecosystem structure

- Describing the food web
- Describe decomposers, predators, herbivores, plants
- Add description of soil structure and vegetative layers
- Result is level of the four ecosystem processes for desired services
- Review to identify conflicts
- Reconcile conflicts using priorities determined in Step 1
Step 4: Map the landscape to identify ecosystem structures

- Include configuration of vegetation, water bodies, livestock, wildlife, recreation and cultural values, all part of ecosystem structure for desired services.
- Guiding principle is delimiting likely effects of landscape and waterscape structure on desired function of ecosystem processes.
- Ability to change spatial configuration will depend on topography and resource availability.
- May require a long-term plan with periodic steps.
Step 5: Plan management actions to change landscape structures

- Plan actions to move toward desired structure of ecosystem and landscape
- Specific actions depend on circumstances and culture of managers
- Use existing knowledge and approaches, adding context and consideration of ecosystem structure and processes to supply desired ecosystem services
- EM perspective helps achieve multiple objectives for land and water resources by incorporating natural functions of the ecosystem
Step 6: Evaluate how risk management might cause negative alteration

- Before acting, ask what actions might increase risk of transforming ecosystem function to an undesirable state.
- This is often overlooked. Witness our history of introducing species.
- We never have complete knowledge.
- Identify thresholds of undesirable change in structure or process for each of the four ecosystem processes.
- If a negative transformation is probable and likely impacts are high, redirect management.
Step 7: Monitor and evaluate to assess ecosystem service delivery

- Our understanding of ecosystems and responses to management are insufficient for fixed plans.
- Complexity and variability mean we must set goals, measure progress, adjust.
- This is *adaptive management*, as discussed in more detail later (Module 12)
The steps are a process

- All 7 are interconnected
- Best seen as multiple feedback loops
- Adaptive management and use of 7 steps allow ecosystem management to ensure ecosystem services meet societal goals
Activity: Focus on steps 1–5 (30 min)

• Consider what you know about your local watershed. Identify and describe the state of ecosystem services and functions. Specify actions you would take for Steps 1–3.
• Briefly, identify data needed to build landscape maps for Step 4.
• Describe three management actions you would assess in Step 5.
• Elect spokesperson to present in plenary
Plenary: Summarize management actions and data (10 min)
Plenary synthesis (5 min)
What have we done and what remains unclear?