Ecology

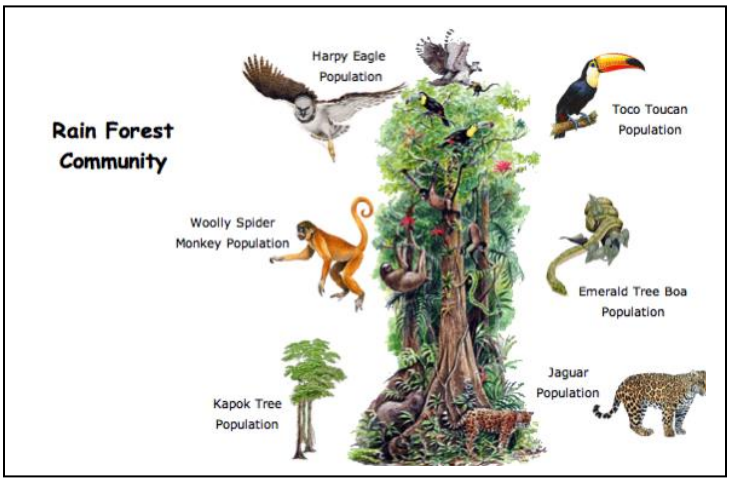
A. Definitions

1. abiotic – nonliving parts of the environment
   Ex : soil, water, weather, rocks, air

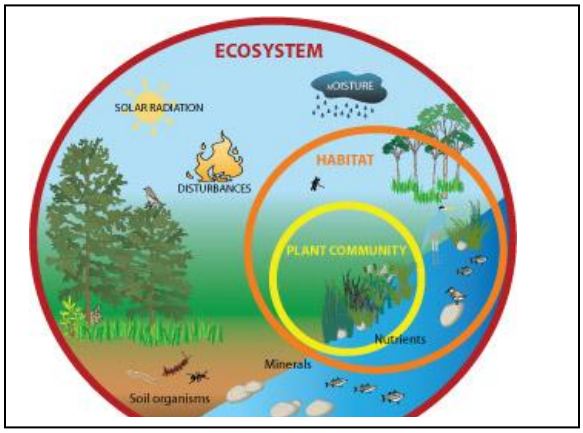
2. biotic – living parts of the environment
   Ex : plans, animals, bacteria

3. population – group of the same species living in the same place at the same time

4. community – group of different populations living together



5. ecosystem - a group of organisms in a community and their interactions with their abiotic environment



6. consumer / heterotroph – must eat food

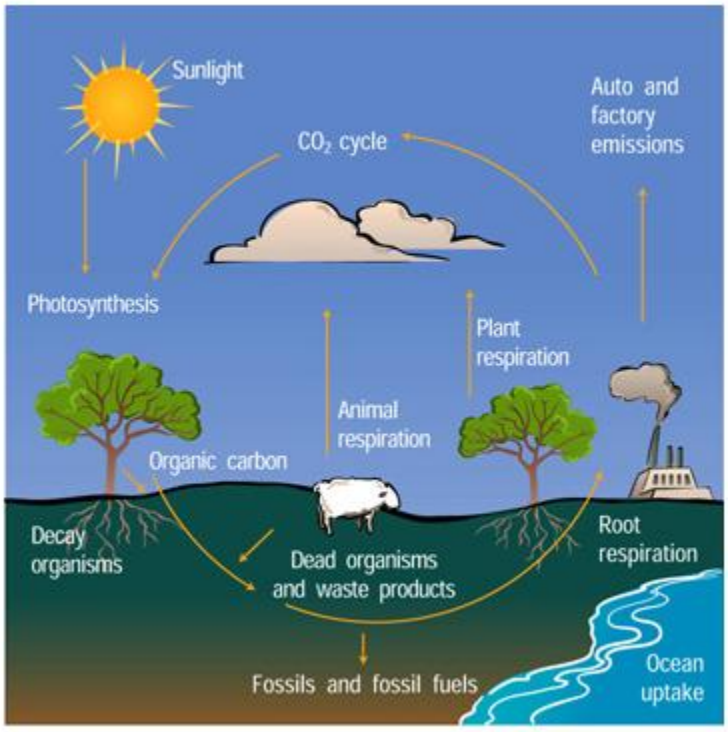
Types of consumers:

a. carnivore – organism that eats only meat Ex : lion, tigers
b. herbivore – organism that eats only plants Ex : cows, deer
c. omnivore – organism that eats both meat and plants Ex : humans, birds
d. decomposer – breaks down organic matter and recycles nutrients back into the soil
Ex : bacteria, fungi
e. scavenger – eats dead or decaying meat Ex : hawk, hyena

7. producer / autotroph – makes it owns food through photosynthesis or chemosynthesis
8. niche – the role an organism plays in its environment Ex : consumer, producer

B. **Carbon Cycle**

1. Carbon enters the atmosphere through
   a. respiration
   b. burning of fossil fuels (human activity)
   c. decomposition
2. Carbon is removed from the atmosphere through
   a. photosynthesis
3. Greenhouse effect : too much carbon in the atmosphere leads to the trapping of warm air close to the earth's surface; leads to global warming



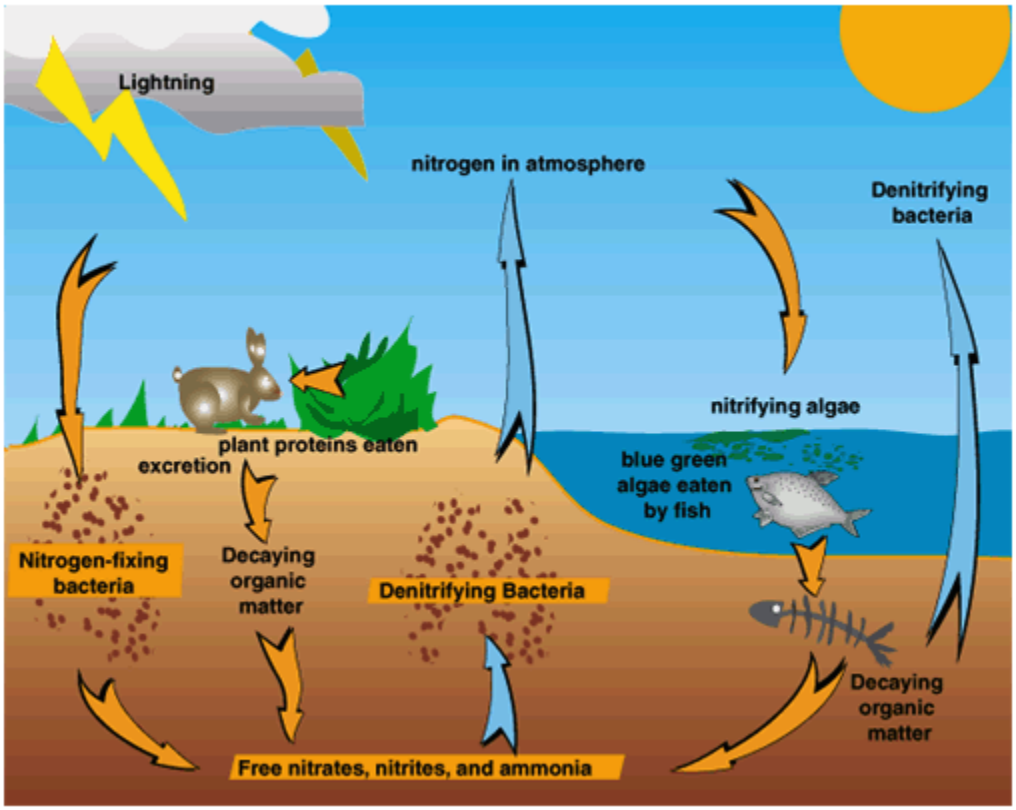
C. **Nitrogen Cycle**

1. nitrogen is found in the atmosphere in the form of a gas
2. nitrogen fixation – the changing of nitrogen gas into nitrogen solid

    Occurs by :

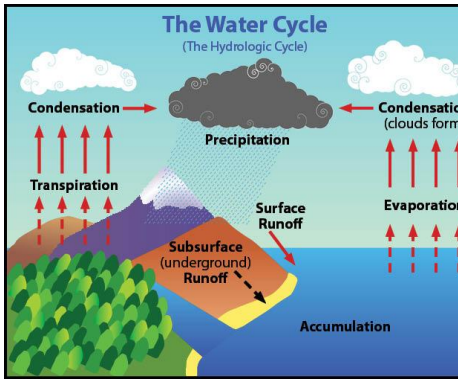
    a. nitrogen fixing bacteria

    b. lightning
3. plants take in nitrogen in to make proteins and DNA
4. animals eat the plants using the nitrogen to make their own proteins and DNA
5. animals excrete wastes and die returning nitrogen to the soil for plants to use



D. Water Cycle

1. Water moves up into the atmosphere through:
    a. condensation
    b. transpiration – loss of water from plant leaves
    c. evaporation
2. Water comes down through:
    a. precipitation



E. Factors that affect climate

1. greenhouse effect (global warming**)** traps warm air close to the earth's surface increasing temperatures
2. volcanic eruptions releases sulfuric dioxide, ash, and other harmful particles into the atmosphere

F. Recycling

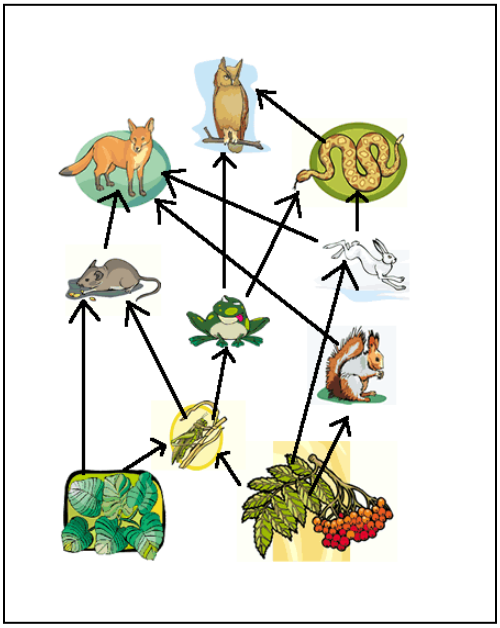
1. matter is recycled within ecosystems through **decomposers** (bacteria and fungi)
2. when decomposers decompose organic matter, whole parts break down into smaller parts that can be reused

G. Energy in the Ecosystem

1. **food chain** – shows how matter and energy move through an ecosystem
    a. ex : grass → insect → frog → snake
        producer → primary consumer → secondary consumer → 3rd consumer
    b. ex :

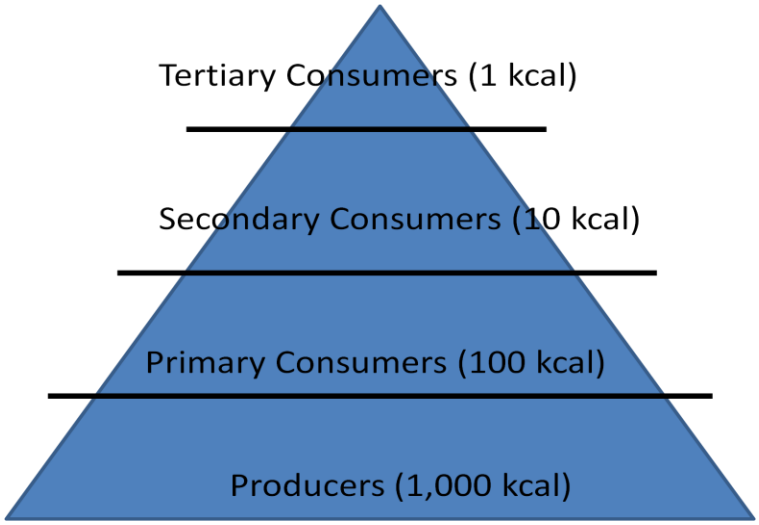
Algae → zooplankton → small fish → heron → bear
(producer) (1° consumer) (2° consumer) (3° consumer) (4° consumer)

2. **food web** – multiple food chains connected



3. energy transfer – only **10%** of energy is transferred from one organism to the next
    - 90% used by organism for hunting, metabolism, heat, etc
4. all energy originates from the sun which is continually being input into an ecosystem
5. plants convert the sun's energy into glucose which is a reactant for producing energy

6. decomposers recycle nutrients and return them back to the soil for plants to use
7. Pyramids – show how energy, numbers, or biomass decrease as you go up the food chain



Relationships

H. **Symbiotic Relationships** – relationships between species whereby one species ALWAYS benefits – 3 types

1. **mutualism** – both species benefit
   Ex : bees and flowers

2. **Parasitism** – one species benefits and the other species is harmed
   Ex : tick and dog

3. **Commensalism** – one species benefits and the other is unaffected

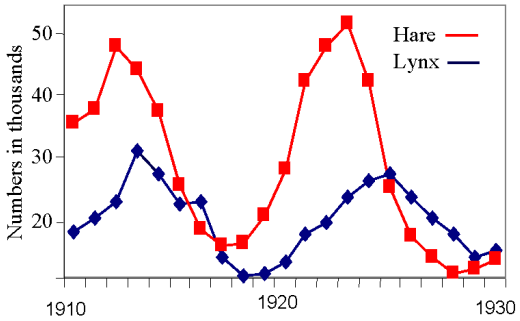
Ex : small fish and shark

I. **Competition** – 2 organisms competing for the same resources

1. different niches reduces competition for organisms sharing a habitat

J. **Predator/Prey** – predators rely on prey for food

Ex : lynx and hare



Population Dynamics

K. Increasing a population : based on:

1. food availability
2. water
3. territory
4. increased birth rate
5. decreased death rate

L. Decreasing a population : based on

1. lack of resources
2. disease
3. decreased birth rate
4. increased death rate

M. Factors Influencing birth and death rates

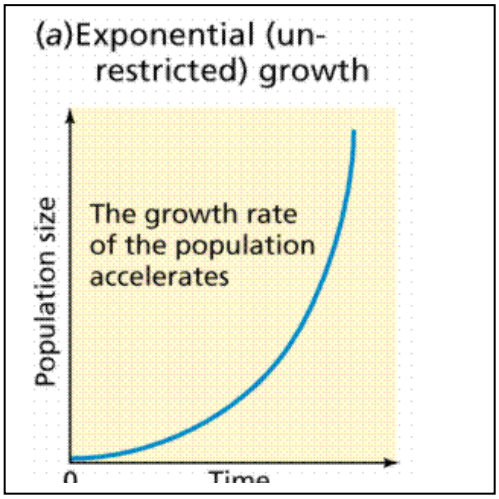
1. disease
2. resources (food, water, territory)
3. courtship / mating
4. number of organisms

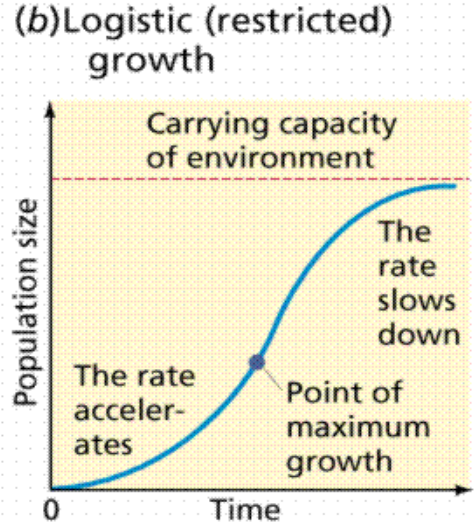
N. **Carrying Capacity** – the maximum number of organisms an ecosystem can support

1. based on **limiting factors** – factors that limit the size of a population – 2 types
    a. density dependent limiting factors – limits the size of a population based on the number of organisms in an area
    ex : food, water, territory, disease
2. density independent limiting factors –limits the size of a population regardless of the number of organisms in an area
    ex : climate

O. **Exponential growth** – population doubles

1. due to lack of limiting factors
2. J growth graph
    a. human population growth
    b. no carrying capacity
3. S growth graph





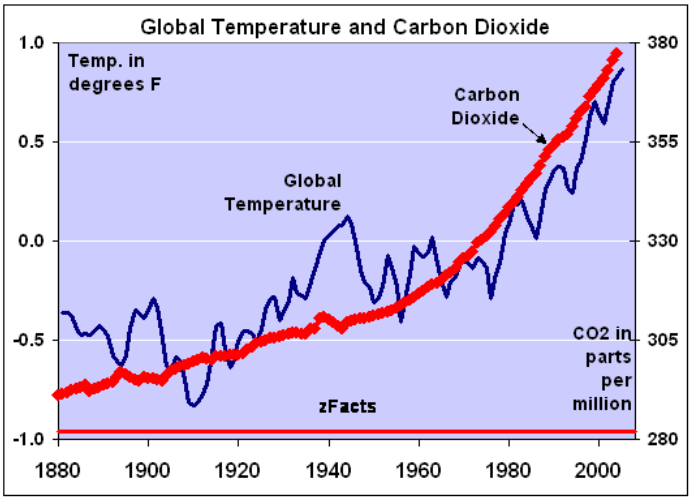
P. **Dynamic Equilibrium** – populations fluctuate with birth and death rates, but the overall size of the population is maintained

<u>Human Impacts</u>

Q. **Global Warming** – trapping of warm air close to Earth's surface due to emission of greenhouse gases such as H2O vapor, CO2 & methane

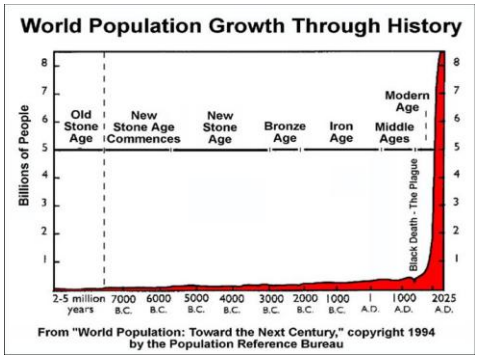
1. increased burning of fossil fuels can cause greenhouse effect (natural phenomenon) to be more pronounced
2. fossil fuels – non renewable resources that are formed over millions of years under the earth's surface from dead organisms, rich in carbon and energy.
3. Results in increase in global temperatures, melting of polar ice caps, increased sea level
4. loss of habitat for polar species (such as the polar bear)
5. islands becoming submerged
6. humans activities (increased burning of fossil fuels, cars, industrial revolution) → lead to increased CO2 emissions

7. more people → more energy needed → more CO2 emission → increased global Warming
8. CFCs – (chloroflorocarbons) cause ozone depletion



R. **Population growth**

1. risen exponentially since the Industrial Revolution
2. lower infant mortality
3. lower death rate
4. longer life span due to better health care and technology
5. at 7 billion



6. Have not yet reached carrying capacity. Unknown as to when we will reach the CC.
7. increased use of natural resources
8. loss of habitats
9. **Human population pyramids:** Age structure diagram showing the distribution of various age groups in a human population in a certain area
   a. Faster growth = larger proportion are in the younger age groups.

Ex. Mexico, India

Ex. USA

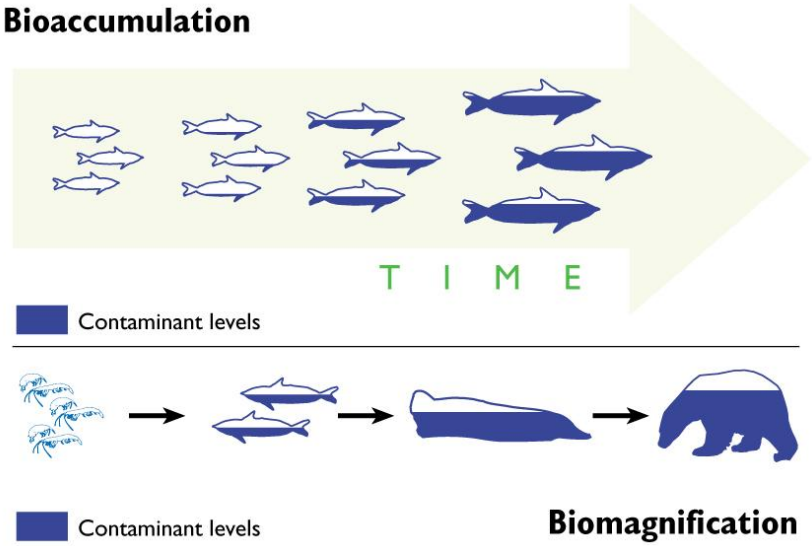
Ex. Japan, Italy

Ex. Ukraine, Russia

S. **Acid Rain**– caused by pollution in atmosphere (nitrogen and sulfur oxides) which is given off into the atmosphere and creates precipitation that is acidic
   1. Affects org that depend on water (especially amphibians)
   2. Habitat degradation (limestone erosion, aquatic ecosystems)

T. **Eutrophication** – caused by too many nutrients in a small body of water
   1. creates algal blooms that can lead to fish kills due to lack of dissolved O2
   2. result of run-off (of fertilizer) from farmland, waste lagoons on hog farms (high in nutrients)

U. **Environmental toxins:** can **bioaccumulate** (toxins accumulate in cells as org move up the food chain)



   1. **Lead** – heavy metal found in batteries, old paint and pipes, industrial use
      a. Lead poisoning can lead to tissue damage (heart, lungs, nervous sys, bones,etc.)
      b. Can cause learning and behavior problems in children
   2. **Mercury** – major source is in fish (bioaccumulation) from pollution washing mercury into water.
      a. Can damage brain, kidneys, lungs
      b. Neurological problems in children
   3. **DDT** – chemical used to kill mosquitoes (not used anymore)
      a. Bioaccumulation → predatory birds eating insects sprayed with DDT
      b. Result - thin egg shells
      c. Ex. Peregrine falcon (endangered species)

V. **Invasive species** (exotic, non-native species):
   1. Compete with native species
   2. Grow fast, decrease biodiversity
   3. Ex. Kudzu (Japanese vine), zebra mussel, snakehead fish

Kudzu

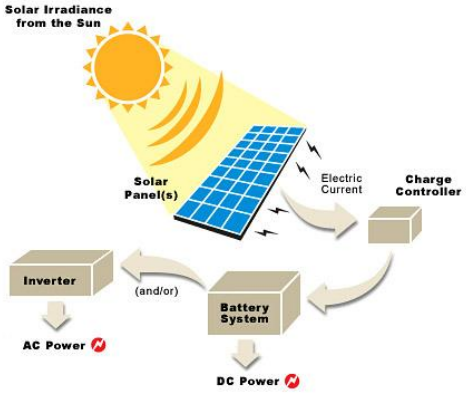
W. **Habitat Destruction**:

1. Loss of habitat due to human population growth in areas mining, agriculture, etc.
2. Deforestation / Clear cutting - Can result in a loss of biodiversity (extinction of species), soil erosion,

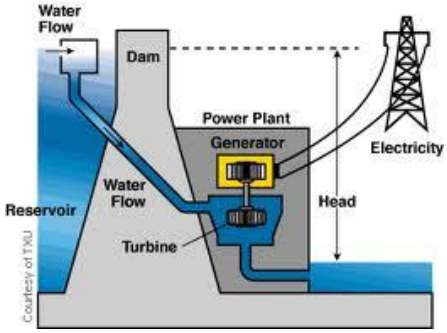
X. Natural Resources

1. Use of natural resources can cause damage to the environment (mining, clear cutting, deforestation, etc.)
2. Sustainability – using resources in such a way that they will be available in the future
3. Sustainable agriculture – alternating crops from year to year in the same field to maintain nutrients in the soil

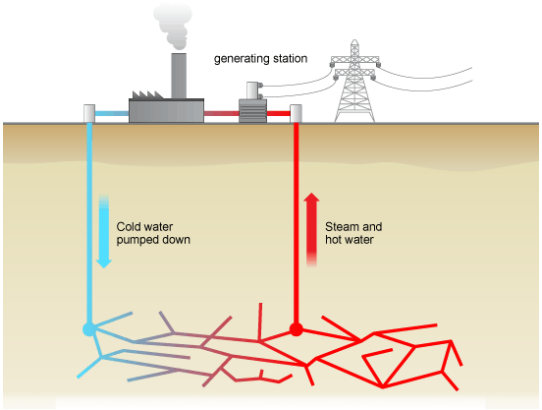
4. Use of renewable energy resources
   a. **Solar**: Direct use of sun's rays for heat and electricity



   b. **Hydroelectric**: Falling water, drives turbines to produce electricity

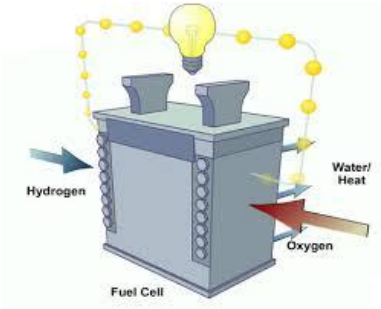


c. **Geothermal**: tapping underground hot water/steam → electricity

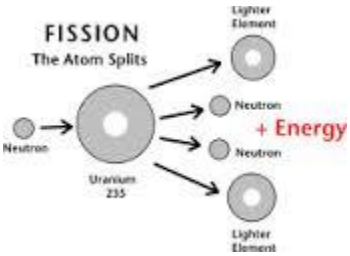


d. **Wind**: wind harnessed → electricity

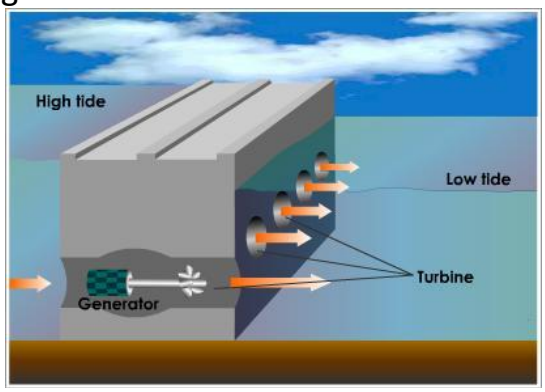
e. **Hydrogen**: hydrogen cells generate electricity



f. **Nuclear**: release energy through nuclear fission



g. **Tidal**: tides drive turbines → electricity



5. Reduce **carbon footprint** – measuring how much carbon dioxide every individual releases into the atmosphere and minimizing output.
6. **Conservation** has the purpose of sustainable use
    a. **Natural parks** – protect natural habitat
    b. **Zoos** – education, reintroduction programs for endangered species
7. **Preservation** has the purpose of maintaining resources without using/minimal disturbance
    a. in some natural reserves, no humans are allowed to enter (ex. Areas of NC coastline during sea turtle nesting season)

Y. Stewardship & Conservation Methods

1. **Stewardship** – use resources in such a way that it is sustainable and can be available for future generations
    a. laws in place to help enforce this
    b. in the US – Environmental Protection Agency (EPA), US Fish and Wildlife Service (USFWS), Endangered Species Act (ESA)
    c. International regulation: International Union for the Conservation of Nature – regulate illegal trading of wildlife (endangered species)
2. Fish and hunting licenses in order to manage certain wildlife species, limits on number of animals that can be caught within a certain time, hunting/fishing only during certain seasons
3. Examples of sustainable conservation
    a. sustainable agriculture – natural windbreaks on farms using trees to prevent soil erosion
    b. sustainable fishery – using lead-free tackle, practice catch & release (unless hooking an invasive species), keeping track of boat carbon emissions