



Module 4



The structure and function of ecosystems

Our goal is to understand ecosystem services and related stakeholder.

I will present about ecosystem structure and process.

Discuss the ecosystem services and structure in your catchment, and priorities stakeholder according to ecosystem services.



Module 4



The structure and function of ecosystems





Defining Ecosystem

An ecosystem includes all plants and animal (biotic element), the nonliving (abiotic element) as well as interactions among those elements

- **Can be defined at many spatial scales**
- **Important processes involve movement of energy and matter through the system**
- **Hydrologic relationships can help us understand resource flow**





Ecosystem Services

- **Ecosystem services are benefits people obtain directly and indirectly from ecosystems**
- **Ecosystem services contribute to making human life possible and worth living**





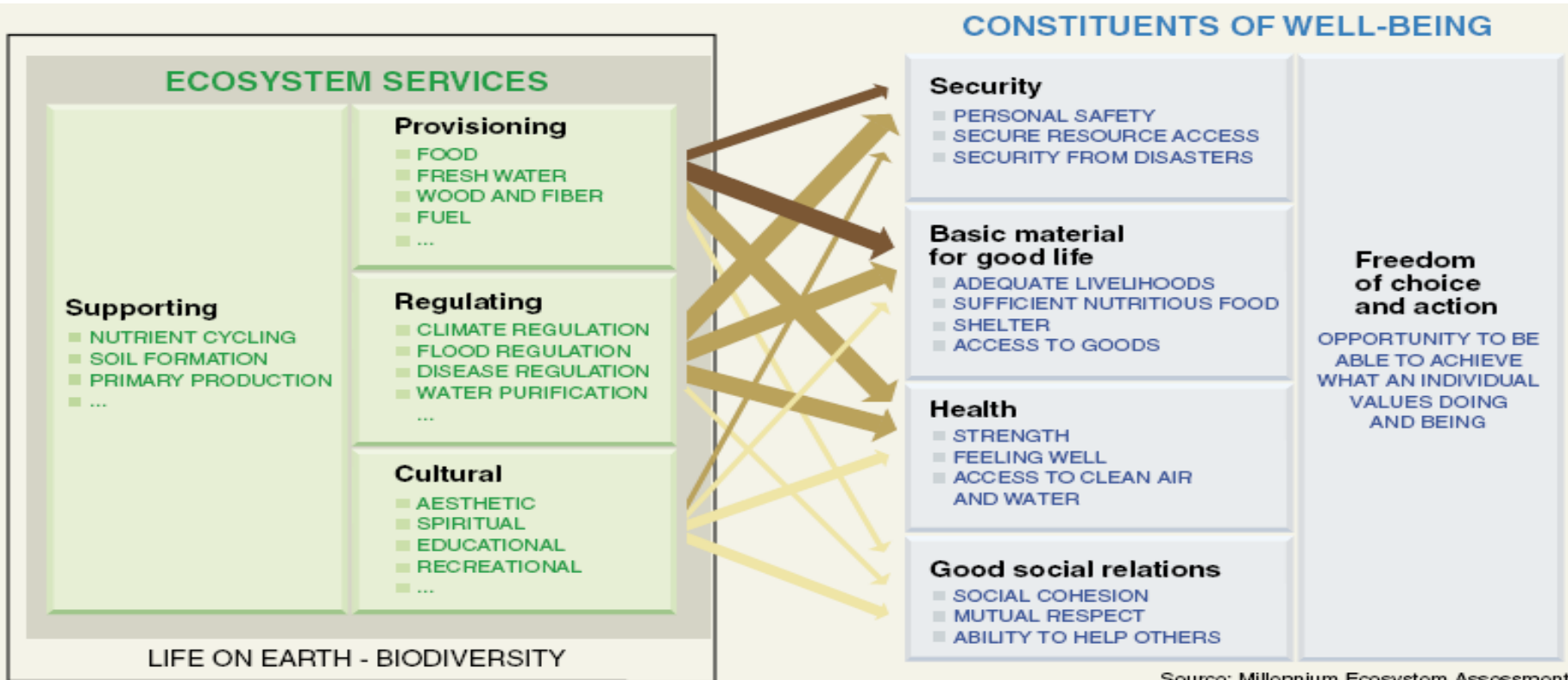
4 categories of ecosystem services

The MEA lists four categories of ecosystem services

1. **Provisioning services: products obtained from ecosystems (food, fiber, fuel, freshwater,.....)**
2. **Regulating services: benefits obtained from the regulation of ecosystem processes (water regulation, erosion regulation, water purification...)**
3. **Cultural services: non-material benefits (recreation, aesthetic experiences, educational values, ecotourism,)**
4. **Supporting services: necessary for sustaining the production of all other ecosystem services (plant growth, nutrient cycling)**



Thinking Like an Ecosystem



Source: Millennium Ecosystem Assessment

ARROW'S COLOR
Potential for mediation by socioeconomic factors

- Low
- Medium
- High

ARROW'S WIDTH
Intensity of linkages between ecosystem services and human well-being

- Weak
- Medium
- Strong



Ecosystem Management

- **Ecosystem management involves working with the functioning of the ecosystem to supply ecosystem services**
- **Ecosystem functions depend on interactions between core ecosystem processes and ecosystem structure**
- **Ecosystem management involves thinking in terms of ecosystem structure, function and processes to improve management**





EM and People

- **Incorporating humans into ecosystems is critical to EM**
- **EM sees people as**
 - dependent on ecosystems
 - part of ecosystems
- **We depend on ecosystems for services and influence them as we harvest products, alter them through a range of land uses, and emit wastes**
- **Our focus here is biophysical management of ecosystems**





Ecosystem Functioning

- **Management for ecosystem service needs to consider both necessary ecosystem structure and the functioning of ecosystem process.**
- **Ecosystem processes**
 - Water cycling
 - Mineral cycling
 - Solar energy flow
 - Biological growth

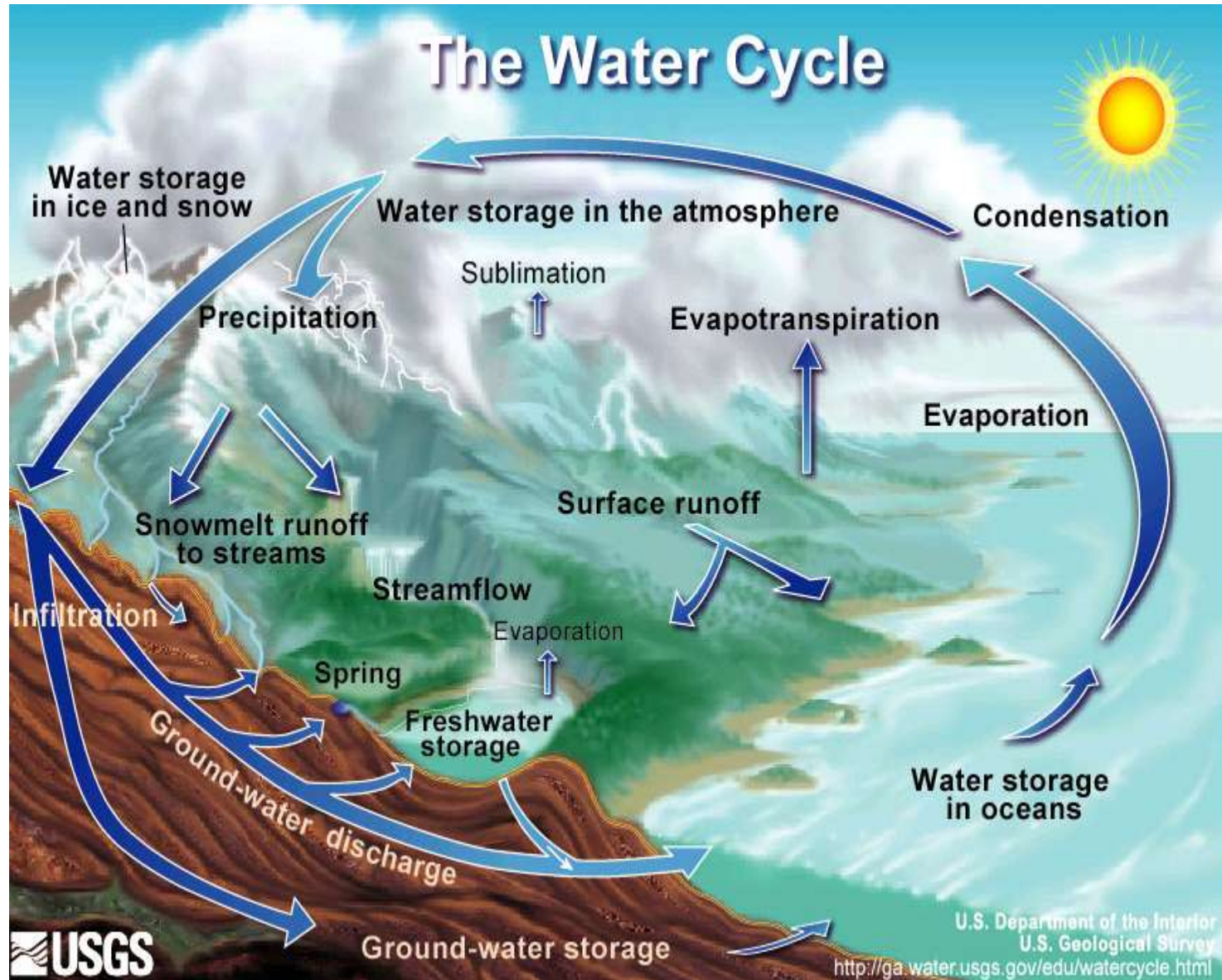




Water Cycling

- **Water is essential for life**
- **In ecosystem management**
 - **How to influence the water cycle on ecosystem from crop to river basin**
- **Ecosystem management of water cycle will need to consider the desired proportion of water, timer and volumes for provision of freshwater, and regulation of flow to rivers, wetland, aquifers and the atmosphere.**







Mineral Cycling

- **Mineral is essential for life and cycled from and to living organisms**
- **Core element of mineral cycle in ecosystem**
 - **covered and biologically active soil**



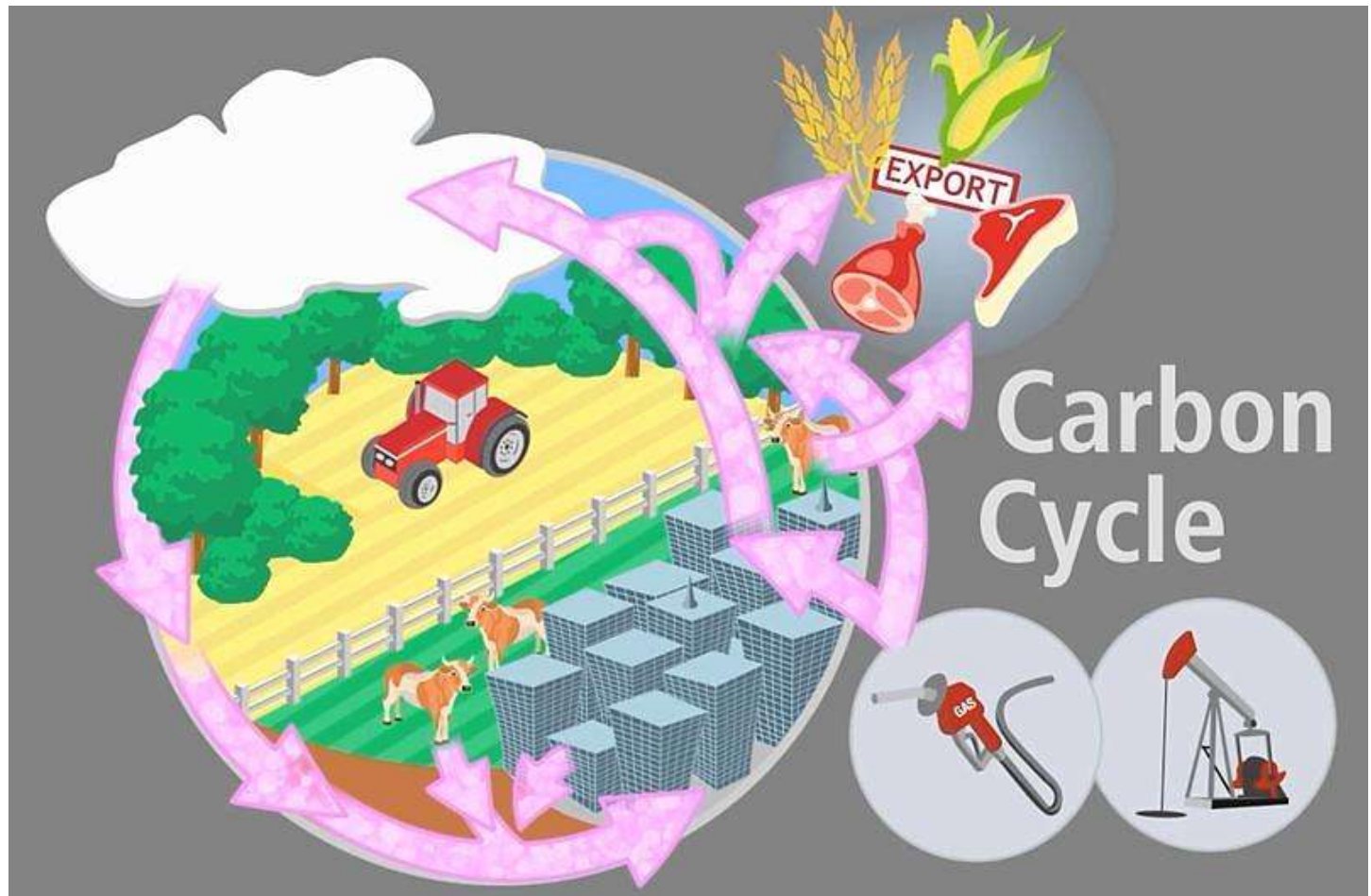


Mineral Cycling

- Mineral cycling is increased by large herbivores, insects and other small animals
- Herbivores increase rate of organic decomposition and liberation of minerals for plant and soil growth
- Functioning of the ecosystem processes of mineral and water cycling are closely linked



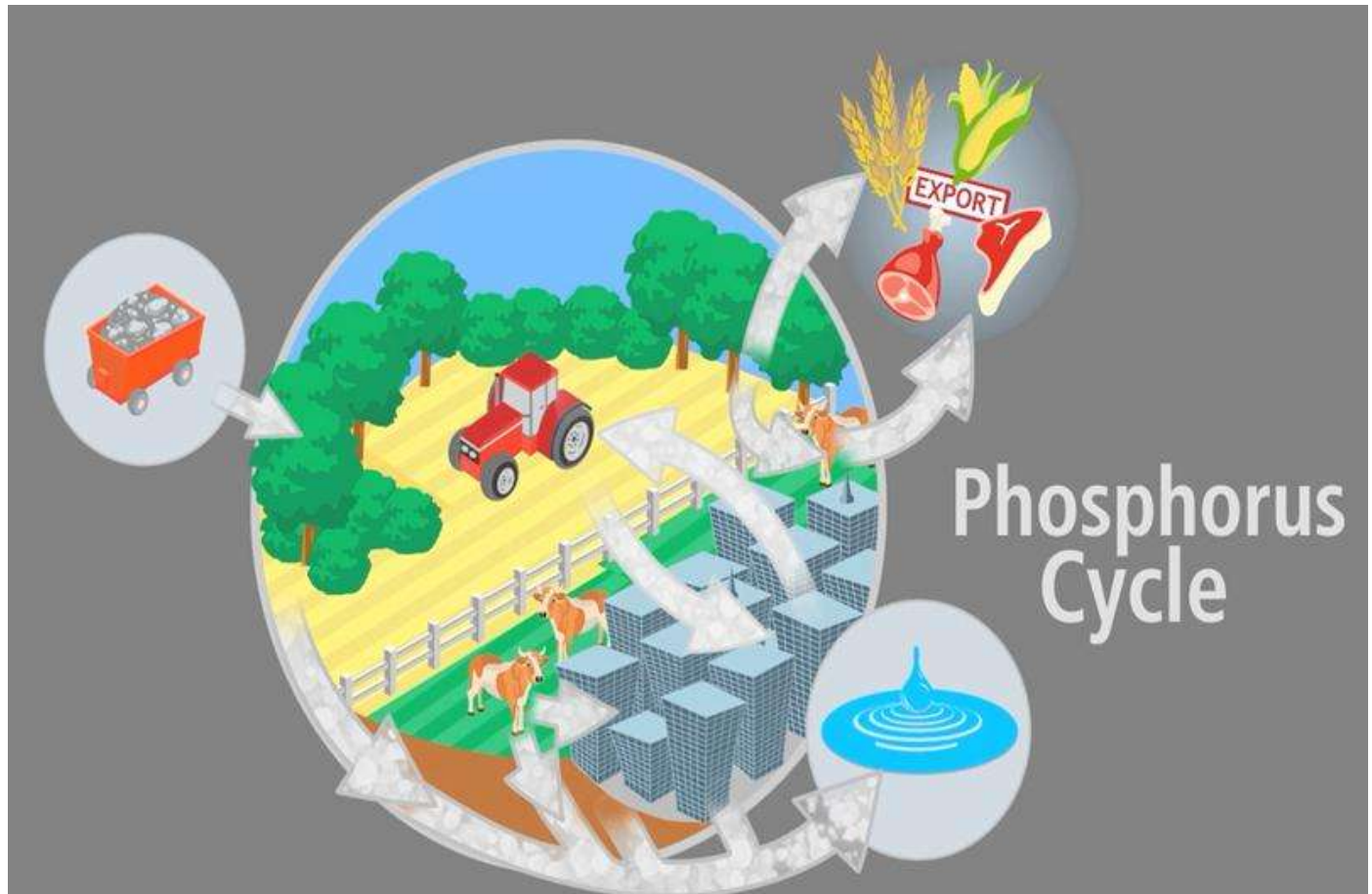
The Carbon Cycle



The Nitrogen Cycle



The Phosphorus Cycle





Solar Energy Flow

- **Ecosystems are fuelled by the energy captured by plants from the sun via photosynthesis**
- **Solar energy flows through food webs: from plants to herbivores and omnivores to carnivores and finally decomposers**
- **Solar energy doesn't cycle; it flows through an ecosystem**





Land Management for water

- Needs to determine ecosystem structure required to promote desired water services
- Soil cover, types and structure of vegetation highly influence water cycle
- Supporting desired vegetation requires specific functioning of the mineral cycle (decomposition for soil formation)
- Availability of solar energy for plants and animals in the biological soil community should be considered in management of water flow and quality





Ecosystem Functioning: Biological Growth

- From EM perspective, managers for provisioning ecosystem services promote growth of valued species
- Manager use ecosystem-scale of biological growth to encourage growth of soil, vegetation and animal communities for regulating and cultural ecosystem services
- Decomposition of accumulated organic matter is a core ecosystem process that must be optimized





Ecosystem structure

- **The structure is what is physically seen and can be directly altered by management**
- **The structure determines the functioning of the process**





Ecosystem structure

For EM, especially freshwater systems, the most useful types of ecosystem structure are:

- **Structure of the food web**
- **Physical structure of vegetation layers**
- **Soil coverage**
- **Water bodies**
- **Decomposition of organic matter**
- **Spatial configuration of species**





Ecosystem Services in Management

Now back to slide 9

- **What services are missing from this list?**
- **Which stakeholders should be added to incorporate missing ecosystem services?**
- **Decide which three stakeholders you rank as top priority and build a new table of ecosystem services (20 minutes)**





Ecosystem Services in Management

- **Decide which three stakeholders you rank as top priority and build a new table of ecosystem services**
- **Elect a new spokesperson and present in plenary**





Review of workshop catchment

10 min groups work

- **Which ecosystem services were expressed as priorities by stakeholders? How might management actions take these needs into account? What surprises did you encounter while exploring? Are there exemplary management practices inspire new ideas for your home catchment?**





Group Debrief





Module 4



What would it be like for you to lead such a module?

Given your background and interests, what will you need in terms of a local co-trainer?

Do you have questions about how this is designed or how it might be implemented?

