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

ECOSYSTEM SERVICES: AN INTRODUCTION

- 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

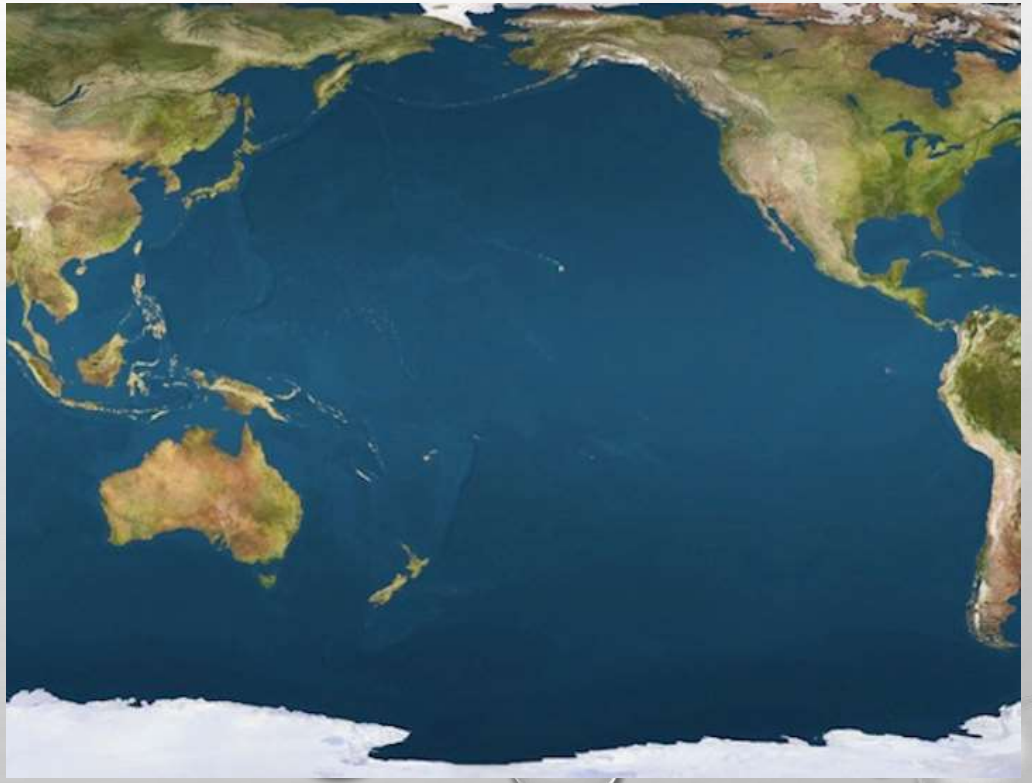
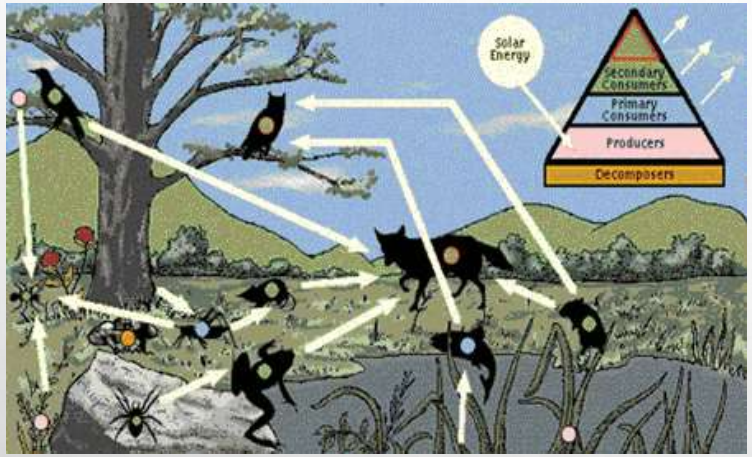


Image from https://www.doi.gov/sites/doi.gov/files/uploads/4_Dr%20Dan%20Aga_Presents%20Final.pdf/

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://wwwrcamnl.wr.usgs.gov/isoig/projects/fingernails/foodweb/definition.html

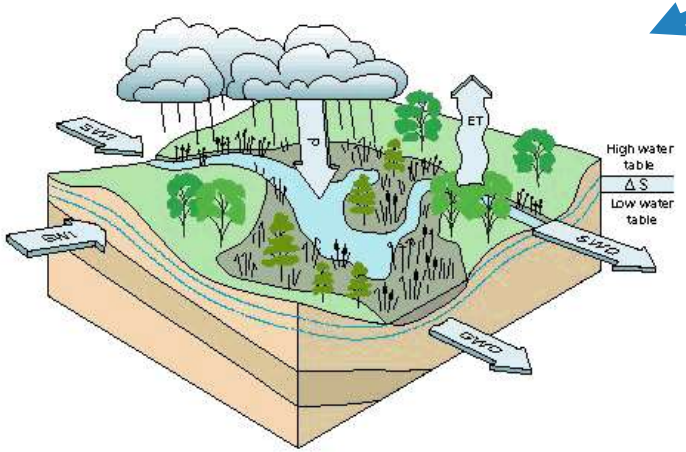
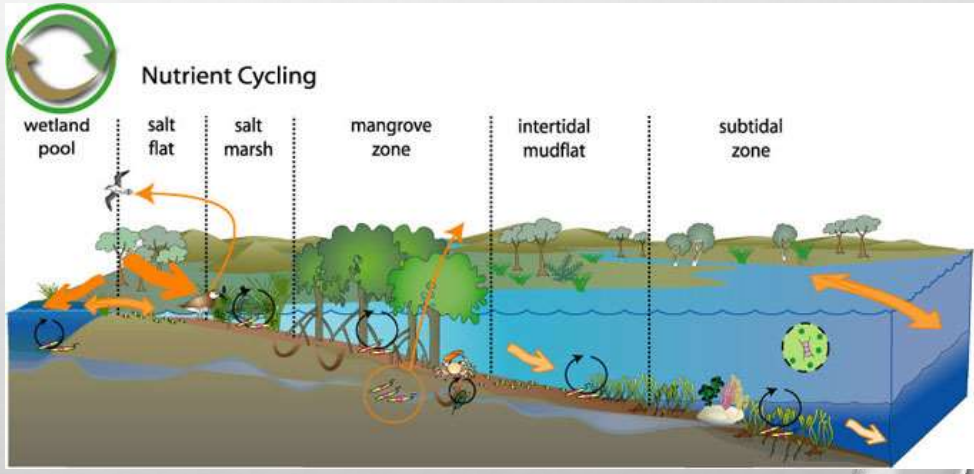


Figure 18. Components of the wetland water budget. (P + SWI + GWI = ET + SWO + GWO + ΔS, where P is precipitation, SWI is surface-water inflow, SWO is surface-water outflow, GWI is ground-water inflow, GWO is ground-water outflow, ET is evapotranspiration, and ΔS is change in storage.)

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.

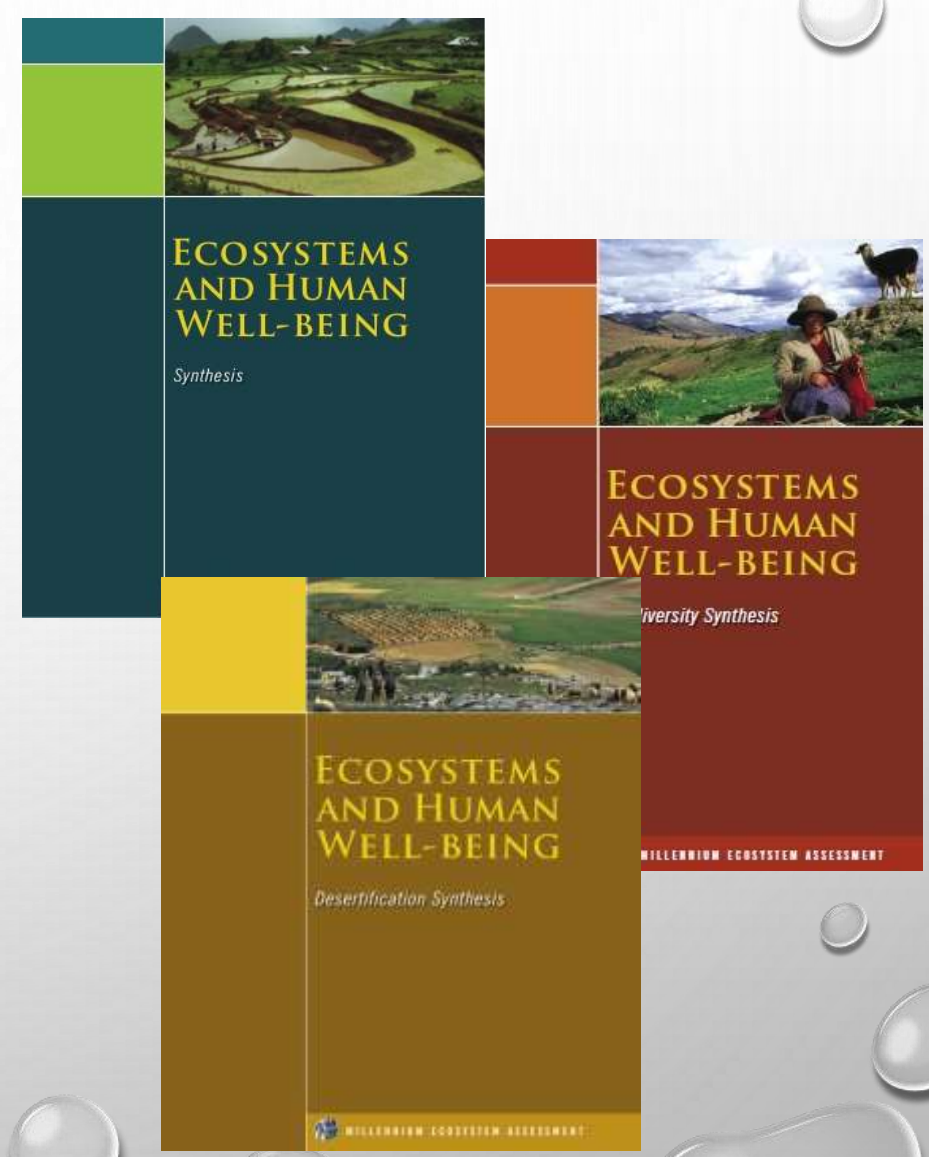
By the end of this presentation, you should be able to:

- 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."

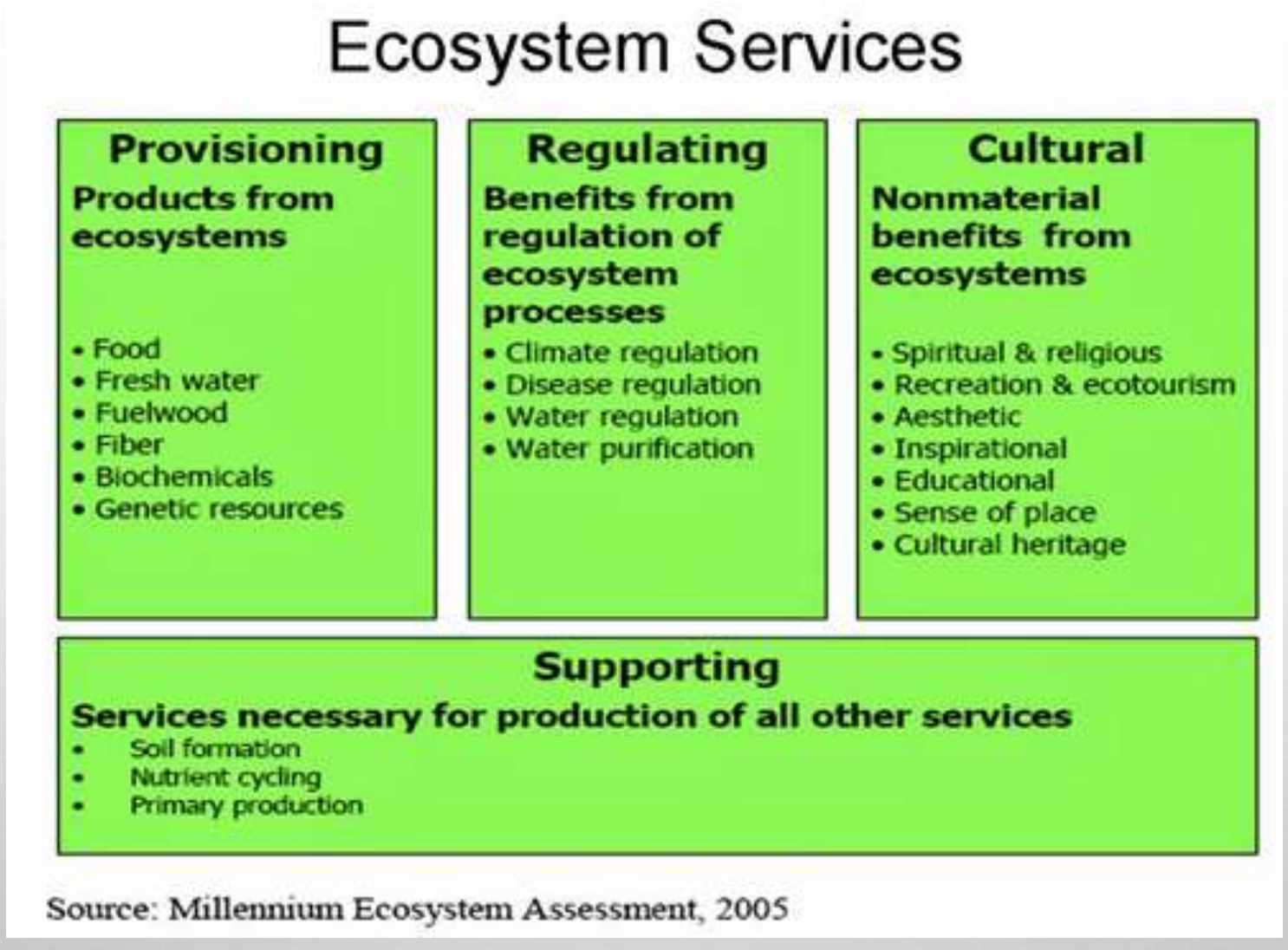
  (*Forward* to the *Synthesis* report)



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.

Adapted from Japan's Ministry of the Environment website: http://www.biodic.go.jp/biodiversity/shiraberu/policy/pes/en/



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 CO_2 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)

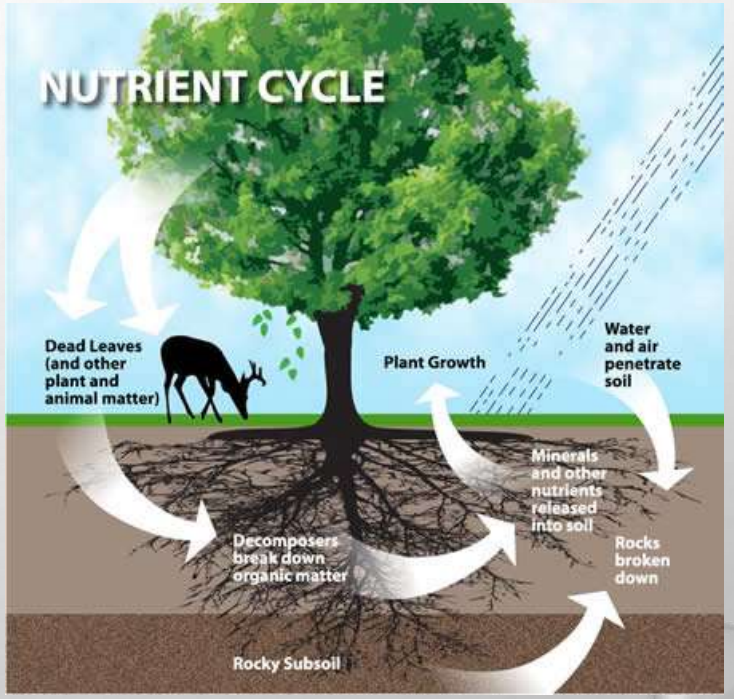
SUPPORTING SERVICES

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

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



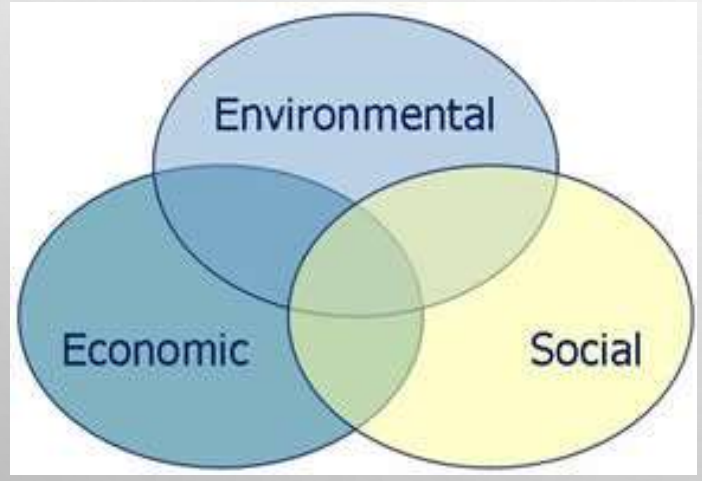
http://www.biorecycle.com/nutrient_cycle.shtm

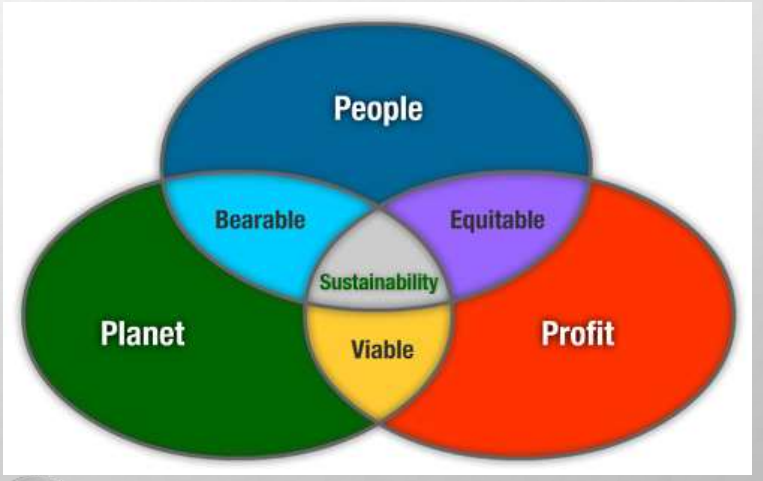
Ecosystem Services and Sustainability:

- 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.

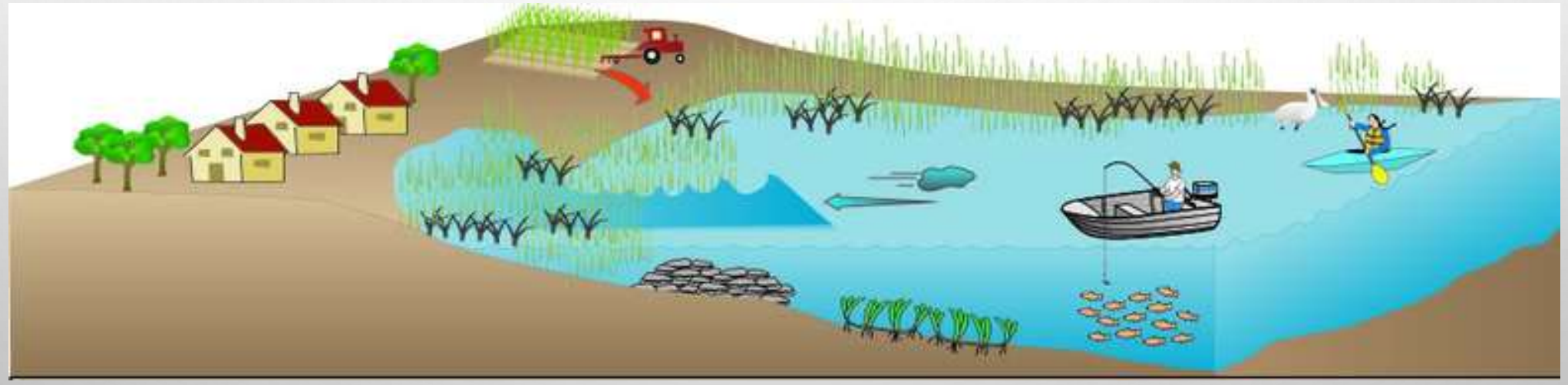
- **Sustainability** is often characterized, graphically, as three overlapping ellipses, each ellipse representing one of these perspectives. If we think of these ellipses as individual lenses though which to view the world, then *sustainability* is only possible where all three outlooks converge, focused 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.

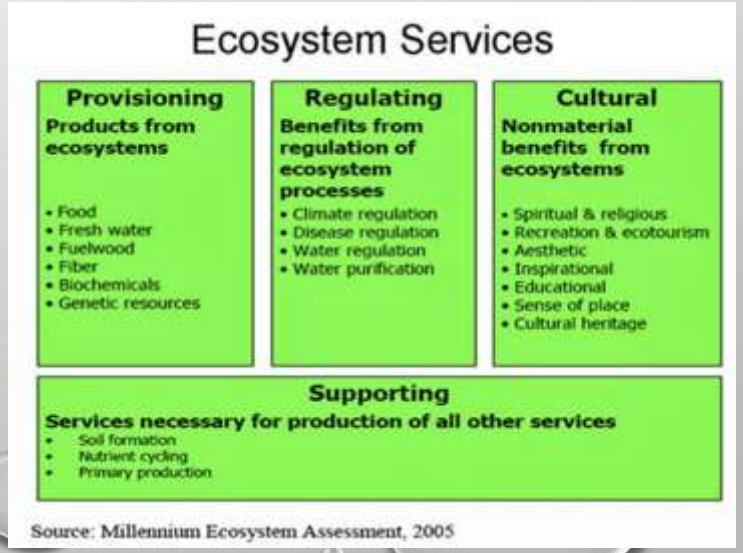


Adapted from University of Maryland, Center for Environmental Science – IAN Science Communication Forum http://ian.umces.edu/discforum/index.php?topic=440.0

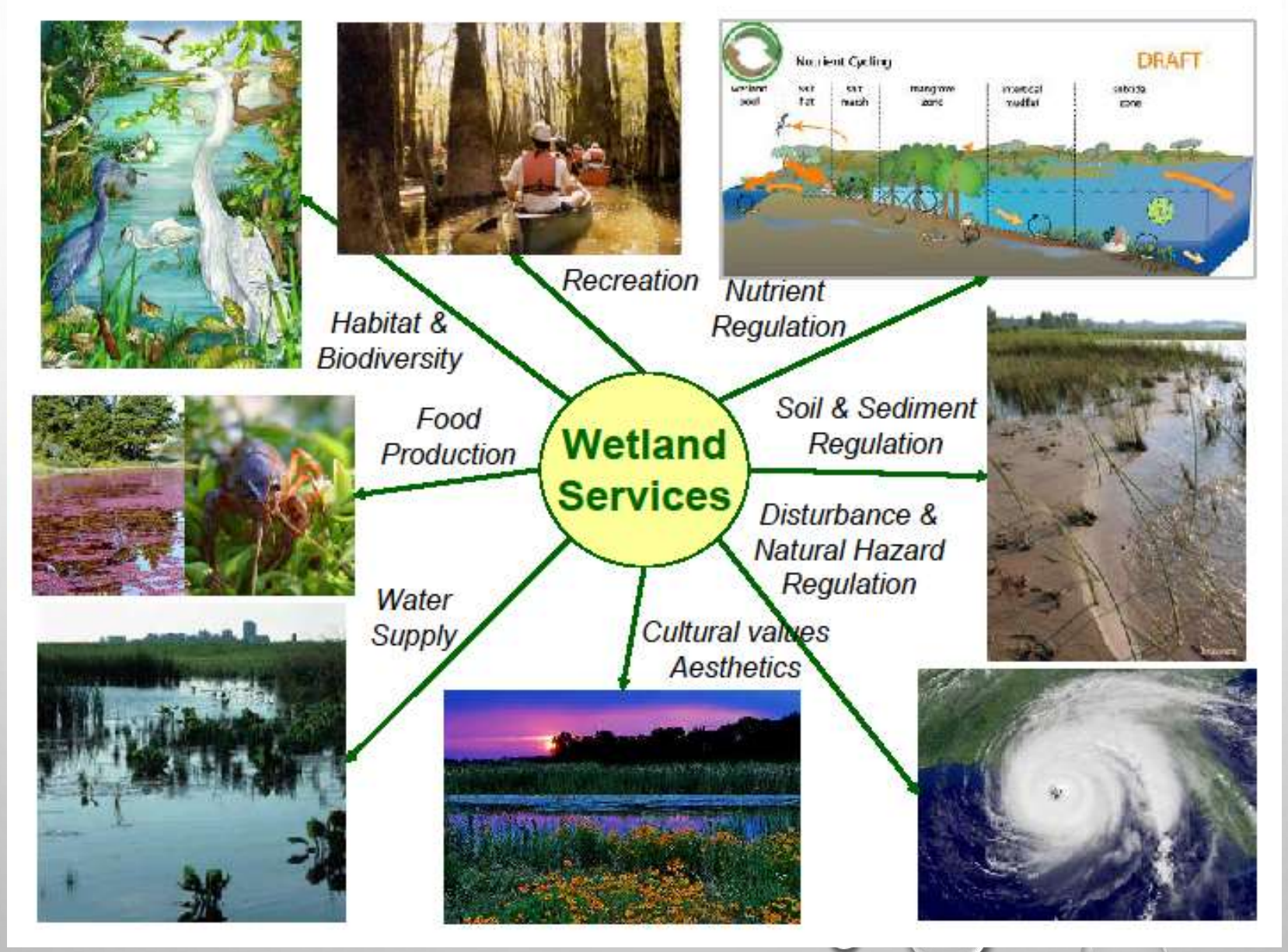
ECOSYSTEM SERVICES: AN INTRODUCTION

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

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



ECOSYSTEM SERVICES: AN INTRODUCTION



http://www.epa.gov/wetlands/wetlands-education

Please complete the Unit 1.1 Before-class Preparation Assessment