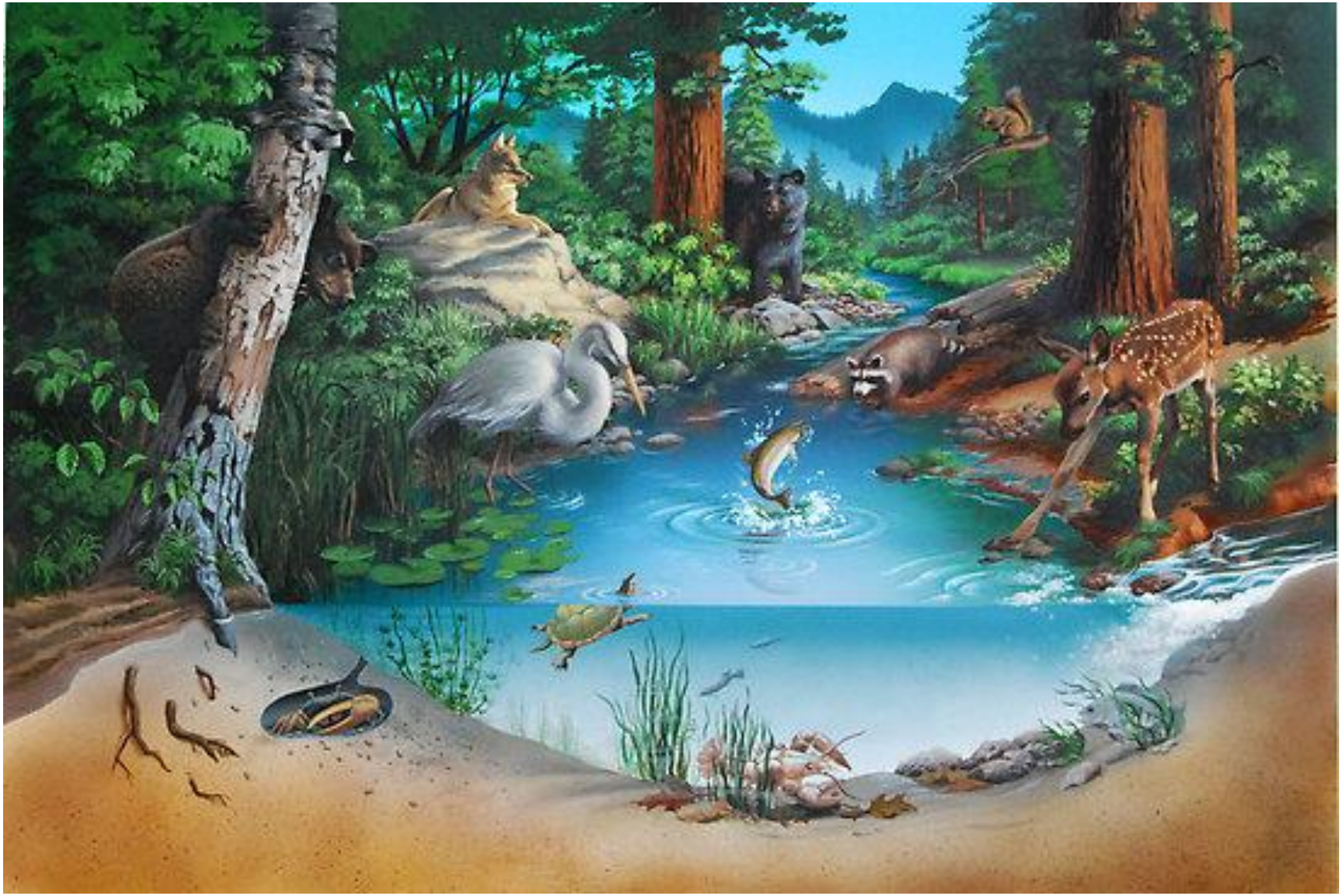
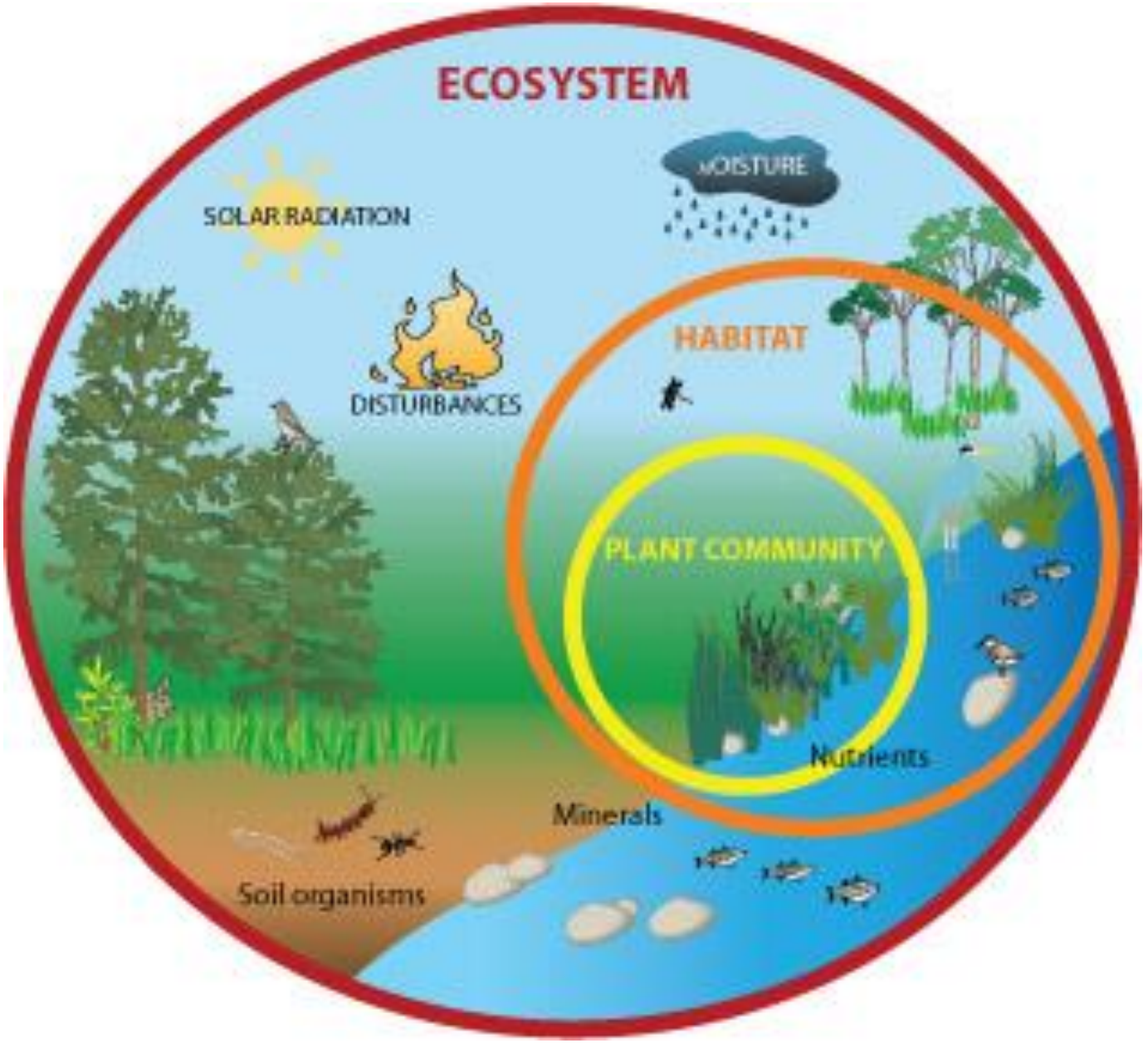
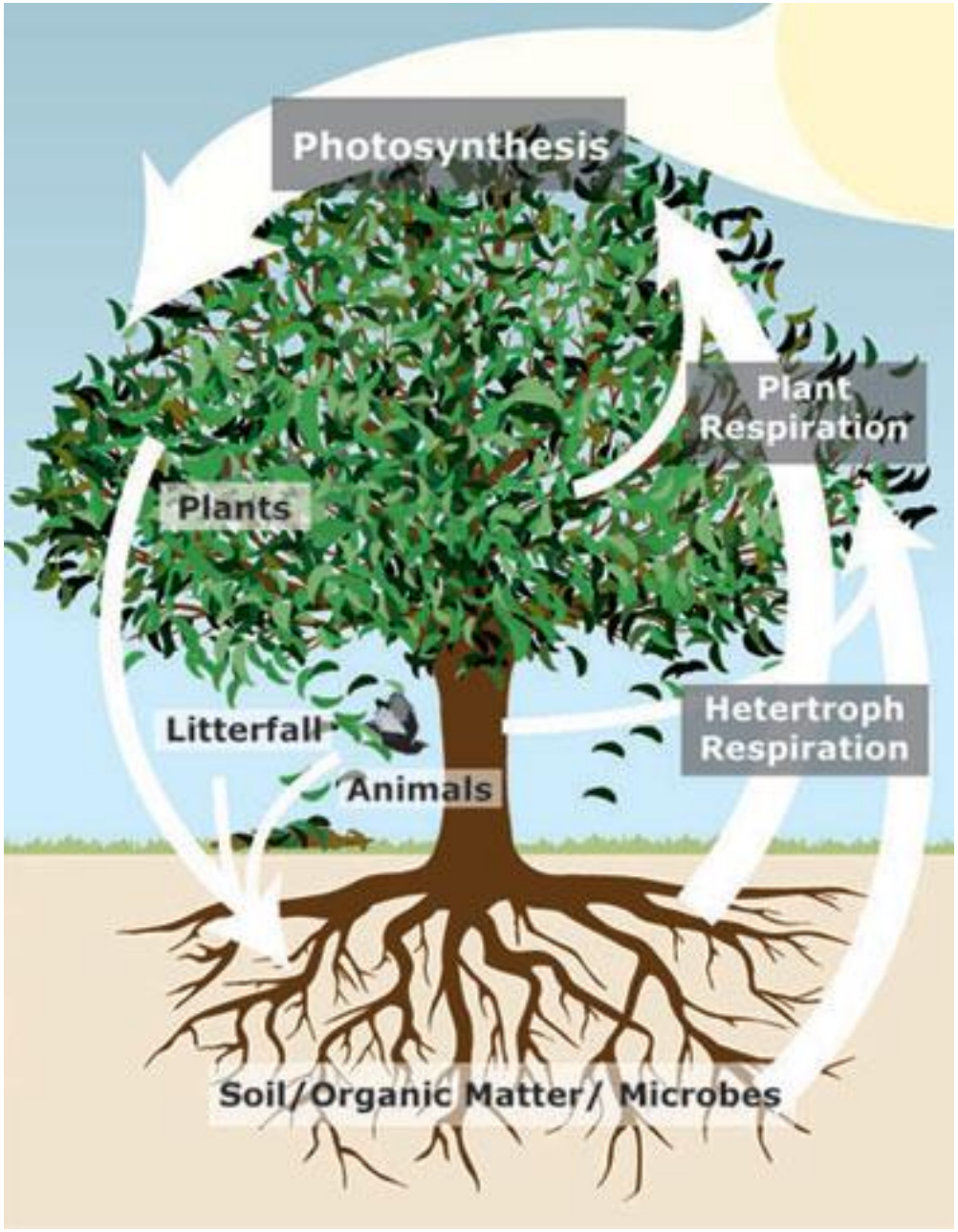


What is an ecosystem?



Parts of an ecosystem



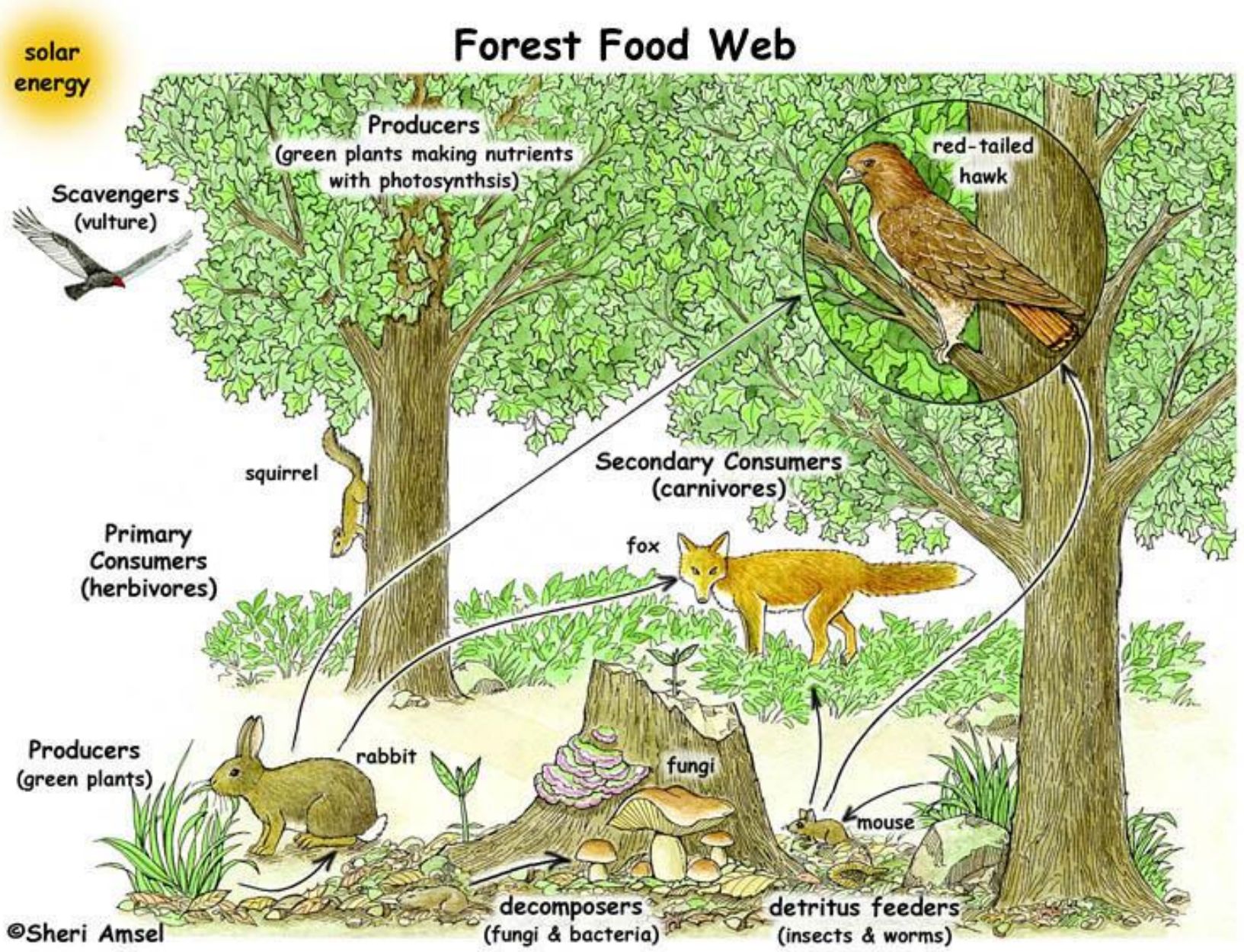
Plants, through photosynthesis, capture and store the energy of the sun fueling ecosystems

Photosynthesis

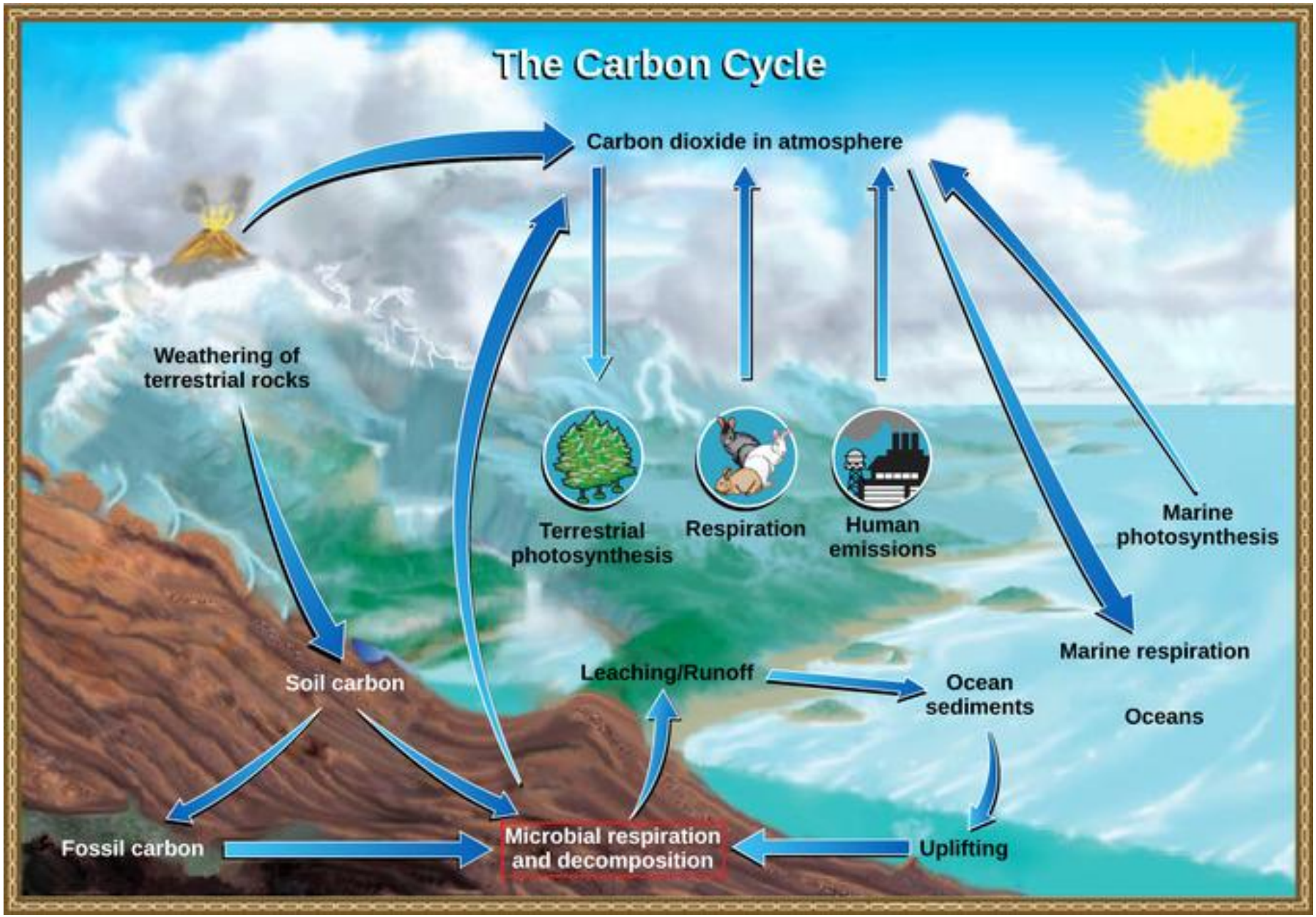
$6CO_2+6H_2O=C_6H_{12}O_6+6O_2$

Respiration

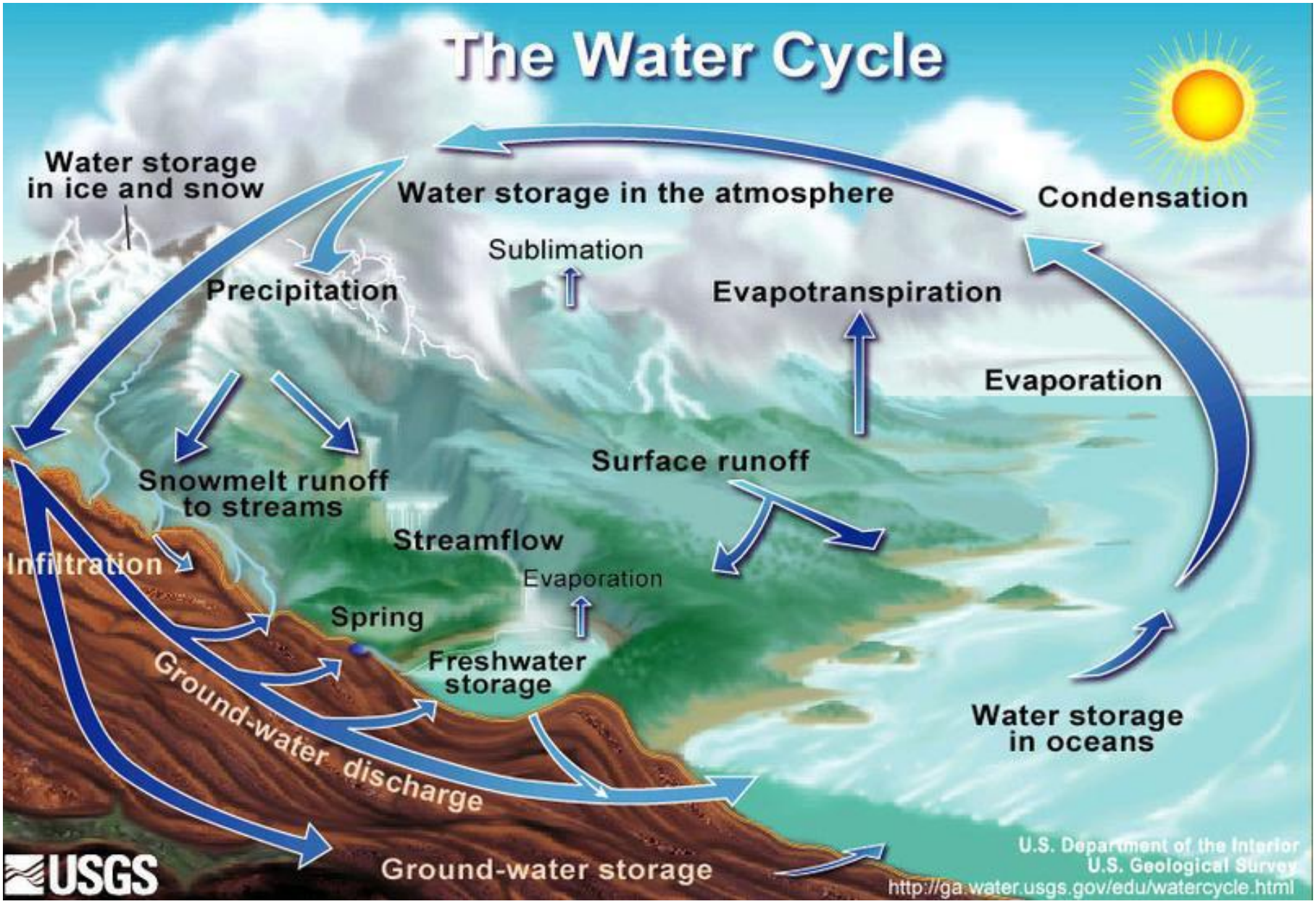
$C_6H_{12}O_6+6O_2=6CO_2+6H_2O$

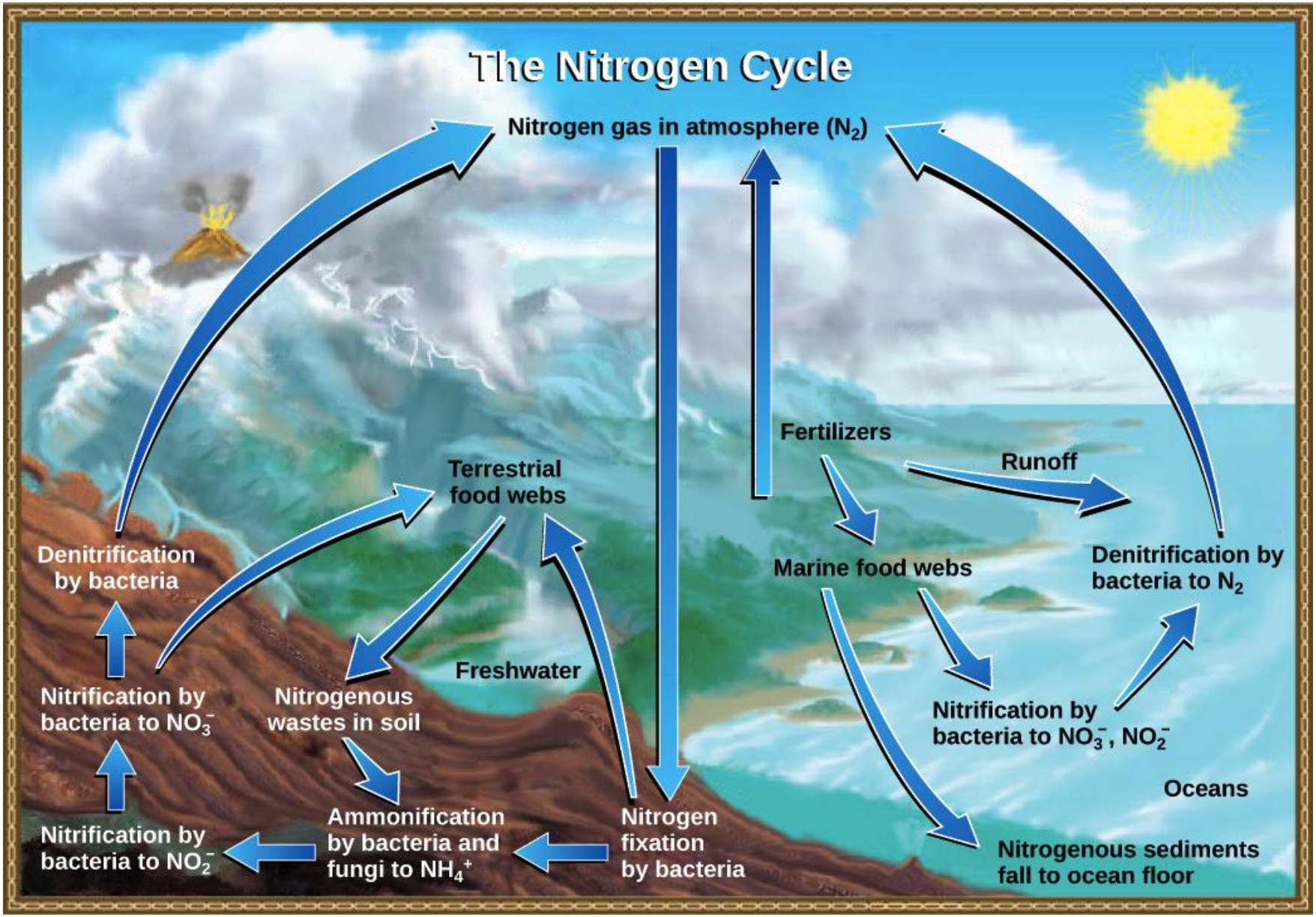


Relationships regulate flows energy, organic matter, nutrients, and water



Global cycles link ecosystems


The Water Cycle
Water storage in ice and snow
Water storage in the atmosphere
Condensation
Sublimation
Precipitation
Evapotranspiration
Evaporation
Surface runoff
Snowmelt runoff to streams
Streamflow
Infiltration
Evaporation
Spring
Freshwater storage
Ground-water discharge
Water storage in oceans
Ground-water storage
USGS
U.S. Department of the Interior
U.S. Geological Survey
http://ga.water.usgs.gov/edu/watercycle.html


The Nitrogen Cycle
Nitrogen gas in atmosphere (N_2)
Fertilizers
Runoff
Terrestrial food webs
Denitrification by bacteria
Marine food webs
Denitrification by bacteria to N_2
Freshwater
Nitrification by bacteria to NO_3^-
Nitrogenous wastes in soil
Nitrification by bacteria to NO_3^-, NO_2^-
Oceans
Nitrification by bacteria to NO_2^-
Ammonification by bacteria and fungi to NH_4^+
Nitrogen fixation by bacteria
Nitrogenous sediments fall to ocean floor

What are ecosystem processes and functions?

Processes are complex interactions, *functions* are the outcomes of those interactions

For example: Precipitation, infiltration, impoundment, surface flow, ground water storage are all interacting *processes* that serve the *function* of improving water quality

The ecosystem functions that benefit humans are often referred to as *ecosystem services*

Chocolate Chi okies

Set the oven at 375°.

Cream
- ½ cup butter

Beat in until light and smooth
- ⅜ cup brown sugar
- ⅜ cup white sugar

Stir in
- 1 egg, slightly beaten
- ½ teaspoon salt
- ½ teaspoon baking soda in 1 tablespoon hot water
- 1⅛ cups flour
- ½ cup chopped nut meats
- 1 teaspon vanilla
- 1 package chocolate bits (6 ounces) or a 6-ounce semi-sweet chocolate bar, cut small

Mix well. Bake like Sugar Cookies (p. 434). *Makes about 40.*

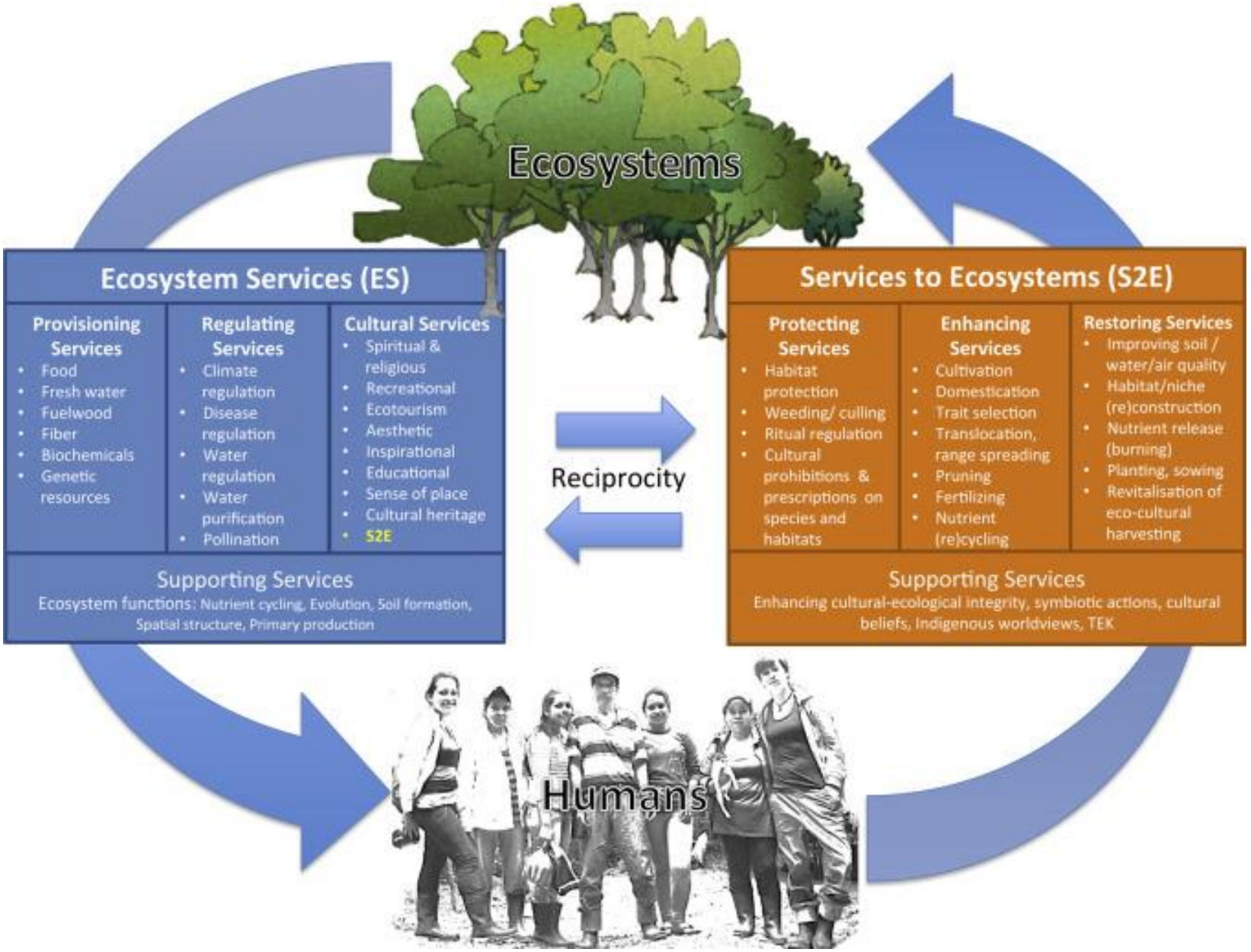
Chocolate Oatmeal Cookies. Use quick oatmeal in place of nuts.

Process

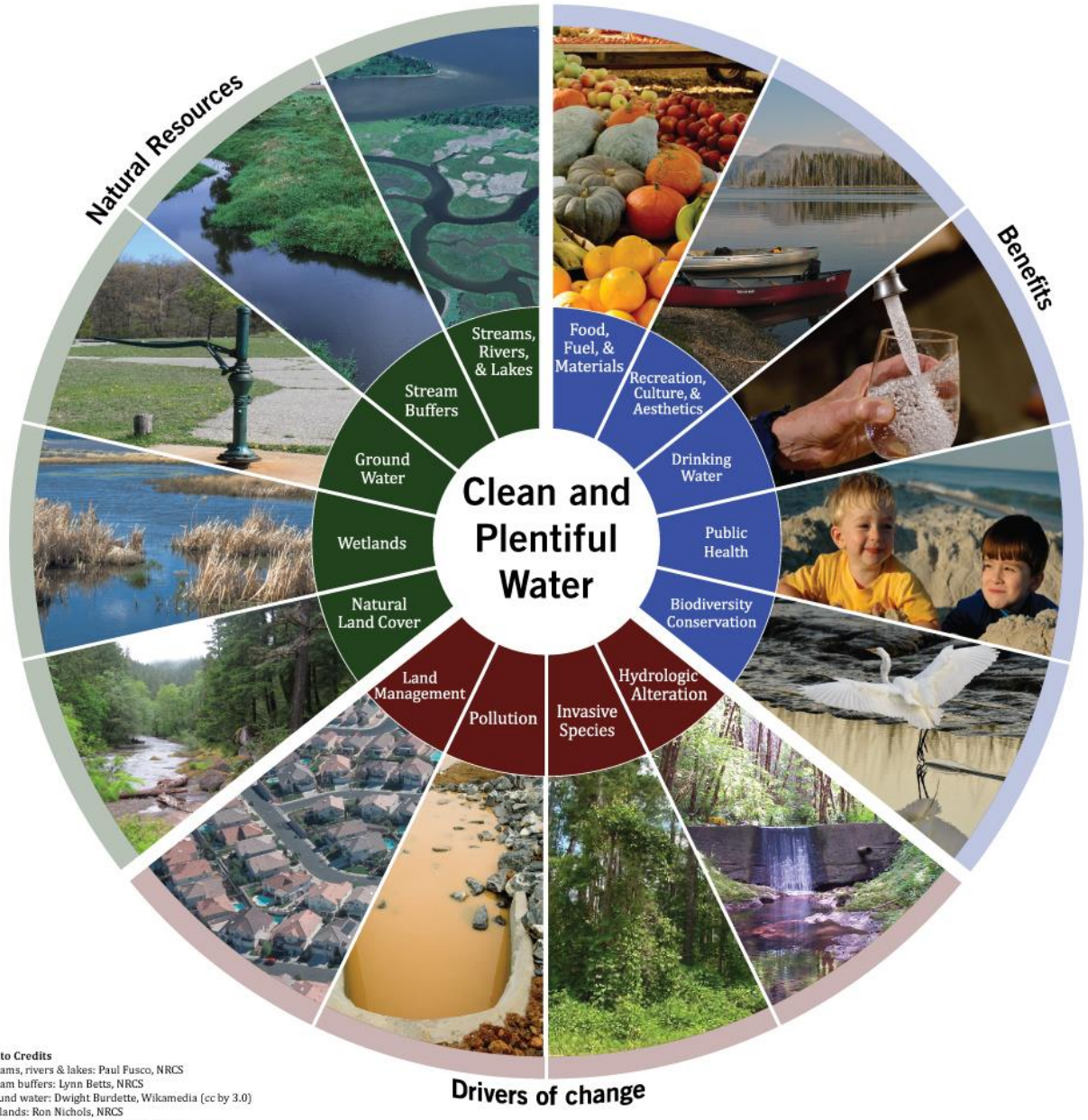
Function/service

Ecosystems provide essential life giving services to humans

For free!



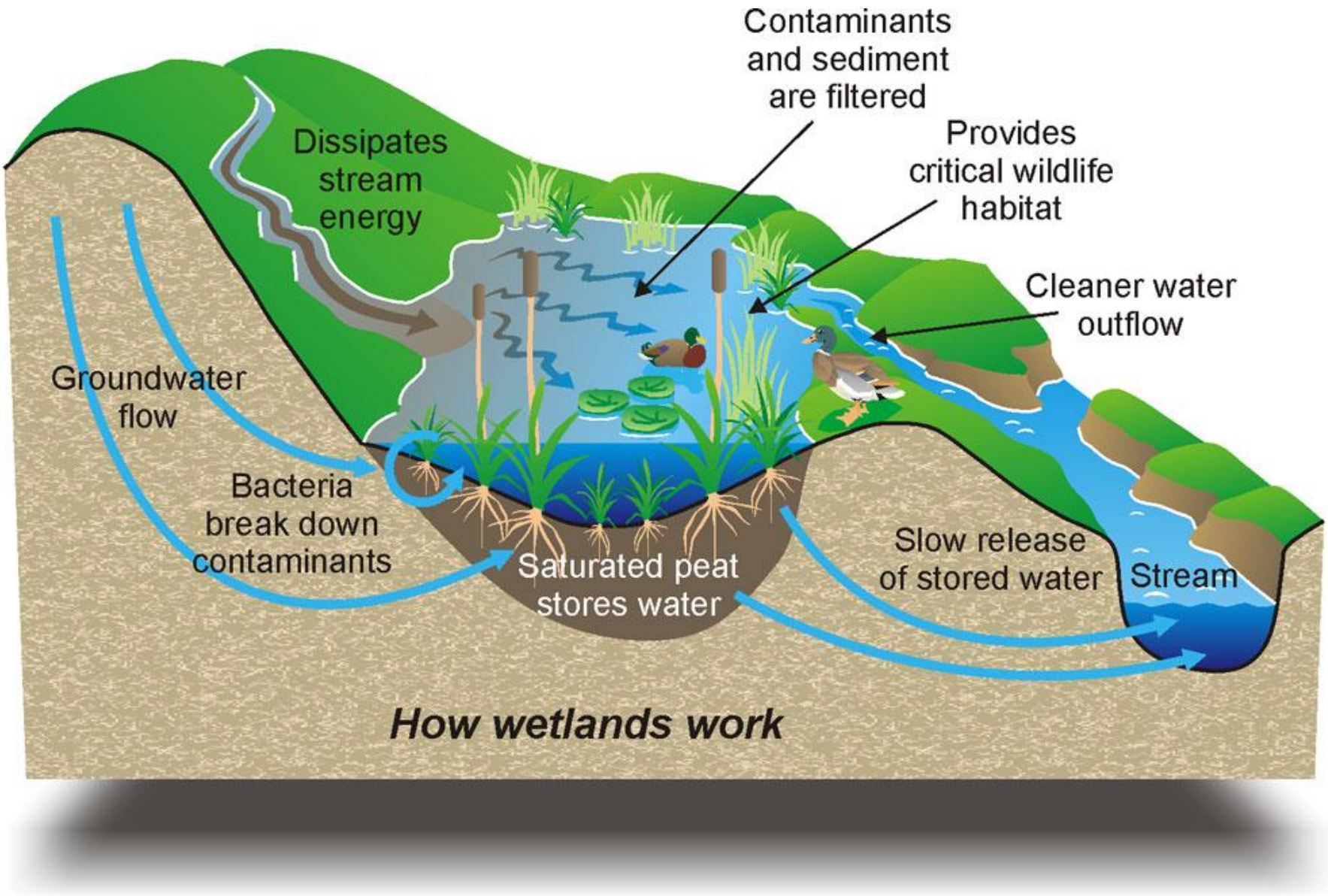
Humans depend on ecosystem services to thrive; ecosystems need and deserve our protection and care



Humans receive benefits from natural resources provided by ecosystems while also impacting and degrading the very same ecosystems that provide those resources.

Photo Credits
Streams, rivers & lakes: Paul Fusco, NRCS
Stream buffers: Lynn Betts, NRCS
Ground water: Dwight Burdette, Wikamedia (cc by 3.0)
Wetlands: Ron Nichols, NRCS
Natural land cover: Jessica Jahre, EPA contractor
Land mangement: Lynn Betts, NRCS
Pollution: Eric Vance, EPA
Invasive species: Jeremy McDonald, U.S. Forest Service
Hydrologic alteration: Laurie Bernstein, U.S. Forest Service
Biodiversity conservation: Eric Vance, EPA
Public health: Elizabeth Ferrer
Drinking water: Eric Vance, EPA
Recreation, culture, and aesthetics: Joe Peaco, NPS
Food, fuel, and materials: Eric Vance, EPA

This EnviroAtlas eco-wheel was created by Jessica Jahre, EPA contractor


Contaminants and sediment are filtered
Dissipates stream energy
Provides critical wildlife habitat
Cleaner water outflow
Groundwater flow
Bacteria break down contaminants
Saturated peat stores water
Slow release of stored water
Stream
How wetlands work

Natural disturbance

Novel disturbances

How ecosystems recover naturally from disturbance - succession

How ecosystems recover naturally from disturbance - microsites

Anthropogenic disturbance to maintain ecosystem services

Prescribed fires regenerate Puget Sound prairies providing a traditional food for the Coast Salish Tribes - camas

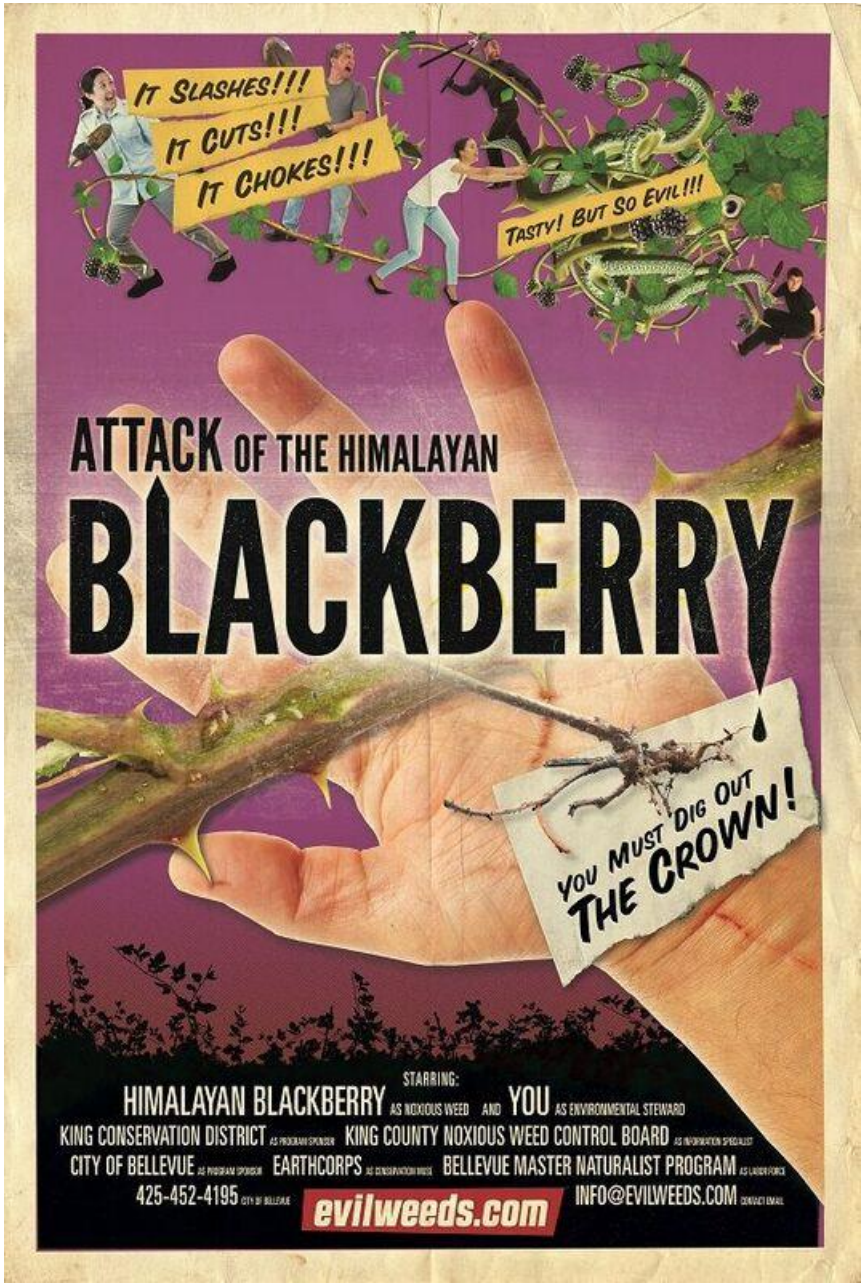
Novel anthropogenic disturbance disrupting ecosystem services– draining wetlands

Novel anthropogenic disturbance disrupting ecosystem services– clear cutting

What are invasive species?

Organisms introduced (usually by humans) from one ecosystem to another different (and often distant) ecosystem that causes disruption to the receiving ecosystem's processes resulting in diminished ecosystem functions/services

Example: Himalayan blackberry (*Rubus armeniacus*) introduced to the PNW by Luther Burbank (famous botanist) from central Asia (Armenia/Iran – 6,000+ miles away) in the early 1900s to be cultivated for fruit crops. They've become the most common invasive species now in the PNW.


IT SLASHES!!!
IT CUTS!!!
IT CHOKES!!!
TASTY! BUT SO EVIL!!!
ATTACK OF THE HIMALAYAN
BLACKBERRY
YOU MUST DIG OUT THE CROWN!
STARRING:
HIMALAYAN BLACKBERRY AS NOXIOUS WEED AND YOU AS ENVIRONMENTAL STEWARD
KING CONSERVATION DISTRICT AS PROGRAM SPONSOR
KING COUNTY NOXIOUS WEED CONTROL BOARD AS INFORMATION SPREADER
CITY OF BELLEVUE AS PROGRAM SPONSOR
EARTHCORPS AS CONSERVATION MUSCLE
BELLEVUE MASTER NATURALIST PROGRAM AS LABOR FORCE
425-452-4195 CITY OF BELLEVUE
evilweeds.com
INFO@EVILWEEDS.COM CONTACT EMAIL

What is Ecological Restoration?

The *process* of:

- Assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (Society for Ecological Restoration definition).

- Regaining diminished ecosystem functions through repairing the disruptions caused by novel human impacts; the work entails re-establishing and nurturing relationships especially an ecologically healthy relationship between nature and human culture (my definition).

Restoring the Earth
https://youtu.be/LvmpnDDt9t4

Forest Restoration in China
https://youtu.be/ILJBAv7qIEg

Forest Restoration in Ethiopia
https://youtu.be/AIZ0Qz3jICg

How is Ecological Restoration Done?

- ✓ The need for restoration is identified
- ✓ Interested parties (stakeholders) agree to cooperate, act, and gather resources
- ✓ Project managers (with stakeholders) define project site, goals, and objectives
- ✓ Site assessment is performed to identify disturbances and determine their causes, extent, intensity, and impacts to ecosystem services
- ✓ Site assessment information gets used to create a project design
- ✓ Project timeline set to plan & coordinate project phases & tasks

Project Phases

- ✓ *Mitigation* - disturbance (if ongoing) is prevented from continuing
- ✓ *Site preparation* – invasive control, earth moving, garbage removal, soil amendments
- ✓ *Infrastructure installation* – trails, campsites, viewing platforms, boardwalks
- ✓ *Habitat feature installation* – nest boxes, snags, woody debris
- ✓ *Plant installation*
- ✓ *Site closeout* – Repair damage done during construction
- ✓ *Baseline monitoring* – make a record of what was done
- ✓ *Site maintenance* – ensuring plant survival

Tomorrow's On-site Session

Location:

Sloped bank of stormwater treatment wetland between Jackson HS & Heatherwood MS

Activities :

Setting site boundaries & site assessment – we will be walking (carefully!) up and down sloped ground out in cold, but sunny conditions, so wear layers; boots are highly recommended – wet, slippery ground possible
Site preparation – we will be grubbing out Himalayan blackberry; you will get dirty

Information to be gathered for your project design :

Identify and locate past and ongoing disturbances
Identify and quantify existing plants
Inspect soils
Identify and locate existing native habitat