

ECOLOGY

Community & Family medicine
First year 2018-2019

By: Dr. Maysaloon Ahmed Khudhair



Ecology:

- the study of the interactions of living things with each other and their physical environment



Ecological Organization:

1. Population: all the members of a species inhabiting a given location
2. Community: all the interacting populations in a given area
3. Ecosystem: the living community and the physical environment functioning together as an independent and relatively stable system

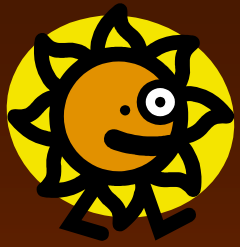


4. Biosphere: that portion of the earth where life exists

a. The biosphere is composed of numerous complex ecosystems.

b. An ecosystem involves interactions between abiotic (physical) and biotic (living) factors. The members of the community in the ecosystem and environment must interact to maintain a balance.





An ecosystem is **self-sustaining** if the following requirements are met:

1. A **constant source of energy** and a living system capable of incorporating this energy into organic molecules.
2. A **cycling of materials** between organisms and their environment.



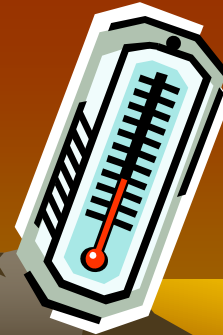
Abiotic factors:

- those physical and chemical factors which affect the ability of organisms to survive and reproduce



Some Abiotic Factors:

1. intensity of light
2. range of temperatures
3. amount of moisture
4. type of substratum (soil or rock type)
5. availability of inorganic substances such as minerals
6. supply of gases such as oxygen, carbon dioxide, and nitrogen
7. pH



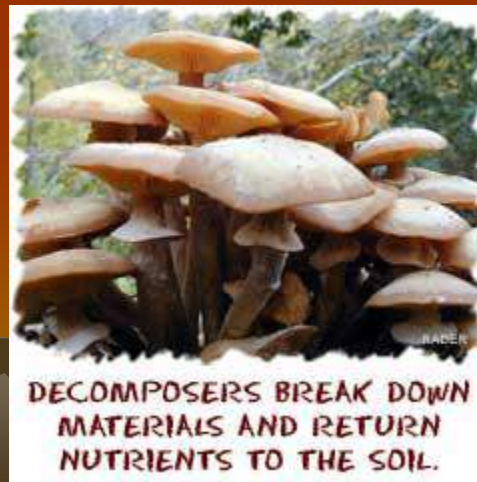
Some examples:

1. A low annual temperature common to the northern latitudes determines in part the species of plants which can exist in that area.
2. The amount of oxygen dissolved in a body of water will help determine what species of fish live there.
3. The dry environment of desert regions limits the organisms that can live there.



Carrying Capacity

- the **maximum** number of organisms the resources of an area can support
- The carrying capacity of the environment is **limited by the available abiotic and biotic resources**, as well as the ability of ecosystems to **recycle the residue of dead organisms** through the activities of bacteria and fungi.

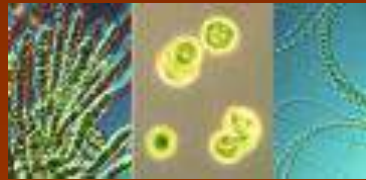


- **Steady State** - this occurs when the population remains relatively constant over a number of years. This will occur when the number of births equals the number of deaths.



Nutritional Relationships:

A. **Autotrophs**: can **synthesize their own food** from inorganic compounds and a usable energy source



B. **Heterotrophs**: can **NOT** synthesize their own food and are **dependent on other organisms for their food**





Types of Heterotrophs:

Saprophytes: include those heterotrophic plants, fungi, and bacteria which live on dead matter - AKA decomposers

Herbivores: plant-eating animals

Carnivores: meat-eating animals

Omnivores: consume both plants and meat



Types of Carnivores:

- **Predators:** animals which kill and consume their prey
- **Scavengers:** those animals that feed on other animals that they have not killed



It's a Jungle out there!

by HAGEN



You see son, this way, we are the first to know!
Yak, Yak, Yak...

Symbiotic Relationships:

- **Symbiosis:** living together with another organism in close association
- Types of (symbiosis):

MUTUALISM



PARASITISM



COMMENSALISM



1. **Commensalism**: one organism is benefited and the other is unharmed

ex. barnacles on whales, orchids on tropical trees

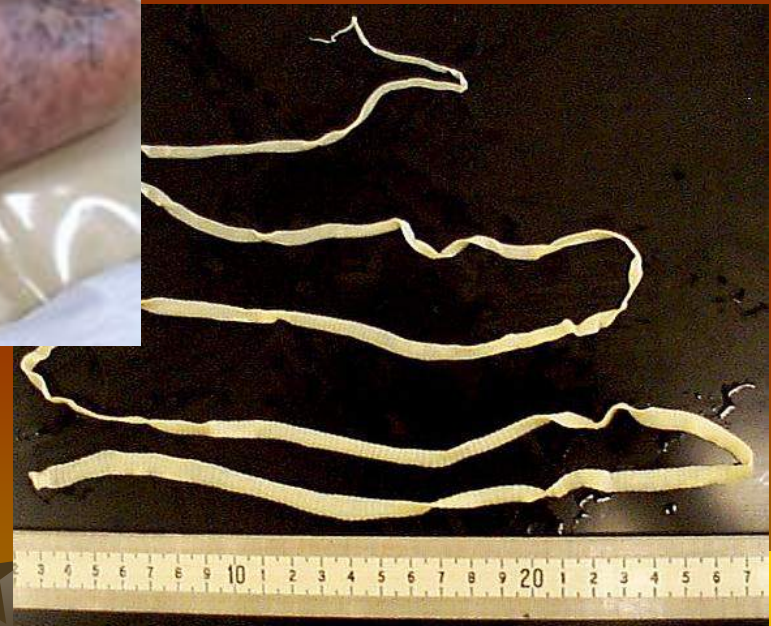


2. **Mutualism**: both organisms benefit from the association

ex. nitrogen-fixing bacteria on legume nodules, certain protozoa within termites (also ruminants)



3. **Parasitism**: the parasite benefits at the expense of the host
- ex. athlete's foot fungus on humans,
tapeworm and heartworm in dogs

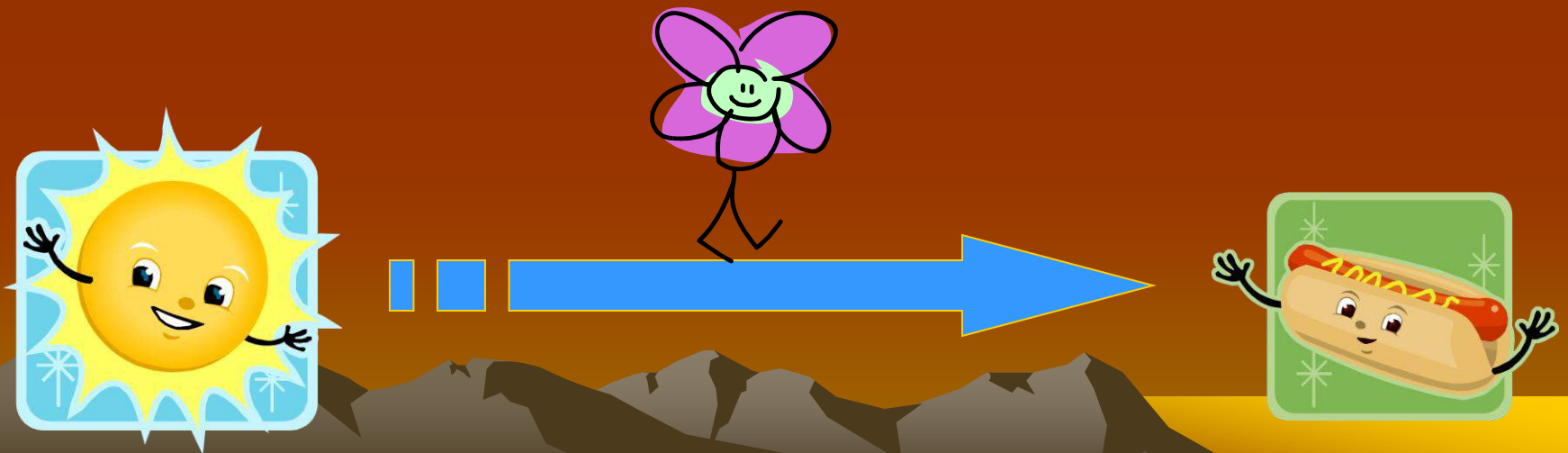


Food Chains and Webs:

- If an ecosystem is to be self-sustaining it must contain a **flow of energy**.
- Those life activities that are characteristic of living organisms require an **expenditure of energy**.



- The pathways of energy through the living components of an ecosystem are represented by **food chains and food webs**.
- **Producers** convert the radiant energy of the sun into the chemical energy of food.



Food Web Interactions:

1. **Producers:** (plants) -- the energy of the community is derived from the organic compounds in plants
 - (grass in the web above)



2. Primary Consumer: (always a herbivore)

- feeds on plants (mice, grasshoppers, and rabbits in the web above)



3. **Secondary Consumer:** (always a carnivore)
-- feeds upon other consumers (frogs, sparrows, snakes, and foxes above)
(The hawk is a secondary or 3rd level consumer depending on the availability of food.)

Omnivores may be primary or secondary consumers.



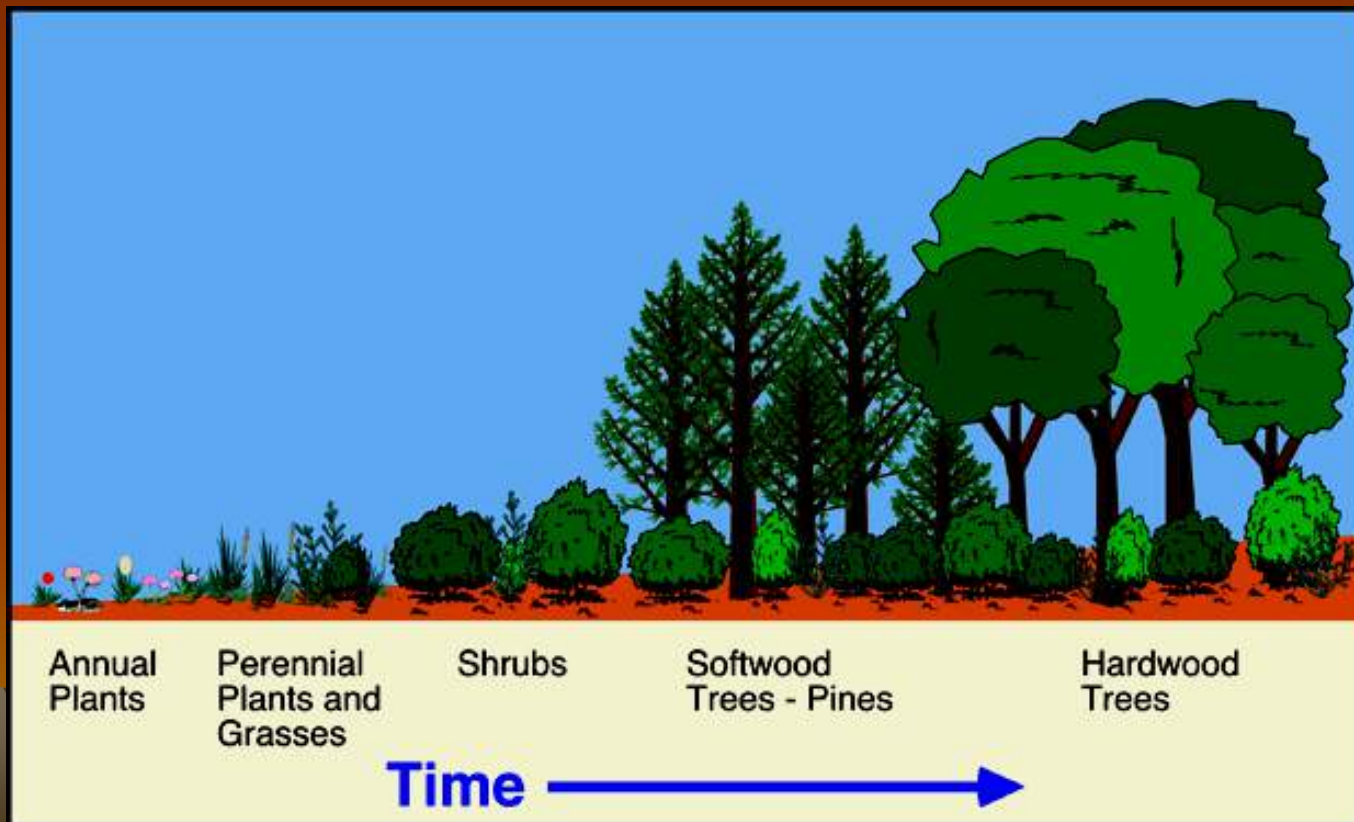
4. **Decomposers**: break down organic wastes and dead organisms to simpler substances (ex. bacteria of decay)

** Through decomposition, chemical substances are returned to the environment where they can be used by other living organisms.



Succession:

- replacement of populations in habitat as it moves toward a stable state
(determined by changes in plants)



- The environment may be altered in substantial ways through the activities of organisms, including humans, or when the climate changes.
- Although these alterations are sometimes abrupt (ex. Natural disasters), in most cases species replace others, resulting in long-term gradual changes in ecosystems.



- Ecosystems tend to change with time until a **stable system** is formed.
- The type of ecosystem that is formed depends on the **climatic limitations** of a given geographical area.



Pioneer Organisms:

- The **first organisms to inhabit** a given location (ex. lichens on bare rock)
- Pioneer organisms **modify their environment**, thus establishing conditions under which **more advanced organisms can live**.
- (ex. seasonal dieback and erosion, for example, would create pockets of "soil" in the crevices and hollows of the bare rock inhabited by the lichen)



- ** Each community modifies its environment, often making it more difficult for itself and, apparently, more favorable for the following community which infiltrates the first community over a period of years.



- **Primary Succession:** the development of plant communities on newly formed habitats that previously lacked plants (ex. a lava flow)



- **Secondary Succession:** return of an area to its natural vegetation following a disruption or removal of the original climax community



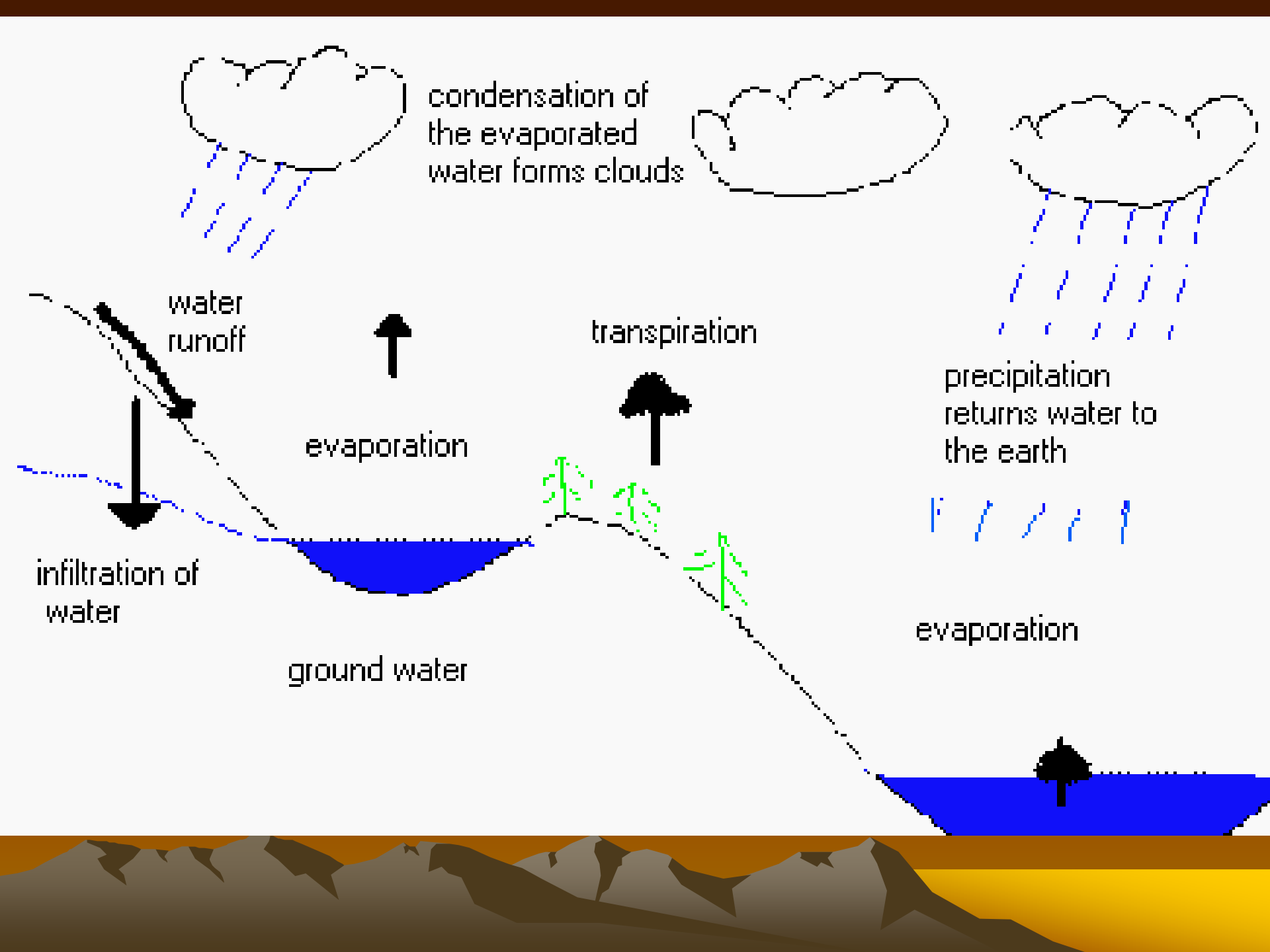
- **Niche** (Job): the organism's role in the community, particularly its role in relation to food with other species.
- **Habitat** - a place where a plant or animal can get the food, water, shelter and space it needs to live.



Water Cycle

- involves the processes of photosynthesis, transpiration, evaporation and condensation, respiration, and excretion





Biomes

Explore the World Around
You!



What is a Habitat?

- A habitat is a place where a particular animal or plant species lives.
- An artificial habitat is a man made place.
- A Biome is



Which habitats do you recognize?

- Desert
- Rain Forest
- Tundra
- Prairie
- Grassland
- Forest
- Marine
- Zoo



Disruption of Existing Ecosystems

- **Urbanization** - growth of cities has destroyed land and wetlands ruining natural habitats



- **Importation of Organisms** - Organisms without any known predators in our area have accidentally been brought to this side of the world.



- Examples: Japanese beetles, Gypsy Moths, Dutch elm disease.
- Since there are now natural enemies for these organisms, they have reproduced at a rapid rate and have caused a lot of damage to plants and crops.




- **Poor farming practices** - overuse of fields, over grazing by animals and erosion of land.
- When crops are harvested, the plants which contain essential nutrients that should be returned to the soil are also taken away.
- Therefore the ground is less fertile and will eventually not be able to support crops.



- **Misuse of Pesticides** - The use of pesticides has disrupted food chains.
- Examples: DDT has killed beneficial insects. DDT does not break down and eventually becomes concentrated at dangerous levels within the soil.

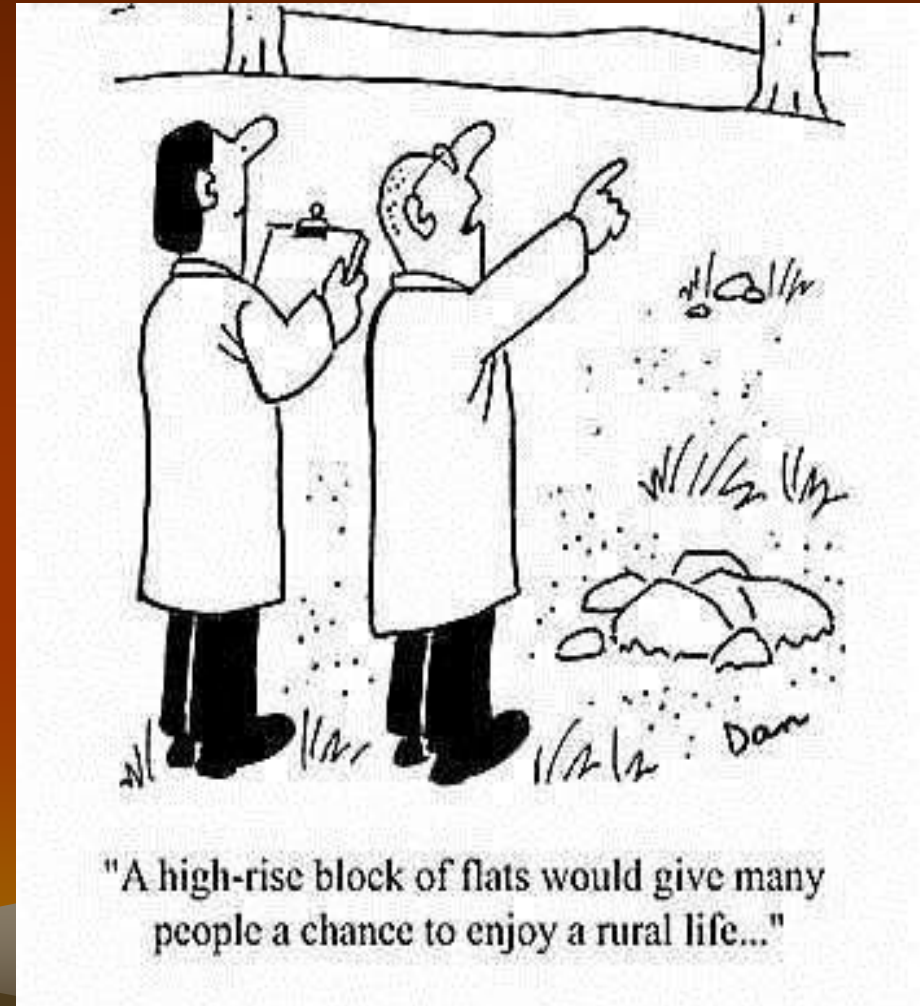


Natural Ecosystem Processes

- Natural ecosystems are involved in a wide variety of **natural processes** influencing humans and other organisms.
 - The activities of humans in the environment are changing many of these natural processes in a **harmful fashion**.
- 

Maintenance of atmospheric quality

- Human activities (namely **Urbanization & Industrial Growth**) have increased the amount of **Pollutants** in the atmosphere, negatively affecting the environment (acid rain)

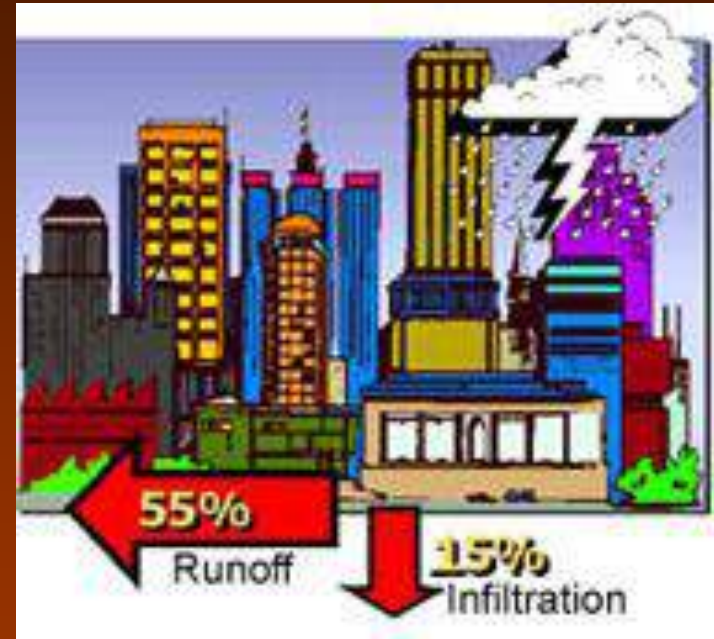
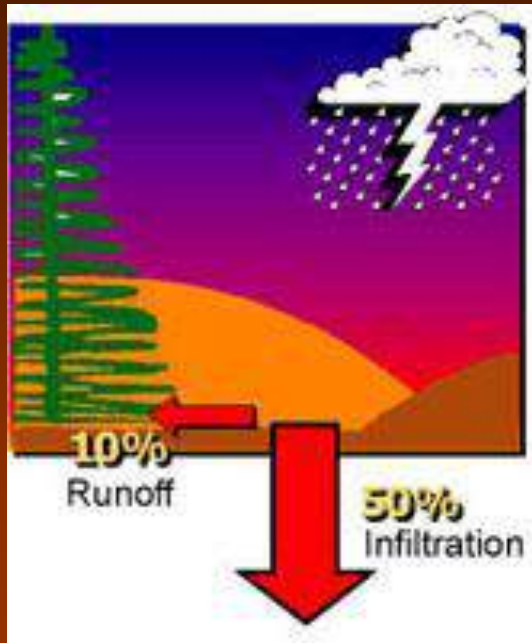


Generation of soils



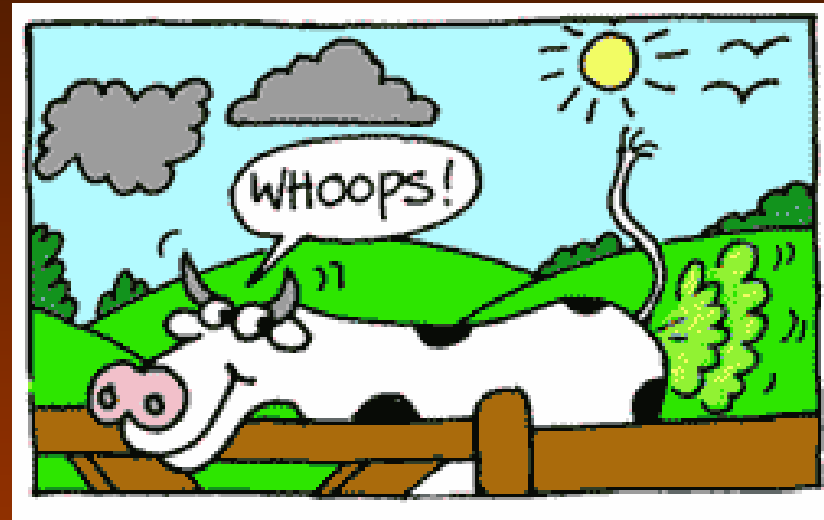
- Agricultural practices have exposed soil to the weather resulting in **great loss of topsoil.**

Control of the water cycle



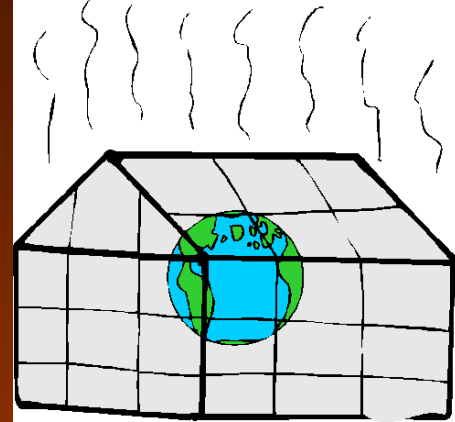
- The cutting of forests and other human activities have allowed increased **uncontrolled runoff** leading to increased **erosion and flooding**.

Removal of Wastes



- Untreated **sewage wastes** and runoff from farms and feedlots have led to increased water pollution.

Energy Flow

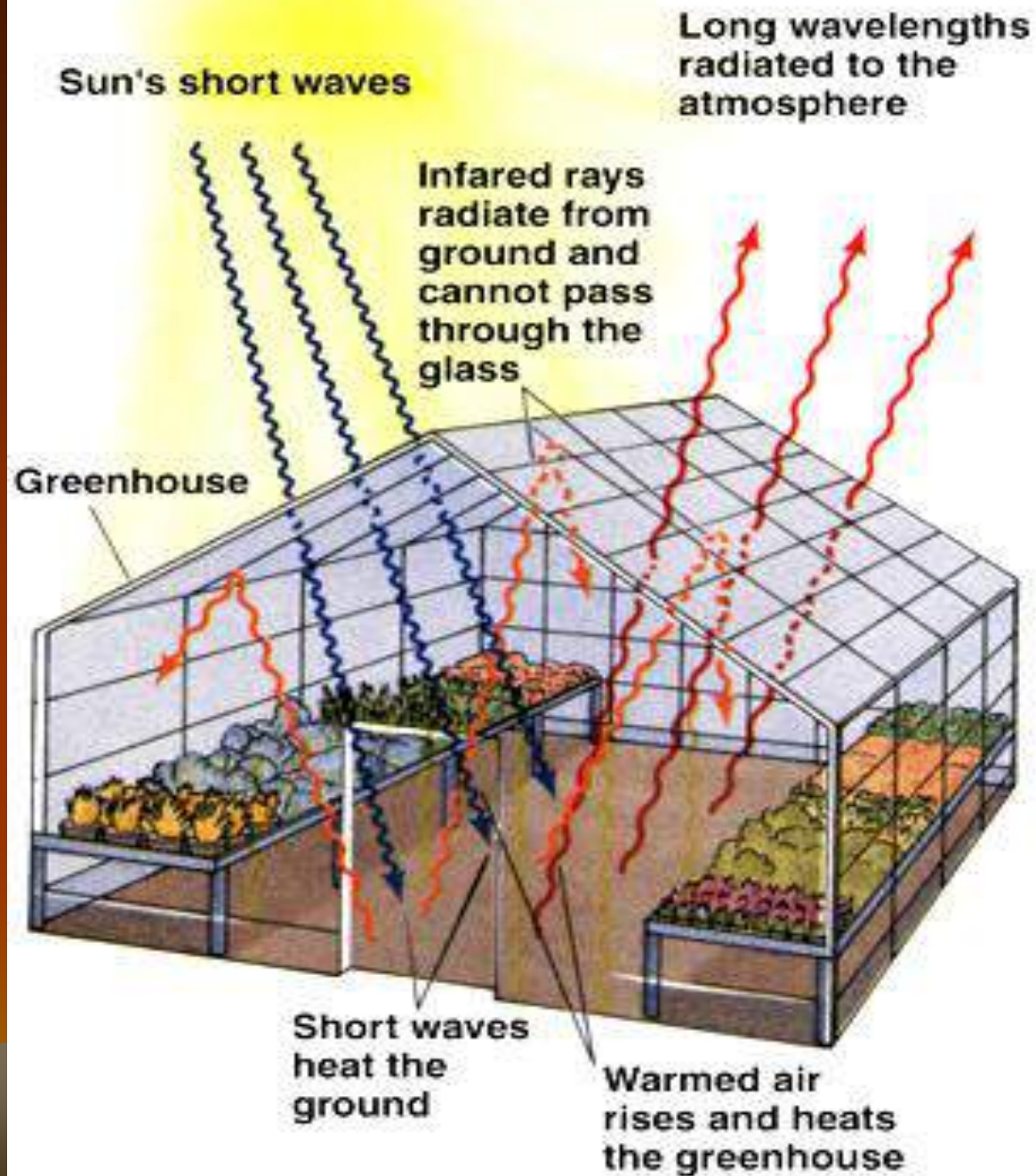


- Some industries and nuclear plants have added **thermal pollution** to the environment. The release of some **gases** from the burning of fossil fuels may be slowly increasing the Earth's temperature.
-- (Greenhouse Effect)

Major Greenhouse Gases

- Carbon Dioxide (CO₂)
- Methane (CH₄)
- Other man-made gases





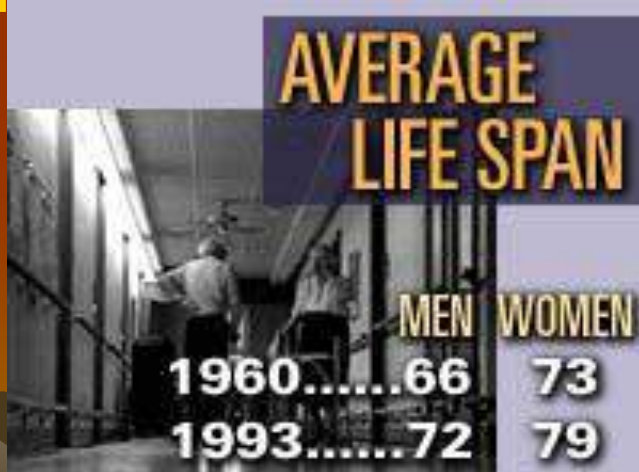
Nutrient Recycling



- The use of packaging material which does not break down, burning of refuse, and the placing of materials in **landfills** prevents the return of some useful materials to the environment.

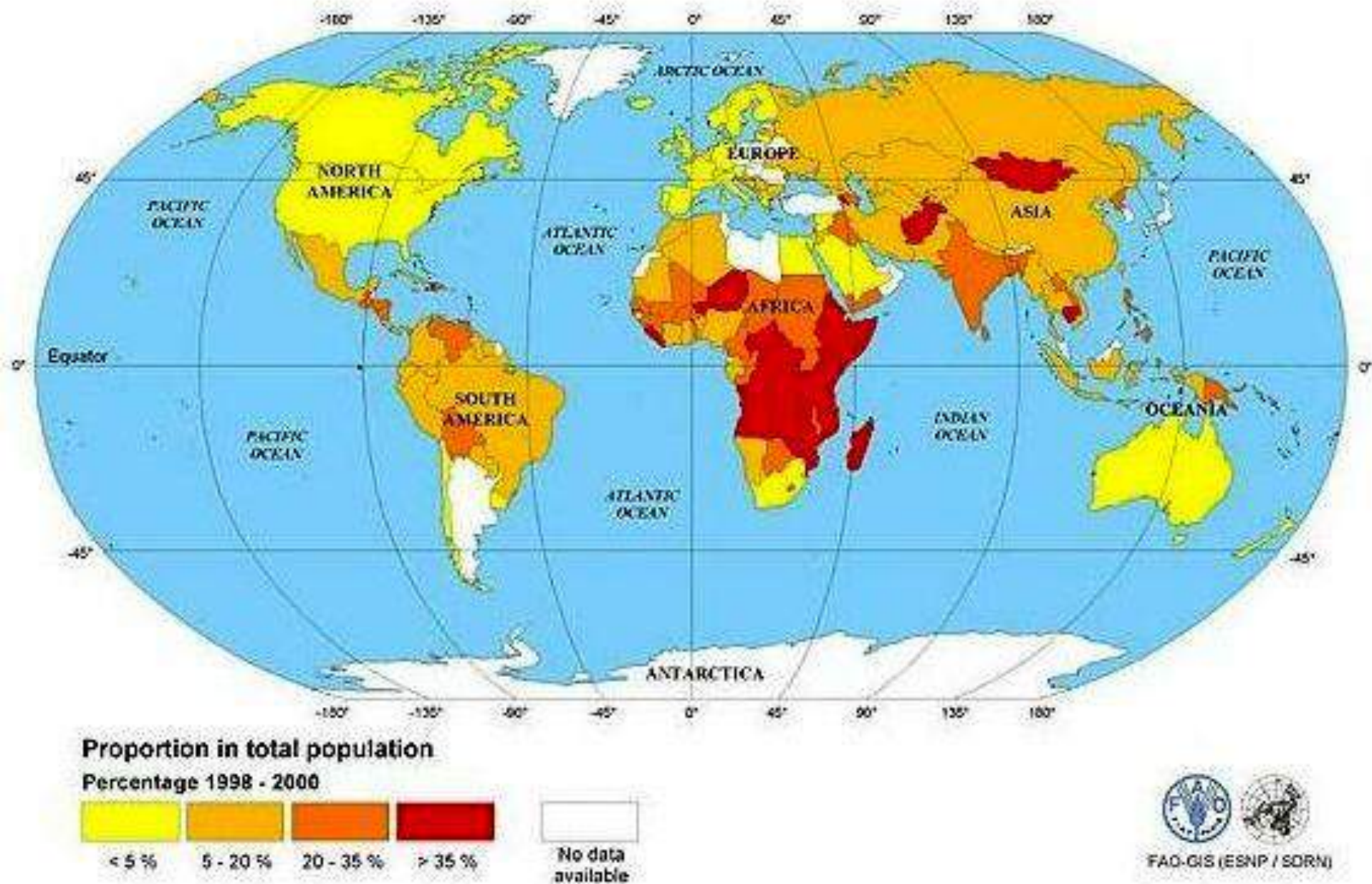
Some specific human influences on Ecosystem Factors

- A. Increasing numbers:
- results from an **increased** human life span
- **health** advances largely led to this



- B. Food: **shortages and inadequate nutrition** lead to starvation and malnutrition
 - **population growth** is outpacing food production in many world regions
 - **starvation**: body lacks sufficient calories for maintenance
 - **malnutrition**: diet lacks specific substances needed by the body

World Starvation % of Population



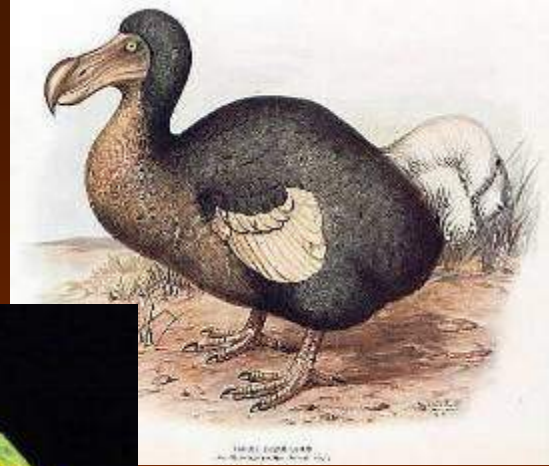
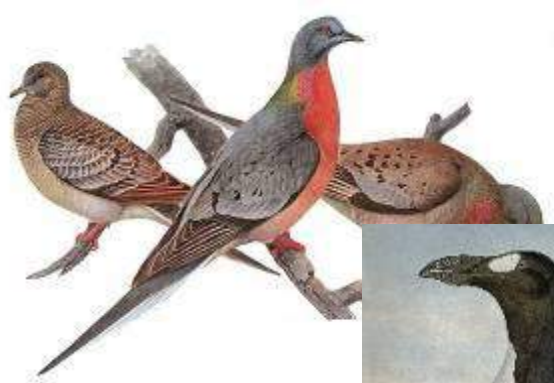
- **C. Soil: much loss of fertile topsoil due to erosion and poor management**
 - the use of biocides has contaminated the soil (no prior assessment was taken of their environmental impact)
 - some causes of topsoil loss include; cutting forests, farming dry grasslands, damming rivers, draining wetlands, etc.
 - much valuable farmland has been lost due to increasing urbanization & suburbanization



- **4. Water: cutting forests has led to increased, uncontrolled runoff**
 - water pollution leaves water unfit for use and the living things remaining in it unfit for consumption (typical water pollutants include **phosphates, heavy metals, and PCB's**)

Biomagnification

- increase in the **concentration** of a substance (poison) in **living tissue** as you move up the food chain
 - (ex. tuna and swordfish, water birds and birds of prey from **DDT** -- thin shelled eggs)
 - This has particularly hurt the peregrine falcon & bald eagle.



- **5. Wildlife: much destruction and damage has been done to many species (hunting, fishing, etc.)**
 - ex. passenger pigeon, dodo, great auk, bison, Carolina parakeet

- ** Other problems include **habitat destruction**, **importation** of some organisms have caused problems for native organisms.
- We have **alien invasive species** which have caused problems for our area in New York. These include the Water Chestnut, E milfoil, Alewife, Z and **Purple Loosestrif**





Remember the Simpson episode where Bart calls Australia to see which way the toilet flushes?



He brings with him a frog and it takes over the country and on the way home, a koala hands on to the Simpson's helicopter!



Photo credit: California Energy Commission

The world currently relies on fossil fuels – oil, coal and gas – for most of its energy¹¹

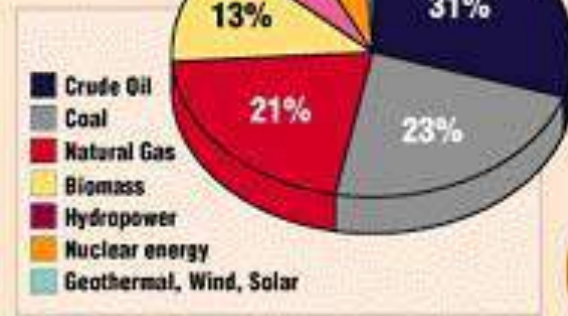
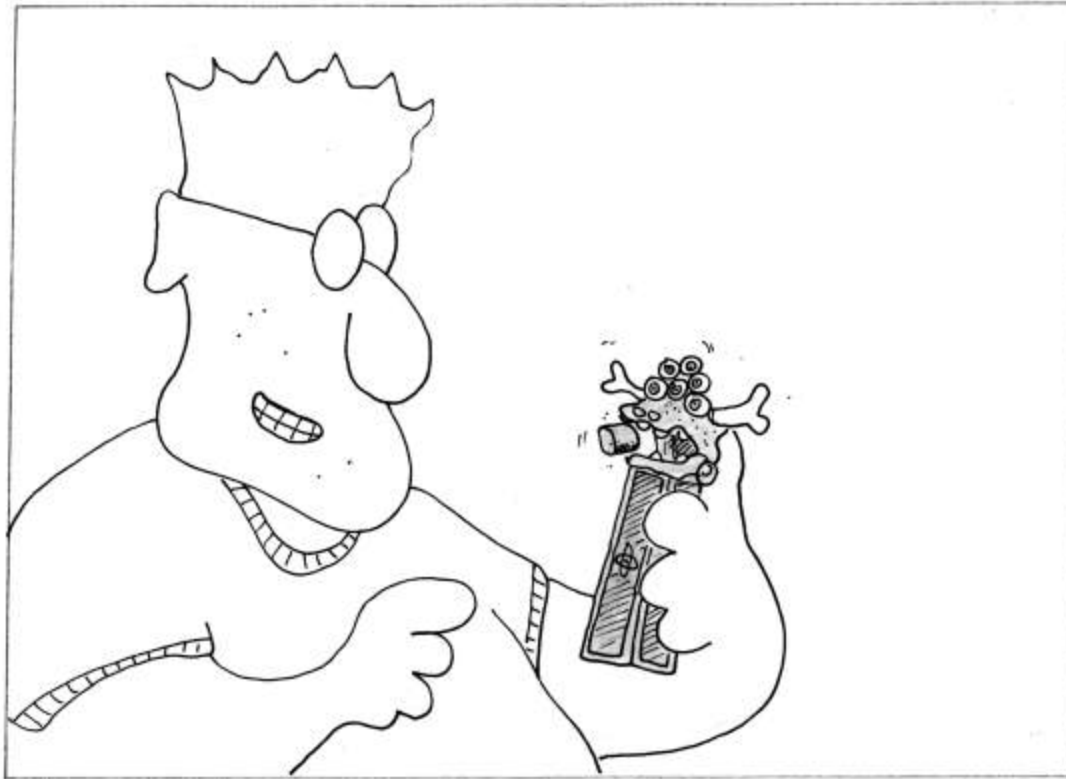
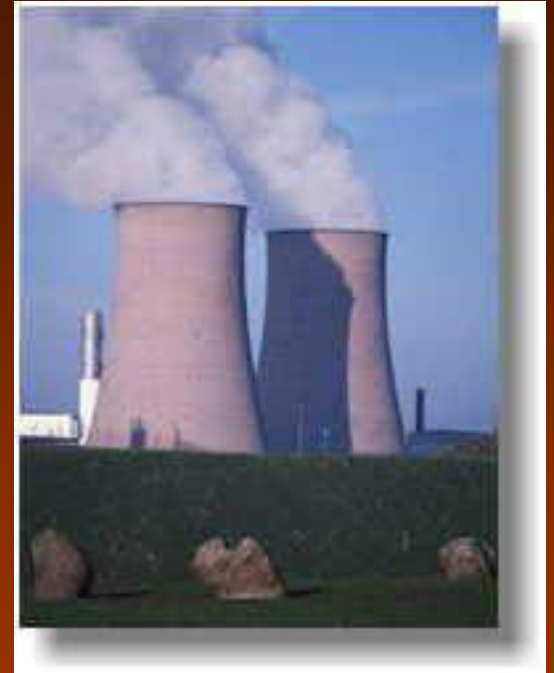


Photo credit:
American Coal Foundation

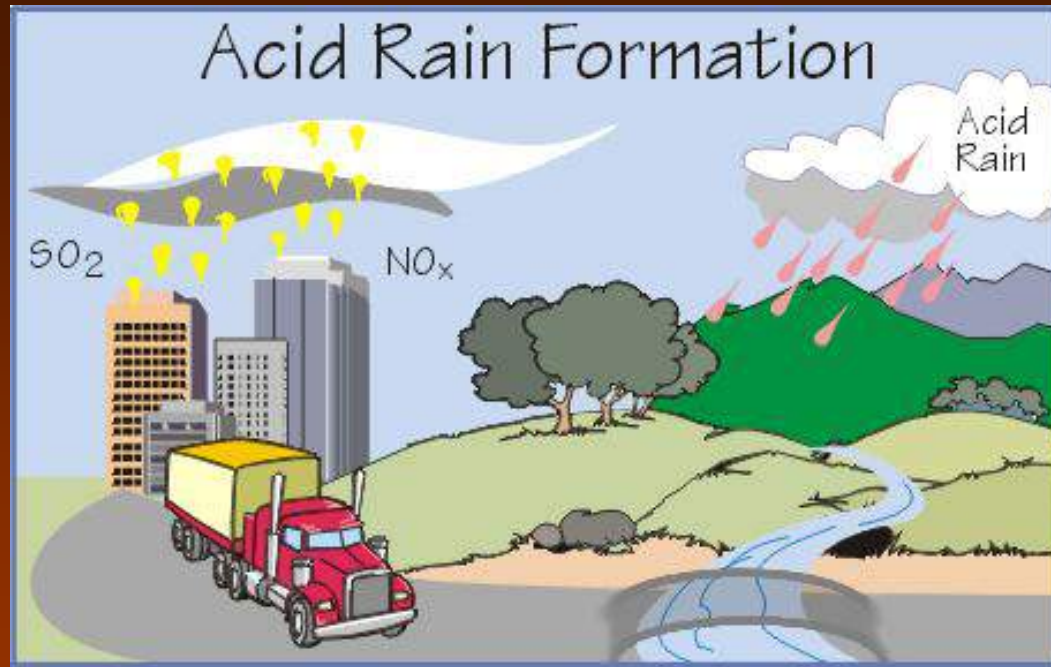
- **6. Fossil Fuels:** are becoming rapidly depleted/add to air pollution problems
 - The search and demand for additional energy resources also impact ecosystems in a negative way.
 - Industrialization has brought an increased demand for and use of energy.



The Pez mutant nuclear fuel pellet dispenser




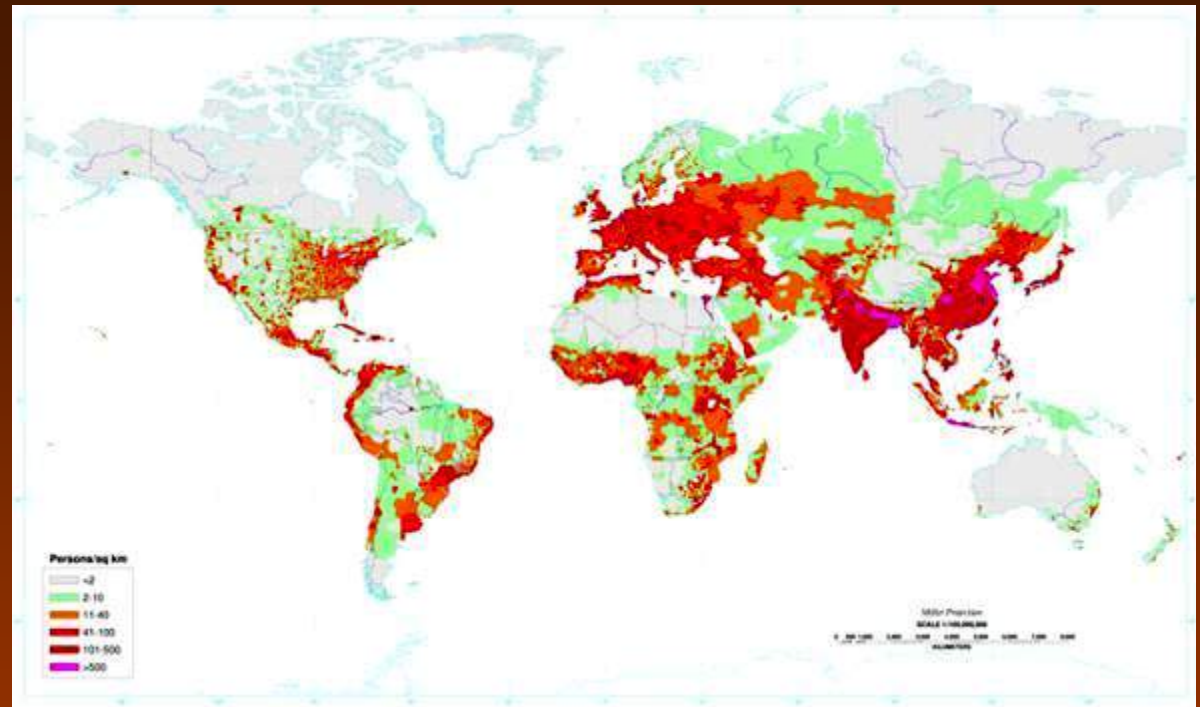
- 7. Nuclear fuels - environmental dangers exist in reference to **obtaining, using, and storing** the wastes from these fuels



- 8. Air is becoming increasingly polluted
 - **Acid Rain** -- sulfur dioxide (also nitrogen oxides) from coal burning sources + rain = ACID RAIN

Problems from Acid Rain:

- **Destruction of limestone and marble monuments due to increased chemical weathering**
 - **Acidification of aquatic ecosystems destroying the life in them**
 - **Damage forests and other plants in a variety of ways**
- 
- A stylized, dark grey silhouette of a mountain range is positioned at the bottom of the slide, spanning the width of the text area. The background of the slide is a gradient from dark brown at the top to a lighter yellowish-brown at the bottom, where the mountains are located.



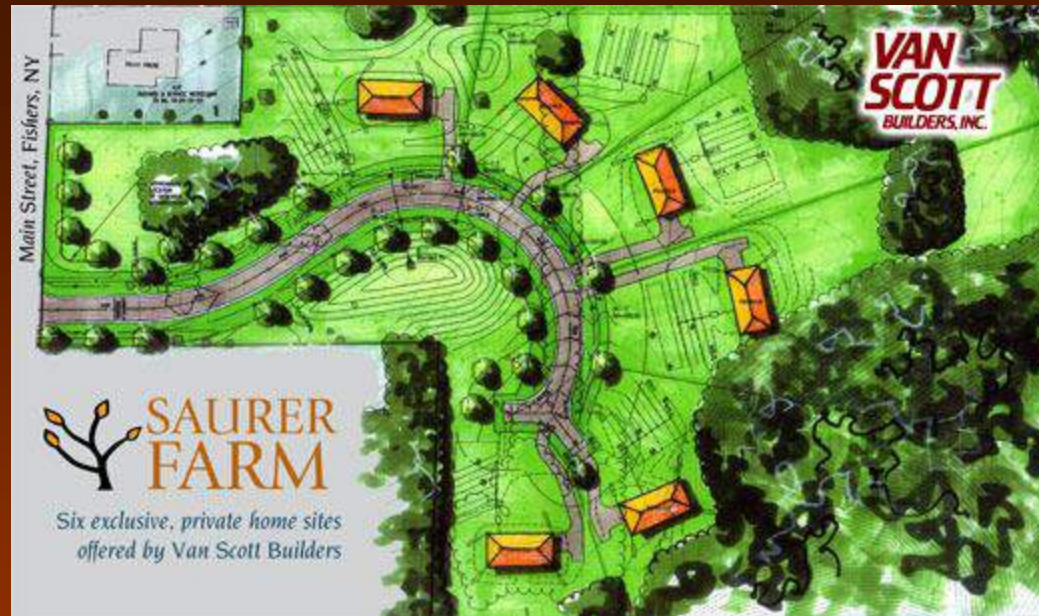
- 9. Living space/available land: is greatly **decreasing** as a result of **increasing** population
 - creates increasing stress on individual humans
 - we are also taking up living space and



- **10. Forests:** are becoming increasingly depleted as a result of **timber needs** & the need for more **agricultural land**
 - the direct harvesting of timber has destroyed many forests
 - this destruction also impacts land use and atmospheric quality



- 11. Insects: our chief competitors for food
 - we have destroyed many **beneficial** insects and many enemies of harmful insects with insecticides



- 12. Land use (includes increasing urbanization and the cultivation of marginal lands)
 - this decreases the space and resources available to other species

Some Other Factors which influence environmental quality

- **1. Population growth and distribution**
- **2. Capacity of technology to solve problems**
- **3. Economic, political, ethical, and cultural views**



Some examples:

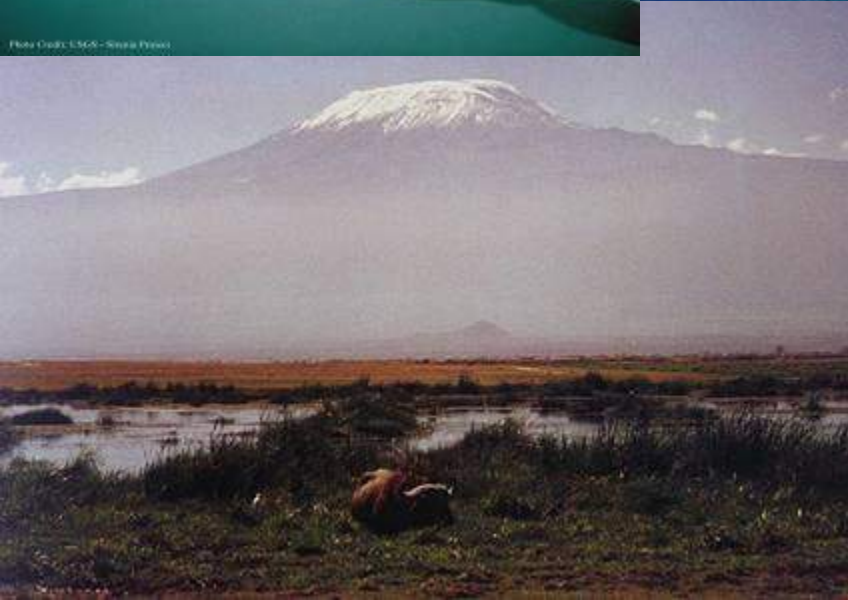
- a.) Wealthy people in the developed world tend to have fewer children.
- b.) Some countries like China have laws concerning the number of children a couple may have without penalty.
- c.) In some poor cultures in third world countries, having many children is seen as a means of having economic security in old age.
- ****What are some ways we are attempting to deal with environmental degradation?**



Species Preservation

- Some efforts to **sustain endangered species** have included **habitat protection** (wildlife refuges and national parks) and wildlife management (game laws and fisheries).
- Animals which were once endangered but are presently successfully reproducing and increasing their numbers are the **bison, gray wolves and egrets.**





- Endangered animals which are currently responding to conservation efforts and beginning to make a comeback are the **whooping crane, bald eagle, and peregrine falcon.**
- **** The future of many species remains in doubt.**
- Human activities that degrade ecosystems result in a **loss of diversity** in the living and nonliving environment. These activities are threatening current global stability.

