

Module 6



State of ecosystem services and function

This module takes participants through a series of steps to express management objectives in terms of ecosystem structure and function. 6 steps are followed by group work and a plenary session



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Determining Management Objectives

- Ecosystem management is defined as working with **ecosystem function to supply ecosystem services**
- **Identify ecosystem service** necessary for their quality of life and income
- **Determine the function** of the ecosystem services to deliver the desired services
- **Plan and monitor ecosystem management**

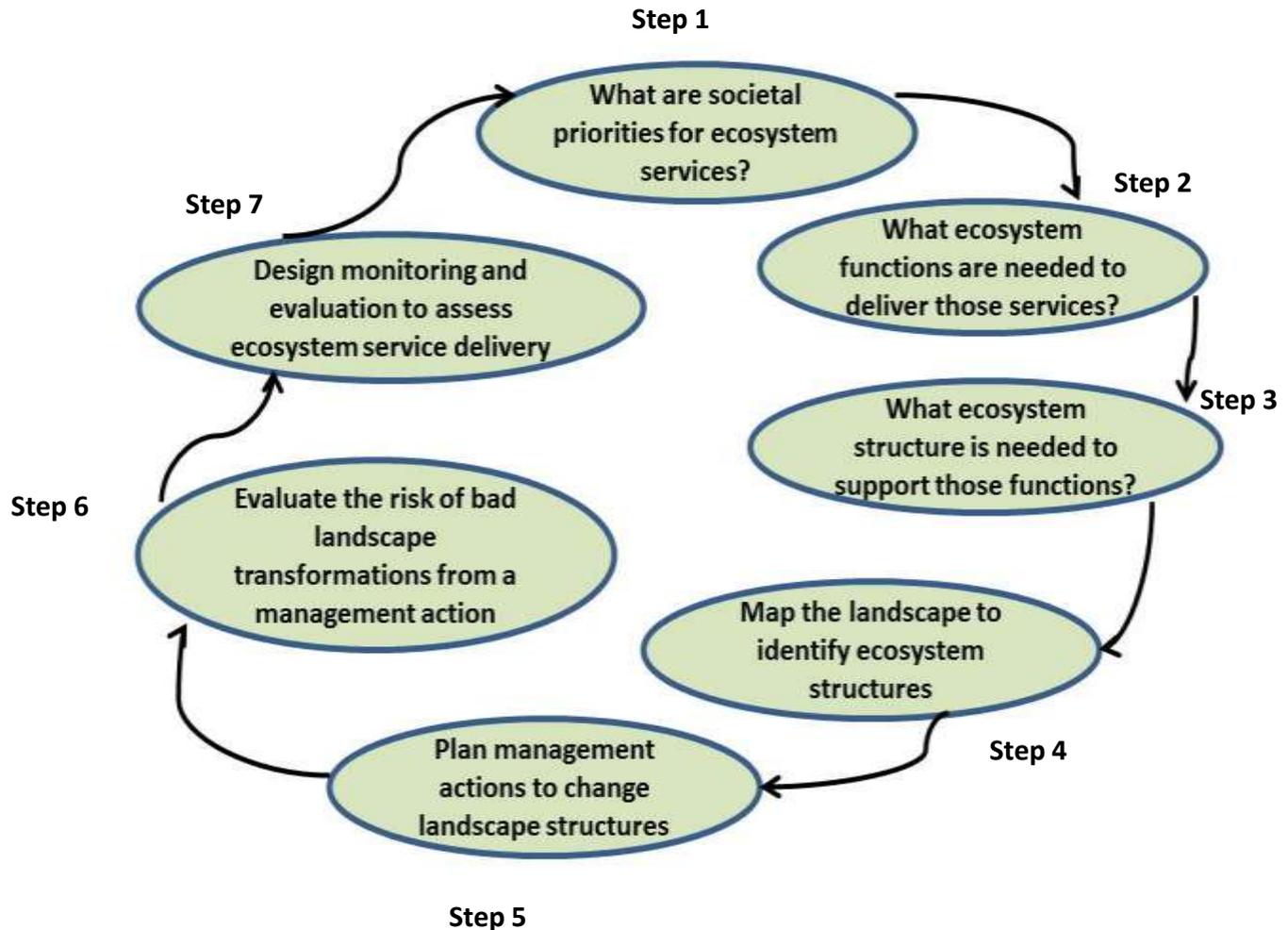


Determining Management Objectives

- This module offers **7 steps for setting management objectives** with this perspective
- Emerging way to **encourage good practices** and **share costs and benefits** among stakeholders involves **harnessing the value** and specifying the **rewards of ecosystem services**



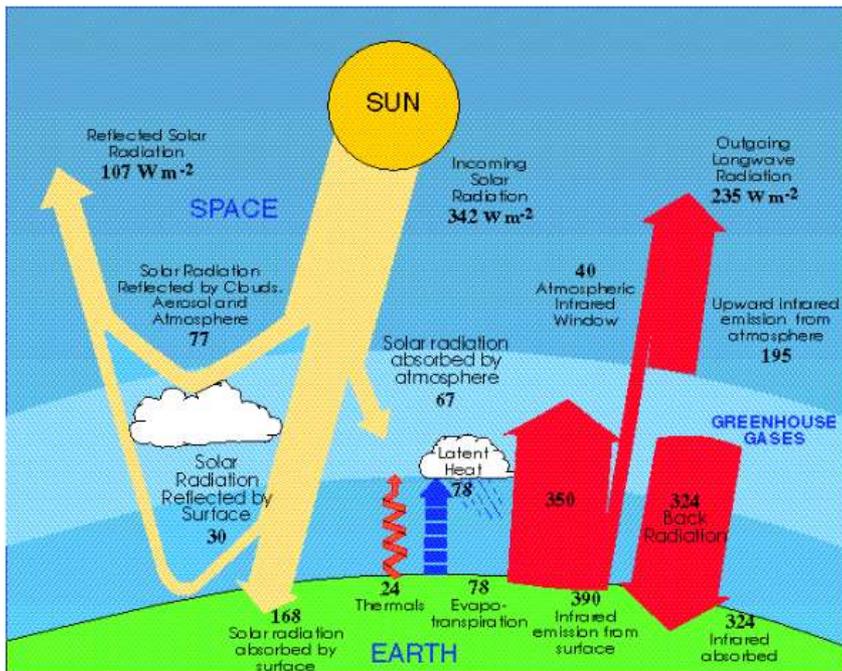
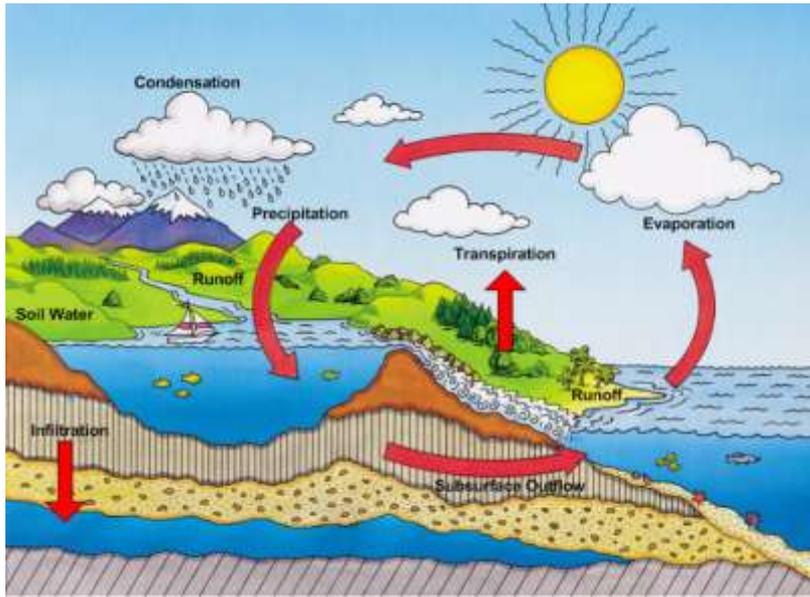
Process of identifying and evaluating ecosystem services in management



Step 1: What are societal priorities for ecosystem services?

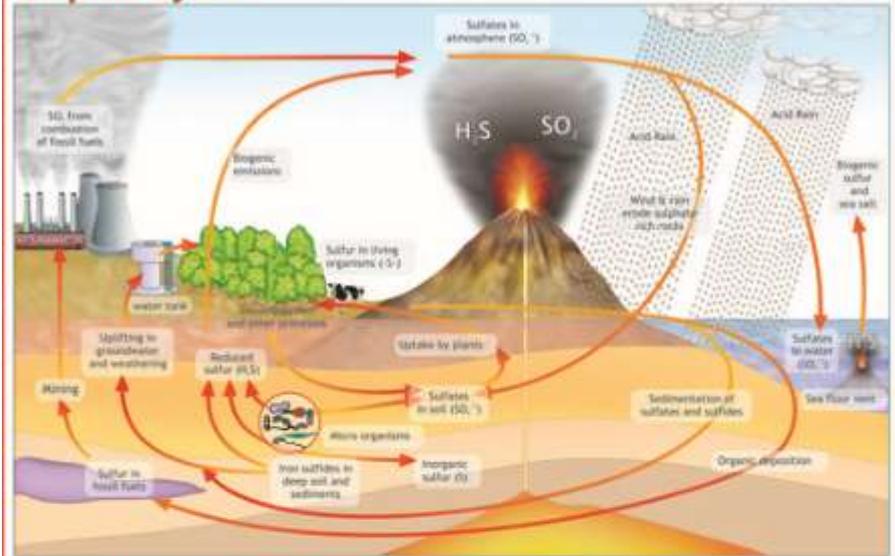
- First select services necessary for quality of life and income generation for stakeholders (e.g., land or water managers, off-site or downstream beneficiaries)
- Identify ecosystem services following 4 core ecosystem processes
 - Water cycling
 - Mineral cycling
 - Solar energy flow
 - Biological growth



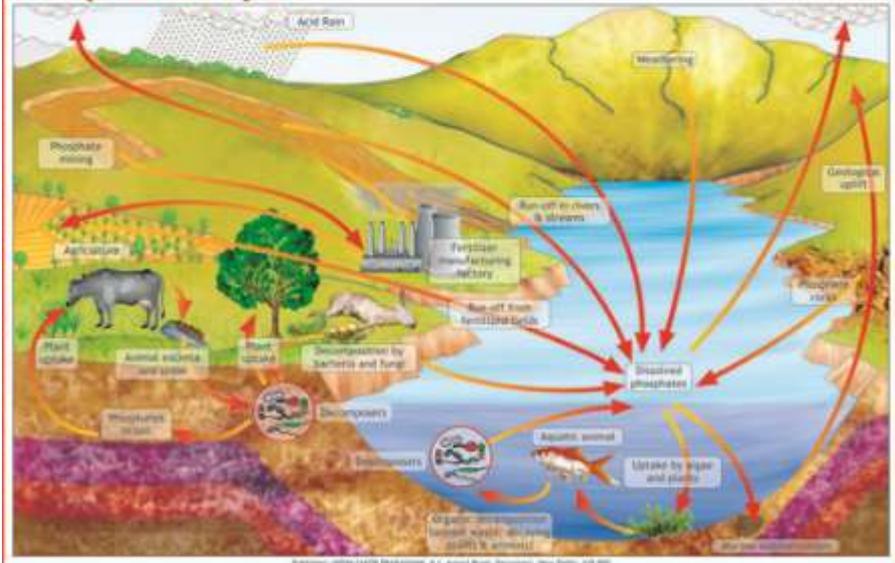


MINERAL CYCLE

Sulphur Cycle



Phosphorous Cycle



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Societal Priorities for Ecosystem Services

- Identify priority **provisioning** and **cultural services**
- Identify 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
- Recognize that 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** realized at the **global scale** over decades; **practices** are conducted at **local scale** over years





Societal Priorities for Ecosystem Services

- Catchments are **hydrologically defined**
- Need to understand **local hydrology** in this step
- Critical to understand **where and how water is delivered**, how **hydrology changes** along waterways and **with land use**, and how ecosystems services require different **water quantities and qualities**
- Recognize that **ecosystem itself is a stakeholder ...**
- ... and that **we never have complete knowledge**



Exemplary provisioning services relative to water cycling

- **Water for crop irrigation:** m^3 per day for x days
- **Soil water moisture levels** for crops or tree growth: x % humidity for x days
- **Flow for livestock and wildlife drinking:** x litres per day for x days
- **River flow or lake volume for aquaculture or transport:** $x m^3$ per day
- **Drinking water for x people per year:** x litres
- **Downstream flow and quality for other users**



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

- **Determine necessary function to achieve the four ecosystem processes**
- **Will differ among ecosystem services**
- **This is catchment-specific; must account for variation in climate, topography and soil types**
- **It will be necessary to prioritize and compromise among ecosystem services**



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

- Ecosystem structure is physically seen and can be altered by management
- Describe and measure to obtain desired processes (i.e., ecosystem function)



Ecosystem Structure Description

- **Begin by describing food web**
 - Describe **decomposers, predators, herbivores, plants**
 - Complete by adding description of **soil structure and vegetation layers**
 - Produce the level of the **4 ecosystem processes for desired structure**
 - 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 as part of ecosystem structure for desired services**
- **Guiding principle** is to delimit 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 and 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



Step 5: Plan management actions to change landscape structures

- EM perspective helps achieve multiple objectives for land and water resources because it incorporates natural environment, functioning as an ecosystem



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

- Before management actions are taken, ask what actions might increase risk of transformation of ecosystem function to an undesirable state

This is often overlooked. Witness our history of introducing species



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

- Identify thresholds for undesirable changes in structure and process, for each of the 4 ecosystem processes
- If probability a negative transformation and impact are high, change management



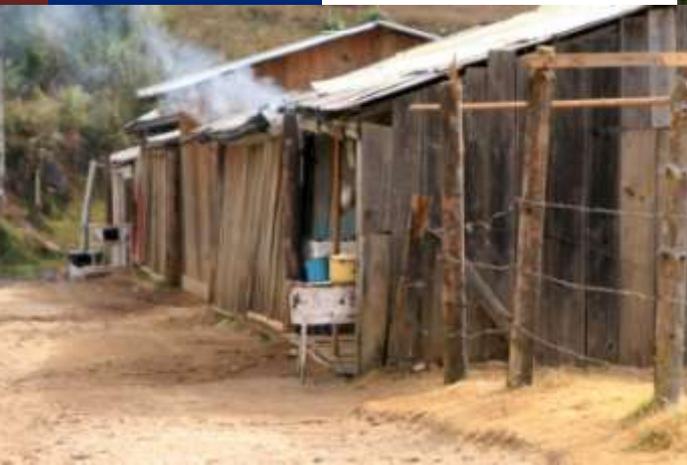
Step 7: Design monitoring and evaluation to assess ecosystem service delivery

- Our understanding of ecosystems and responses to management is not sufficient to make fixed plans
- Complexity and variability mean we must measure our progress and make needed adjustments
- This *adaptive management* step is discussed in more detail in a different Module



7 Steps as a Process

- Steps are interconnected
- Better phrased as multiple feedback loops
- Adaptive management and use of 7 steps connect EM and ecosystem services to meet environmental goals of society



Working Groups: Focus on Steps 1-5

- **Using your conceptual model of the workshop catchment, add to your model to include state and goals of ecosystem services and function. Choose a component from your conceptual model. Build an analysis and descriptions for steps 1-3.**
- **Now more briefly, identify the data you would need to build landscape maps for step 4. Describe 3 management actions you would want to assess in step 5.**
- **Working groups (25 min)**
- **Elect a spokesperson to present in plenary (10 min)**



Plenary report back and discussion



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Does that seem appropriate and rational?
Could you lead your participants through that structure? What would make it difficult?

Recognize you might need to adapt-see
Module 7 Brief

