

ECOSYSTEM SERVICES: AN INTRODUCTION

Outline:

- What is an Ecosystem?
- Ecosystem Functions & Processes
- Ecosystem Services
- Millennium Ecosystem Assessment (MEA) report categories
 - provisioning services
 - regulating services
 - cultural services
 - supporting services
- Ecosystem Services and Sustainability Resource Management
- An example: a coastal wetland

- An **ECOSYSTEM** includes all of the living things in a particular area — plants, animals and organisms, including people — interacting with each other and with the elements of the nonliving environments (weather, Earth, sun, soil, climate, atmosphere).
- An ecosystem can be defined as: *a dynamic complex of plant, animal and microorganism communities and the nonliving environment interacting as a functional unit.*
- Ecosystems vary enormously in size,
 - from a temporary pond in a pothole,
 - to an entire ocean basin.



<https://www.nps.gov/blca/learn/nature/potholes.htm>

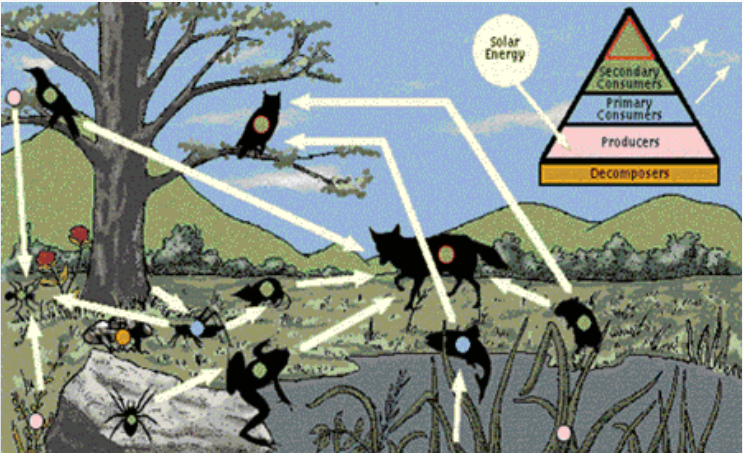


Image from https://www.doi.gov/sites/doi.gov/files/uploads/4_Dr%20Dan%20Aga_Presents%20Final.pdf/

Ecosystems can be looked at, described and evaluated in several different ways and through many different lenses.

An ecosystem can be looked at in terms of some of its *functions* and *processes*, like:

food webs, or water flows, or nutrient cycles.



<http://www.camnl.wr.usgs.gov/isoig/projects/fingernai/foodweb/definition.html>

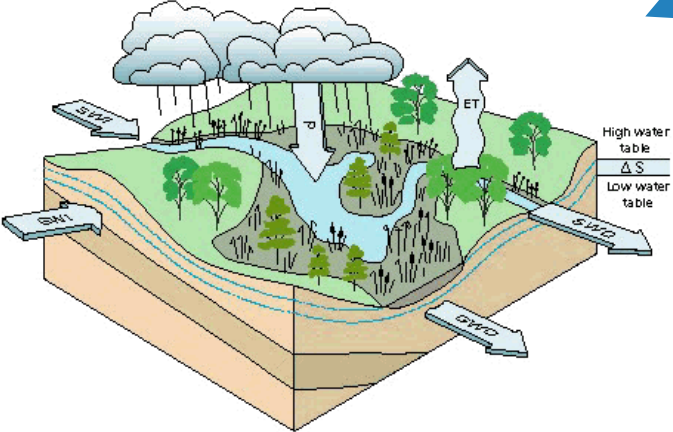
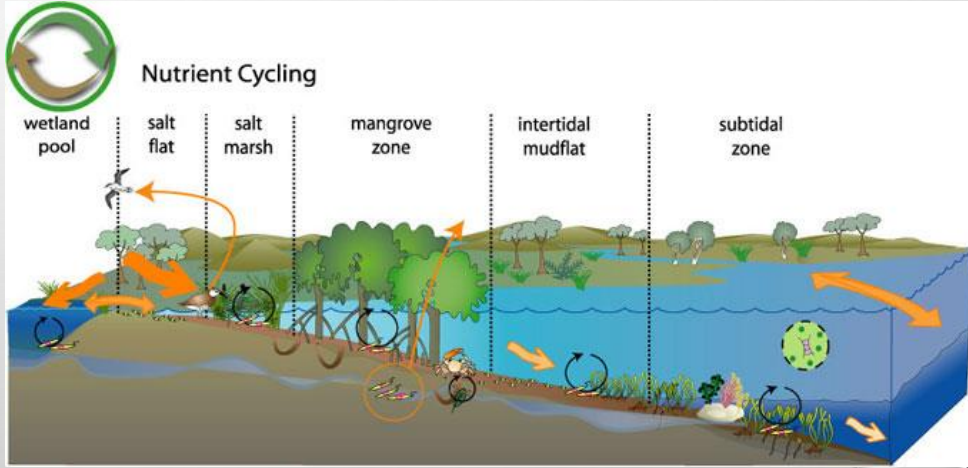


Figure 18. Components of the wetland water budget. ($P + SWI + GWI = ET + SWO + GWO + \Delta S$, where P is precipitation, SWI is surface-water inflow, SWO is surface-water outflow, GWI is ground-water inflow, GWO is ground-water outflow, ET is evapotranspiration, and ΔS is change in storage.)

<https://water.usgs.gov/nwsum/WSP2425/images/fig18.gif>



http://www.ozcoasts.gov.au/conceptual_mods/processes/nutrient.jsp

Throughout this module, we will be concerned with describing and evaluating an ecosystem primarily in terms of the services it provides.

Ecosystem Services can be defined simply, but broadly, as: the goods and services provided by ecosystems that benefit, sustain and support the well-being of people.

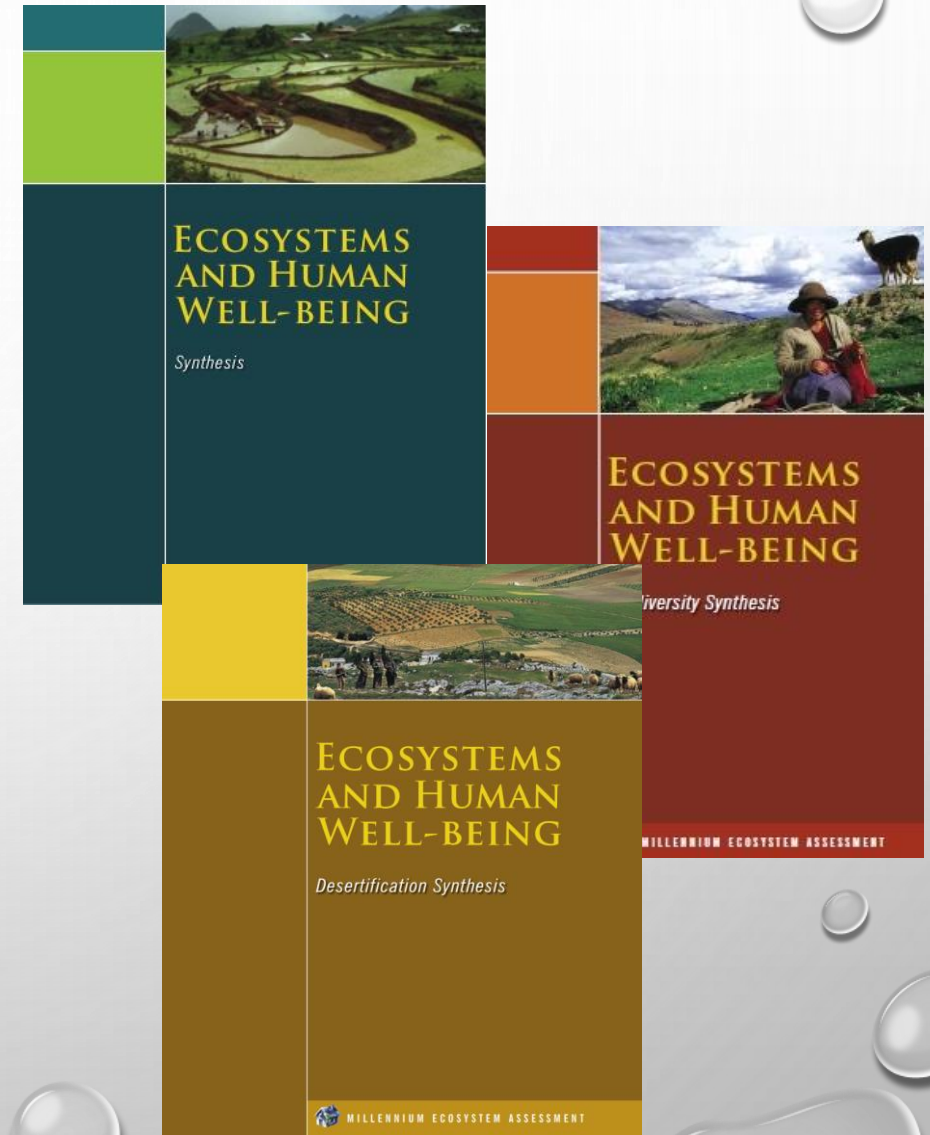
This presentation is meant to be an introduction to the entire module, by familiarizing you with Ecosystem Services.

By the end of this presentation, you should be able to:

- Identify some of the services provided by a particular ecosystem.
- Classify those services into one of four categories, as set out in the Millennium Ecosystem Assessment (MEA).
- Understand the broader context of sustainable resource management that underlies an ecosystem services approach.

- The standard model identifying and categorizing Ecosystem Services comes from **The Millennium Ecosystem Assessment (MEA)**
- The MEA was called for by United Nations Secretary-General Kofi Annan in 2000, and it was published in 2005.
- It is not one single report, but is rather a series of assessments.
- The main objective of the MEA was:
“to assess the consequences of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being.”

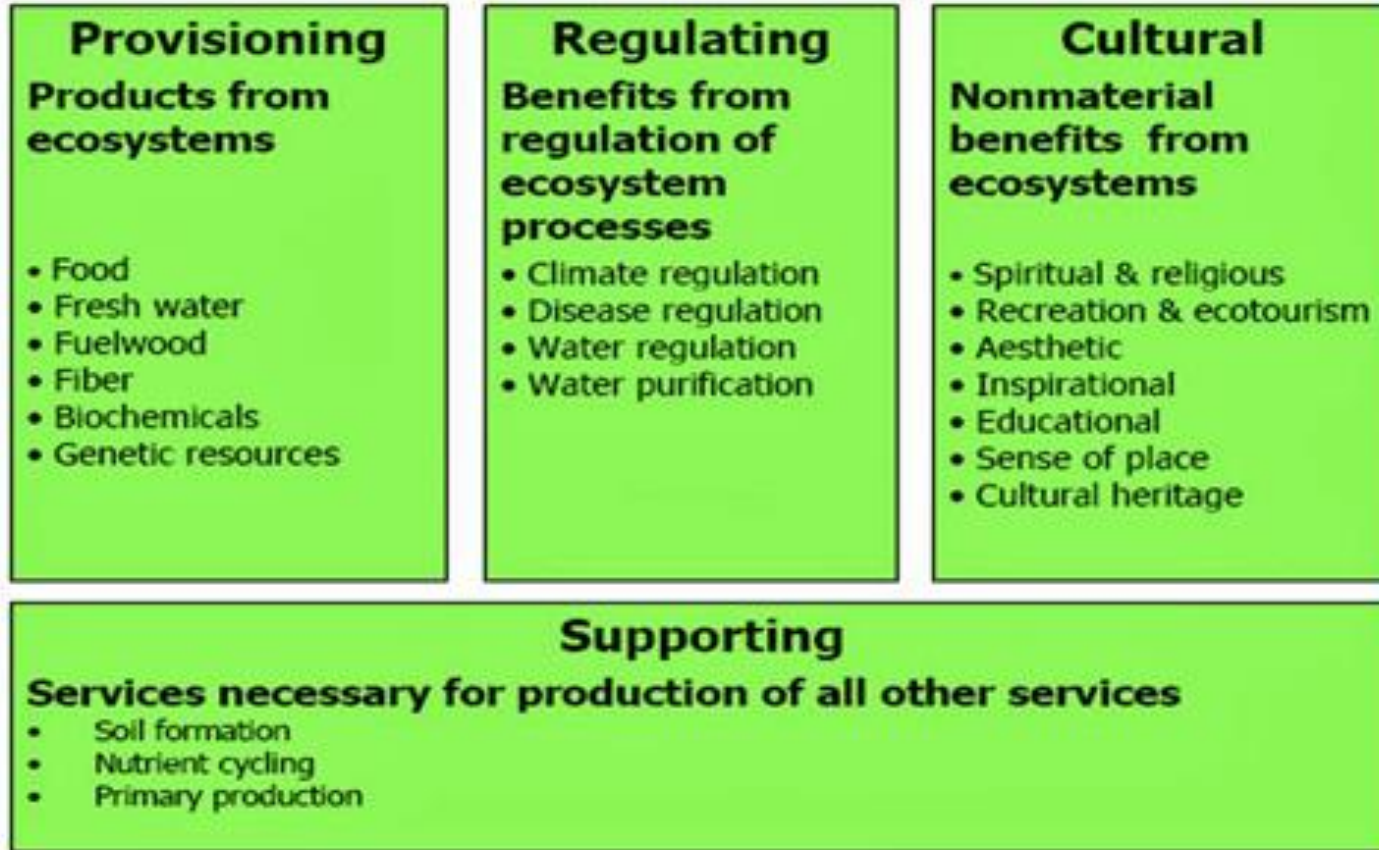
(Forward to the Synthesis report)



The Millennium Ecosystem Assessment (MEA) groups ecosystem services into four broad categories:

1. **Provisioning Services**: Nature provides us with food and water, wood, fuel, fiber, pharmaceuticals and material for industrial products.
2. **Regulating Services**: Nature reserves and purifies water, regulates temperatures, prevents floods and decomposes waste.
3. **Cultural Services**: We can enjoy recreational experiences in nature. Nature contains landscapes that we appreciate and subjects of worship or sites for education.
4. **Supporting Services**: In support of 1, 2, and 3, oxygen is generated through photosynthesis, and water is circulated in nature. After a rainstorm, water is collected in forests and retained in soils and leaves; it is enriched with iron and other minerals, and then it flows out to the ocean through rivers.

Ecosystem Services



Source: Millennium Ecosystem Assessment, 2005

PROVISIONING SERVICES

Ecosystem Provisioning services are the various products obtained from an ecosystem, which can include:

- food (Including seafood, game, crops, wild foods and spices)
- raw materials (including lumber, skins, fuel wood, organic matter, fodder, and fertilizer)
- genetic resources (including crop improvement genes, and health care)
- water
- minerals
- medicinal resources (including pharmaceuticals, chemical models, and test and assay organisms)
- energy (hydropower, biomass fuels)
- ornamental resources (including fashion, handicraft, jewelry, pets, worship, decoration and souvenirs [furs, feathers, ivory, orchids, butterflies, aquarium fish, shells])

REGULATING SERVICES

Ecosystem Regulating Services are the various benefits that come from the regulation of ecosystem functions and processes, which include:

- Carbon sequestration (pulling CO₂ from the atmosphere and storing it in plants and soils)
- Climate Regulation
- Waste decomposition and detoxification
- Purification of water and air
- Pest and disease control
- Flood prevention and control

CULTURAL SERVICES

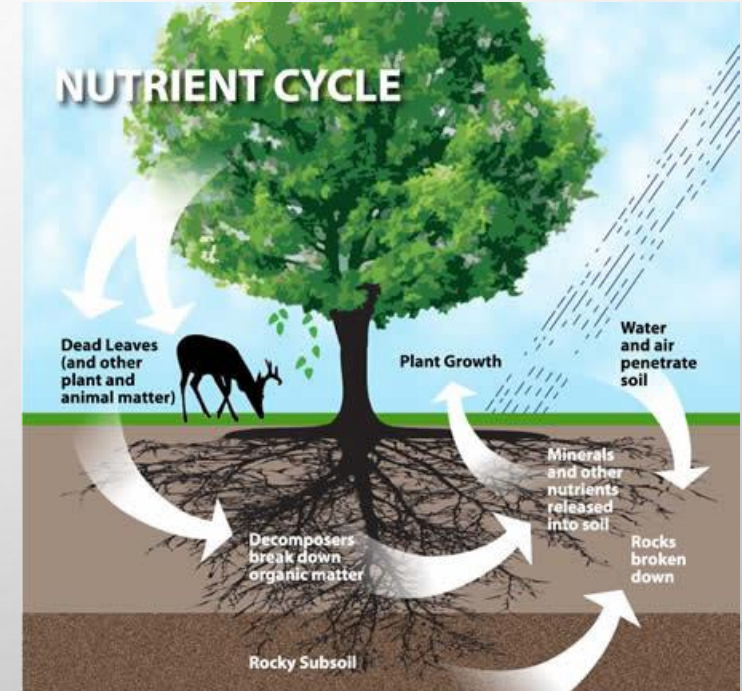
Ecosystem Cultural services are the various non-material benefits that humans derive, though such things as

- Recreation, spiritual enrichment, aesthetic contemplation and reflection, and cognitive development, which can include:
 - Culture (such as the use of nature as a motif in books, films, painting, architecture, advertising, folklore, national symbols)
 - Spiritual and historical
 - Recreational experiences (such as ecotourism, outdoor sports, and recreation)
 - Science and education (such as for school excursions and scientific discovery)

SUPPORTING SERVICES

Ecosystem Supporting Services are the various services that are necessary for the production of all the other ecosystem services.

They include such things as soil formation and nutrient recycling.



http://www.biorecycle.com/nutrient_cycle.shtm

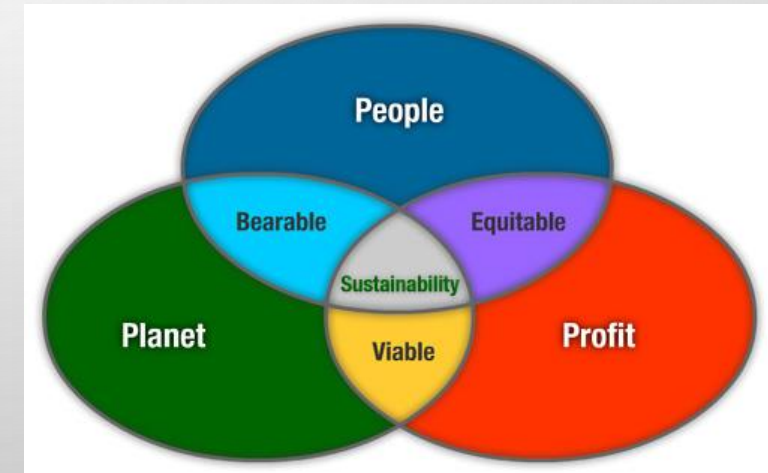
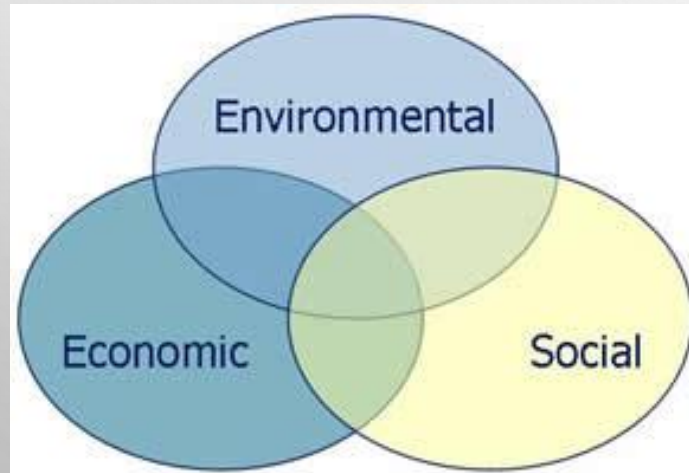


Detritivores like this dung beetle help to turn animal wastes into organic material that can be reused by primary producers.

http://en.wikipedia.org/wiki/Dung_beetle

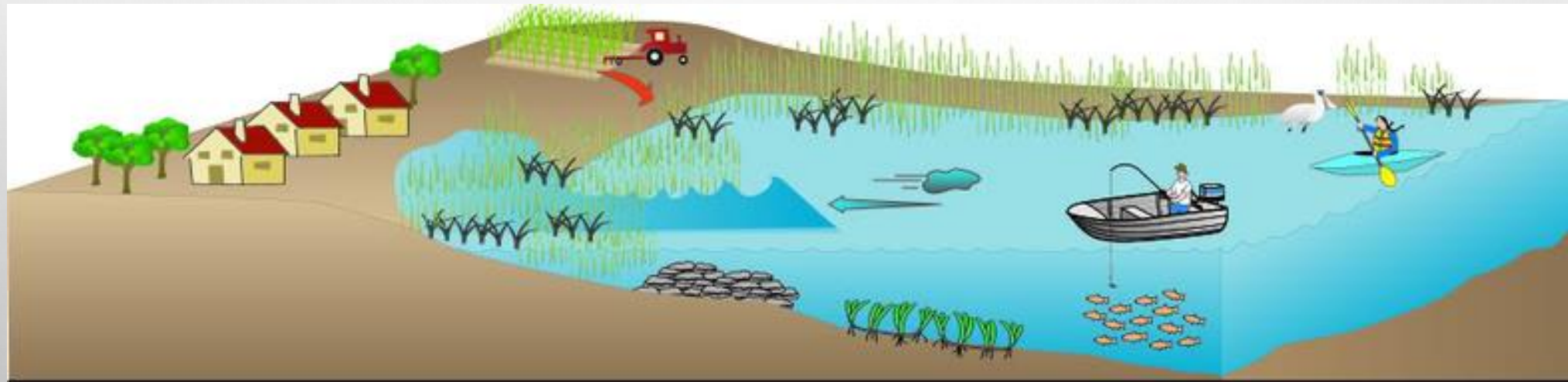
Ecosystem Services and Sustainability:

- Collectively, the variety of Ecosystem Services identified for a particular ecosystem represent its values to humans as seen from either an environmental, an economic, or a social perspective.
- To manage an ecosystem responsibly and sustainably, we must recognize and balance all these values against one another, which requires us to see ecosystems simultaneously from each of these three perspectives.
- **Sustainability** is often characterized, graphically, as three overlapping ellipses, each ellipse representing one of these perspectives. If we think of these ellipses as individual lenses through which to view the world, then sustainability is only possible where all three outlooks converge, focused into a single, clear, and integrated vision.

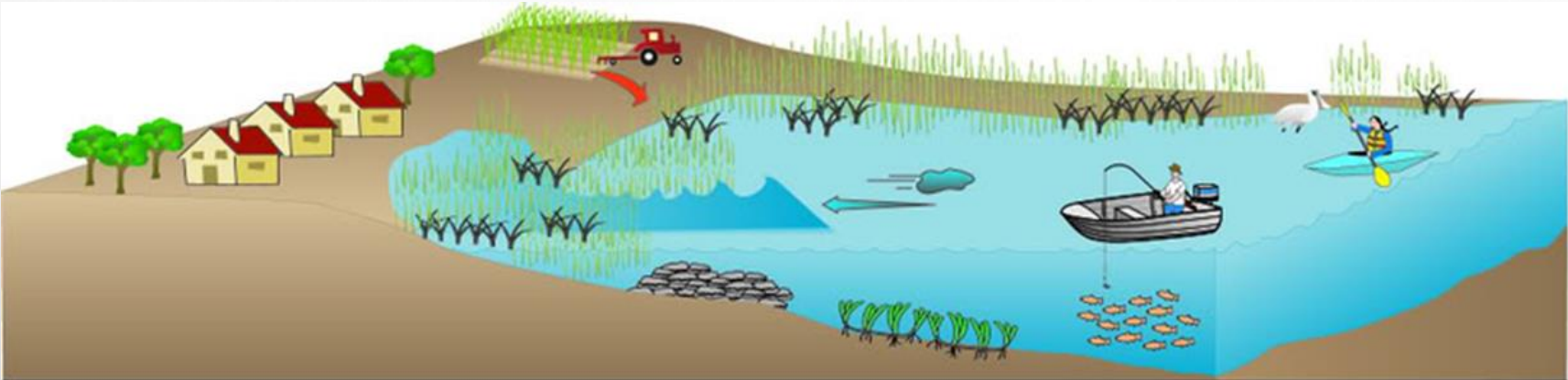


An example for you to consider – A Coastal Wetland

Look at the graphic below of a coastal wetland, and see how many key features and ecosystem services you can identify.



Identify the Ecosystem Services listed under the graphic, and categorize them according to the MEA.



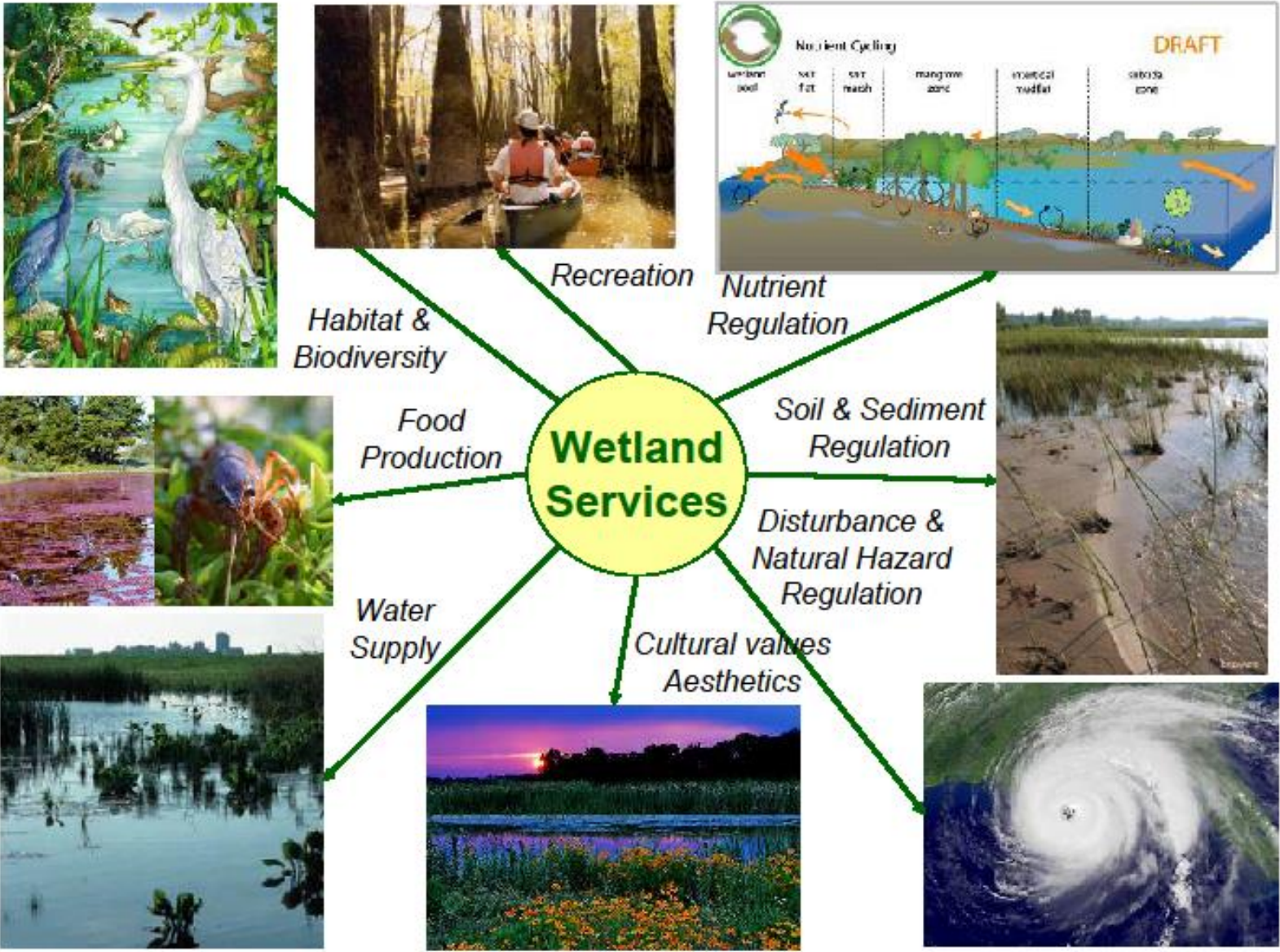
Key Ecosystem Services and Features of Coastal Wetlands

	Coastal communities protected from storm surge by wetlands		Nursery areas benefit recreational fishing		Saltmarsh
	Storm surge		Wildlife and wetland ecosystems increase recreation and tourism value		Oyster reef
	Nutrient runoff from agriculture				Seagrass

Ecosystem Services

<p>Provisioning Products from ecosystems</p> <ul style="list-style-type: none"> • Food • Fresh water • Fuelwood • Fiber • Biochemicals • Genetic resources 	<p>Regulating Benefits from regulation of ecosystem processes</p> <ul style="list-style-type: none"> • Climate regulation • Disease regulation • Water regulation • Water purification 	<p>Cultural Nonmaterial benefits from ecosystems</p> <ul style="list-style-type: none"> • Spiritual & religious • Recreation & ecotourism • Aesthetic • Inspirational • Educational • Sense of place • Cultural heritage
<p>Supporting Services necessary for production of all other services</p> <ul style="list-style-type: none"> • Soil formation • Nutrient cycling • Primary production 		

University of Maryland, Center for Environmental Science – IAN Science Communication Forum <http://ian.umces.edu/discforum/index.php?topic=440.0>



Please complete the Unit 1.1 Before-class Preparation Assessment