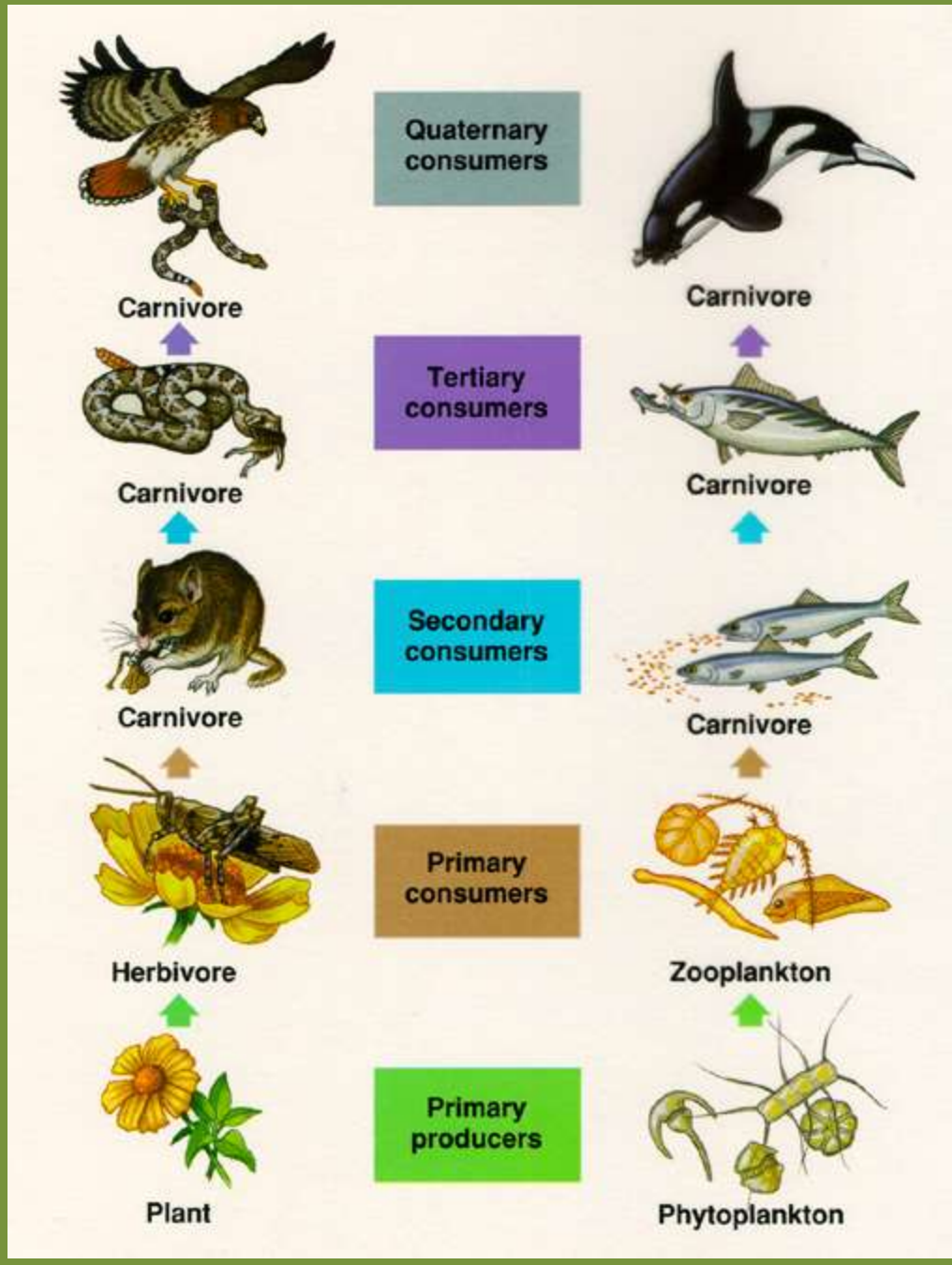
Biosphere Unit



Ecology

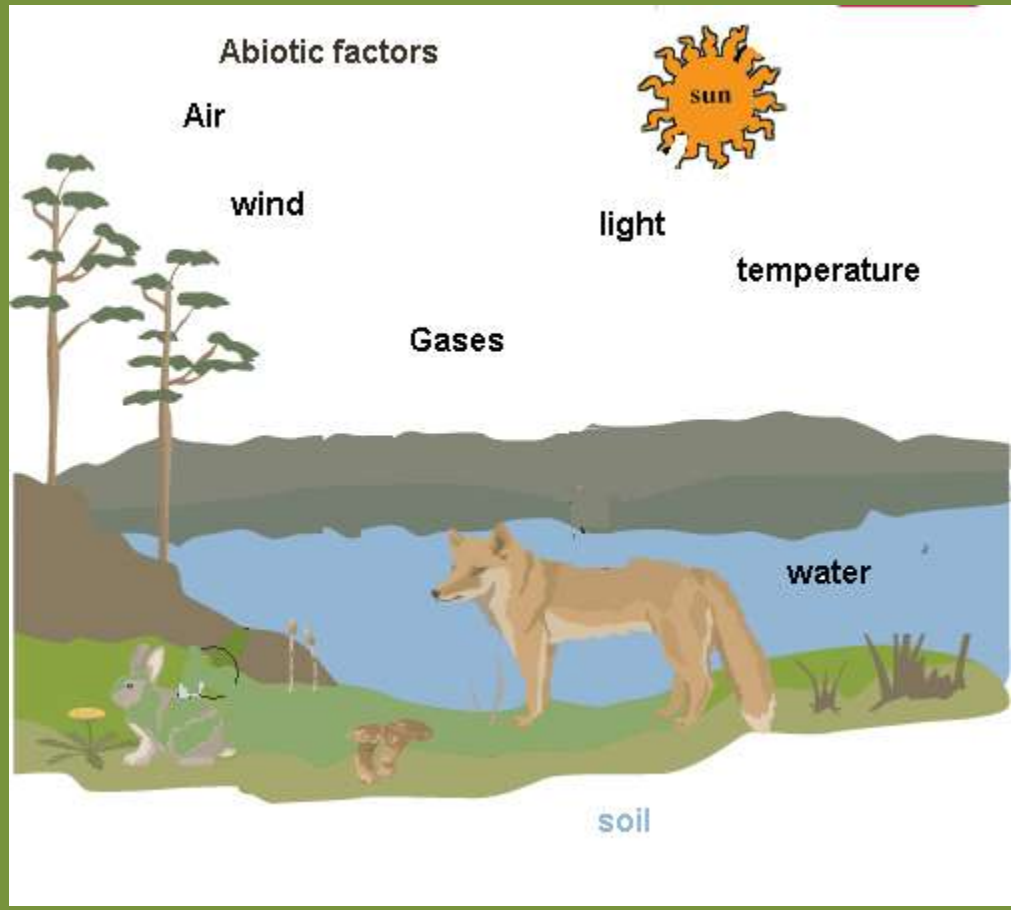
- Ecology is the study of interactions that occur between organisms and their environment

Biosphere

- ALL LIVING THINGS
- Living things are affected by nonliving (**abiotic**) and living (**biotic**) things

Abiotic Factors

- Nonliving parts of the environment
- EX: temperature, precipitation, light, soil



Biotic Factors

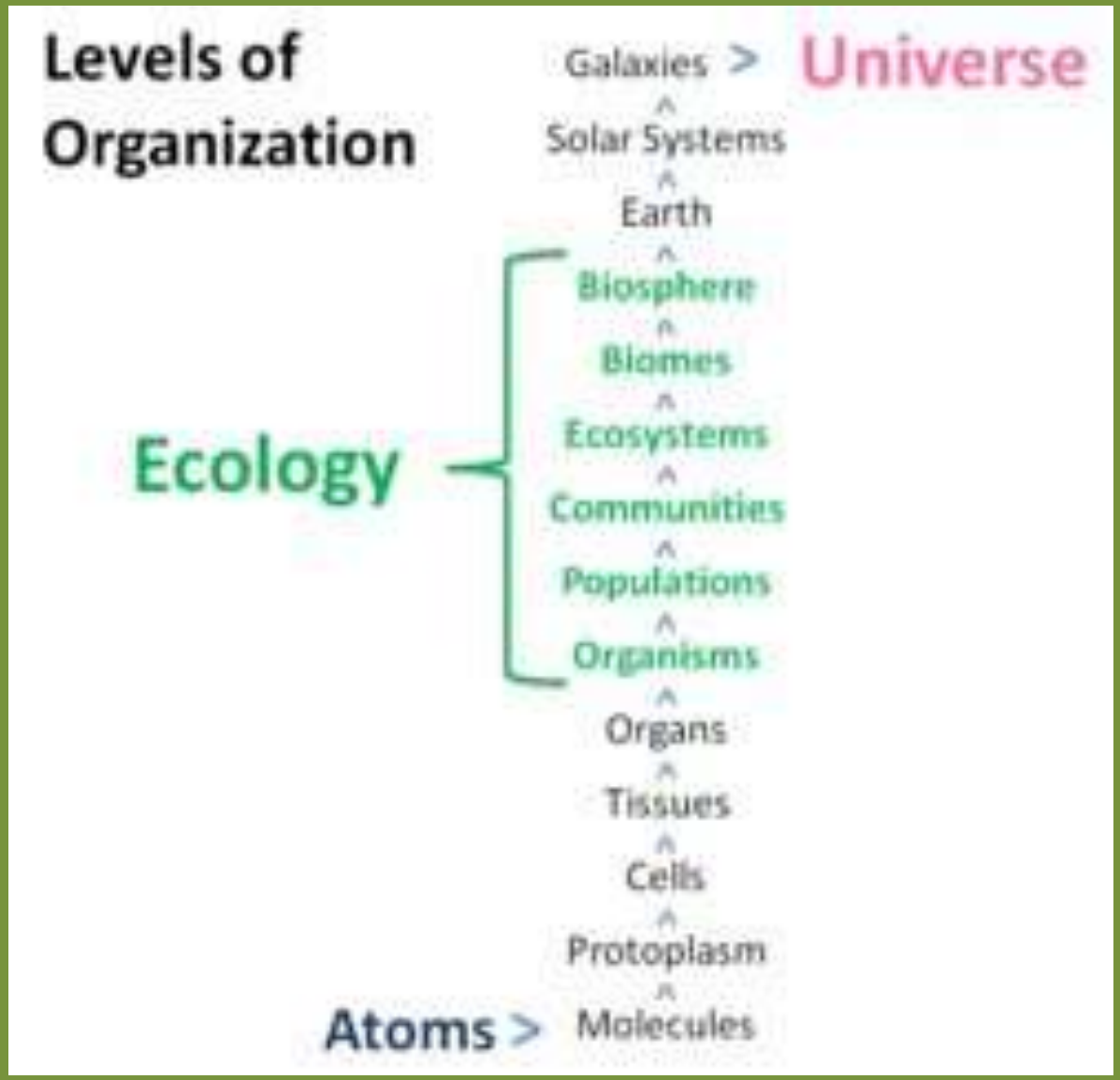
- Living things that inhabit an environment
- All organisms depend on other living things for food, shelter, reproduction, or protection

Biotic and Abiotic Factors Activity

- *Using the picture you've been given, identify:*
- *(1) abiotic factors*
- *(2) biotic factors*
- *(3) how abiotic factors are important to biotic factors*
- *(4) how biotic factors are important to biotic factors*
- *(5) how biotic factors are important to abiotic factors*

Levels of Organization

Copy down the Diagram in green only in that order

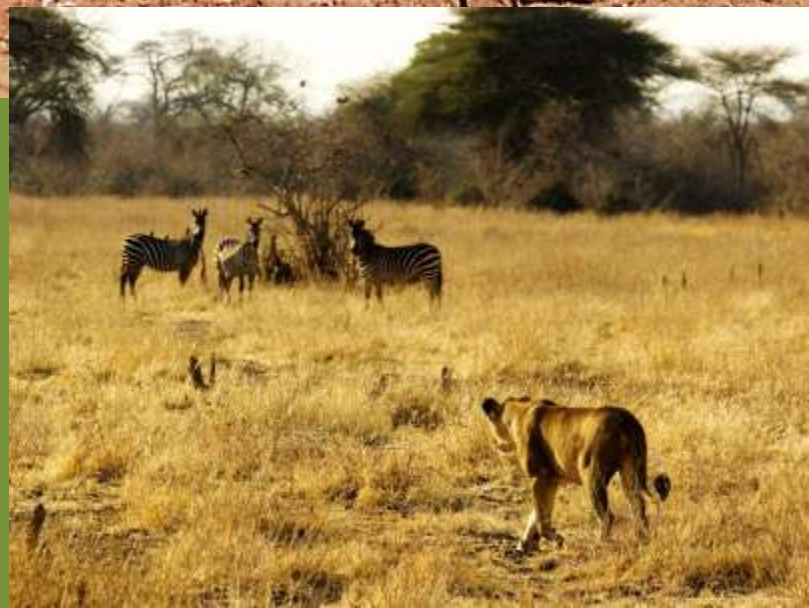


Population

- Group of organisms of same species that **interbreed** and live in the same area at the same time; **compete** for same resources.

Community

- Made up of **interacting populations** in a certain area at a certain time
- EX: zebras live with lions, giraffes, elephants, and gazelles



Ecosystem

- Interacting populations in a community and the community's **abiotic** factors
- EX: Populations of animals drink from same waterhole

Koppen Climate Classification

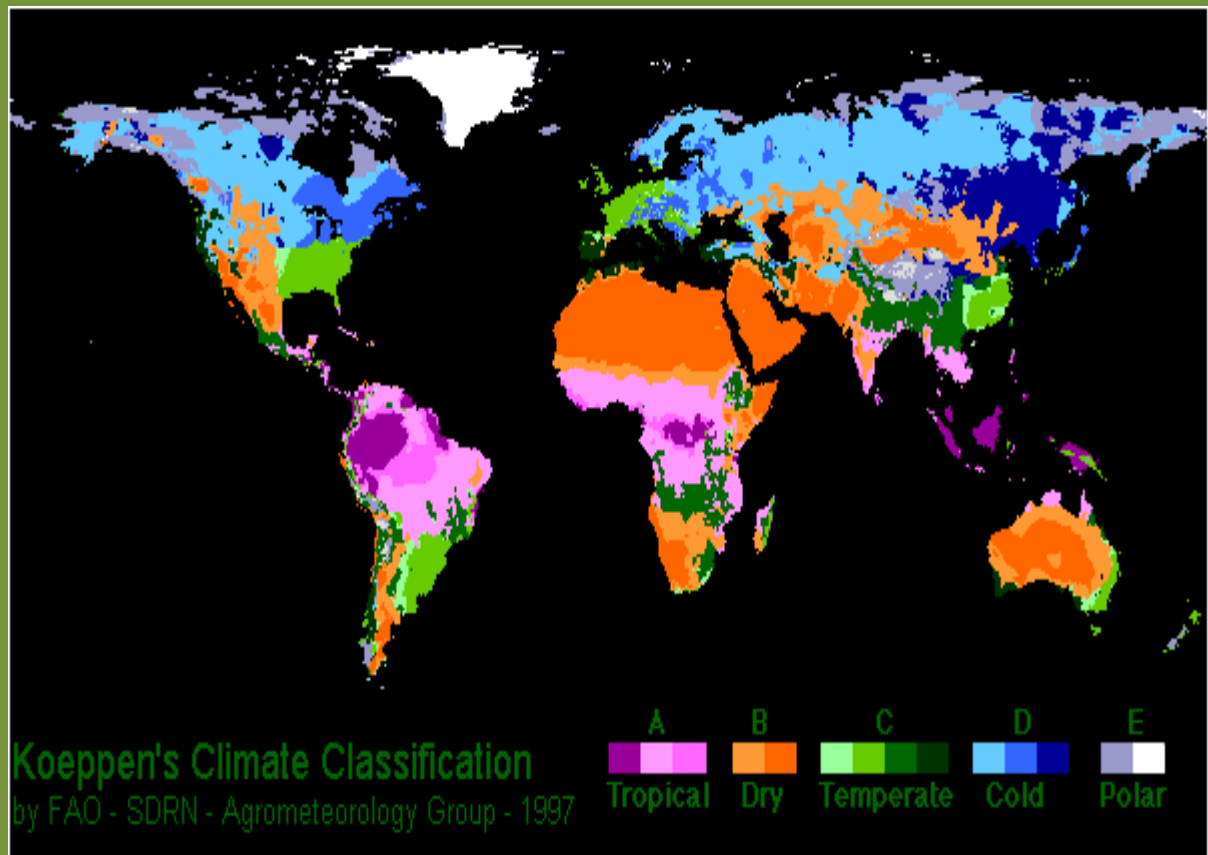
- In 1884 Koppen first organized world into climate classifications based on *air temperature* and *precipitation*.

Koppen Climate Classification

- A- Tropical Moist Climates- all months have average temp above 18
- B- Dry Climates- deficient precipation during most of the year
- C- Moist Mid- latitutde Climates with mild winters
- D- Moist Mid-latitutde Climates with cold winters
- E- Polar Climates: extremely cold winters and summers
- H- Highland Climates: cooler, less moisture

Koppen Climate Classification

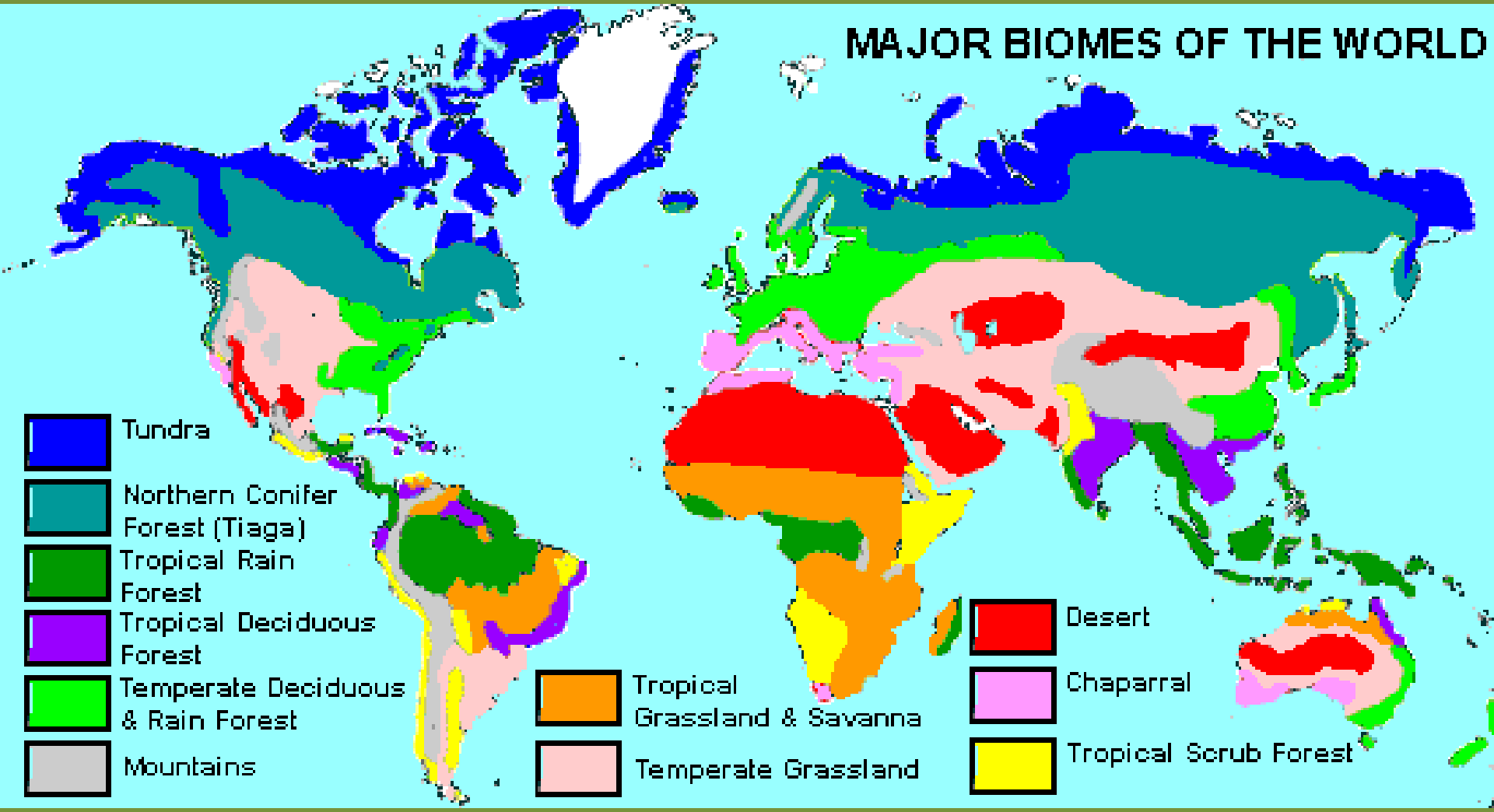
- Five main types of climate classifications organized by Koppen in 1884:
- (1) Tropical
- (2) Dry
- (3) Temperate
- (4) Cold
- (5) Polar



Biomes

- made of similar ecosystems and are controlled by climate.
- climate determines what plants will grow there, and what animals will inhabit it.
- All three components; **climate**, **plants** and **animals** are interwoven to create a biome.

Major Biomes of the World



Major Biomes of the World

- Some disagreement among scientists on how to divide up the Earth's biomes, most can agree on the following seven terrestrial (land) biomes.

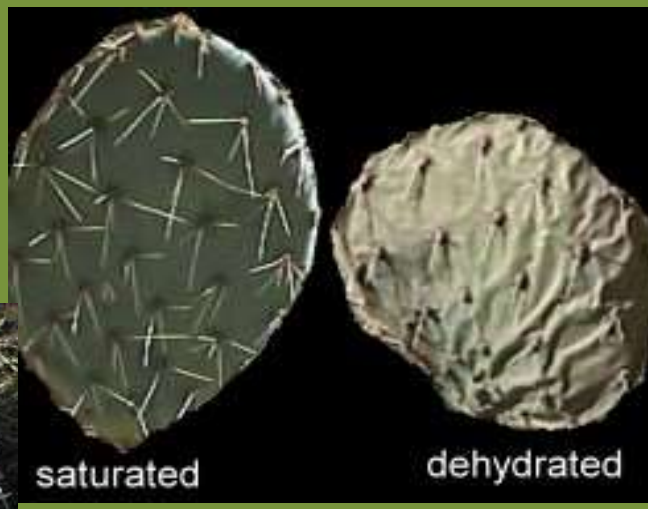
Desert

- Location- mid-latitudes
- Climate- very hot days, cool nights, <10 in/yr of rain
- Soil- little to no topsoil due to high winds, rich in minerals, too dry for decay

Desert

Plant adaptations

- Spines
- Succulents
- Thick, waxy cuticle
- Shallow, broad roots



Desert

Animal adaptation

- Store water in fatty tissues
- Get water from food
- Large ears
- Smaller animals= less surface area
- Burrow during the day

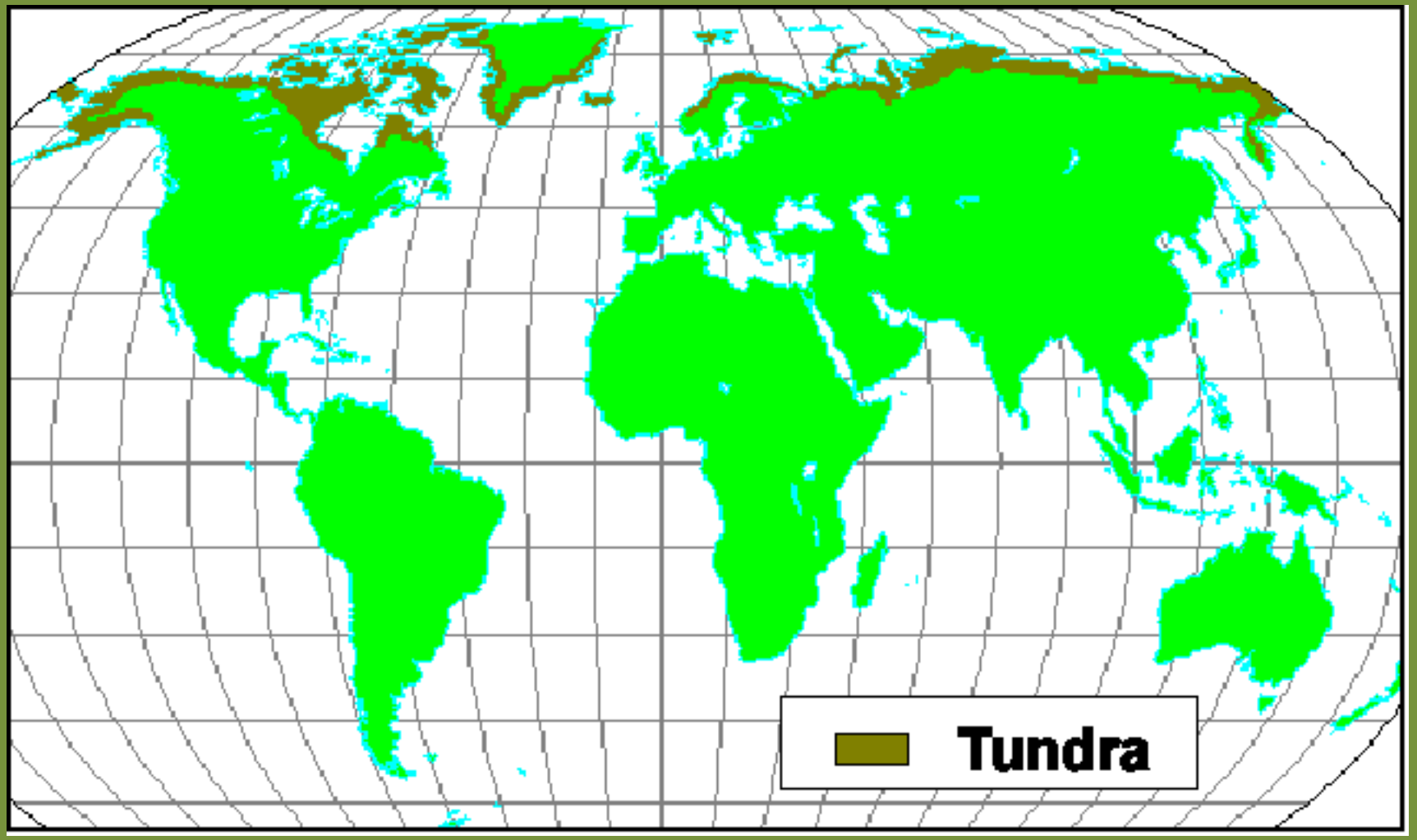
Desert

THREATS

- Residential development
- Off road recreation
- Leave no trace

Tundra

- Location: North of the Arctic Circle



Tundra

- “treeless or marshy plain”
- Location- high northern latitudes
- Climate- very cold, harsh, long winters; short and cool summers, 4-10 inches of rain per year
- Soil- nutrient- poor, p
  - permafrost layer (permanently frozen)- few cm. below the surface limits plant growth
  - short growing season

    ~8 weeks

Tundra

Plant Adaptations:

- Growing close to the ground
- Having shallow roots to absorb the limited water resources.
- Any trees present grow less than 1 m high!

Tundra

Arctic fox

Animal Adaptations:

- Small ears
- Insulation, thick coat
- Many visitors, migration
- Few predators
- Little competition

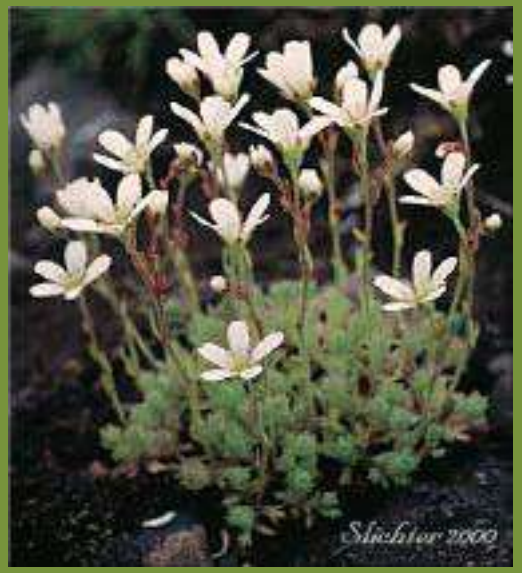
snowy owl

Grizzly Bear

Tundra

THREATS:

- One of the most fragile biomes on the planet
- Oil drilling is proposed in Alaska and other areas
- Slow to recover from damage



Grassland

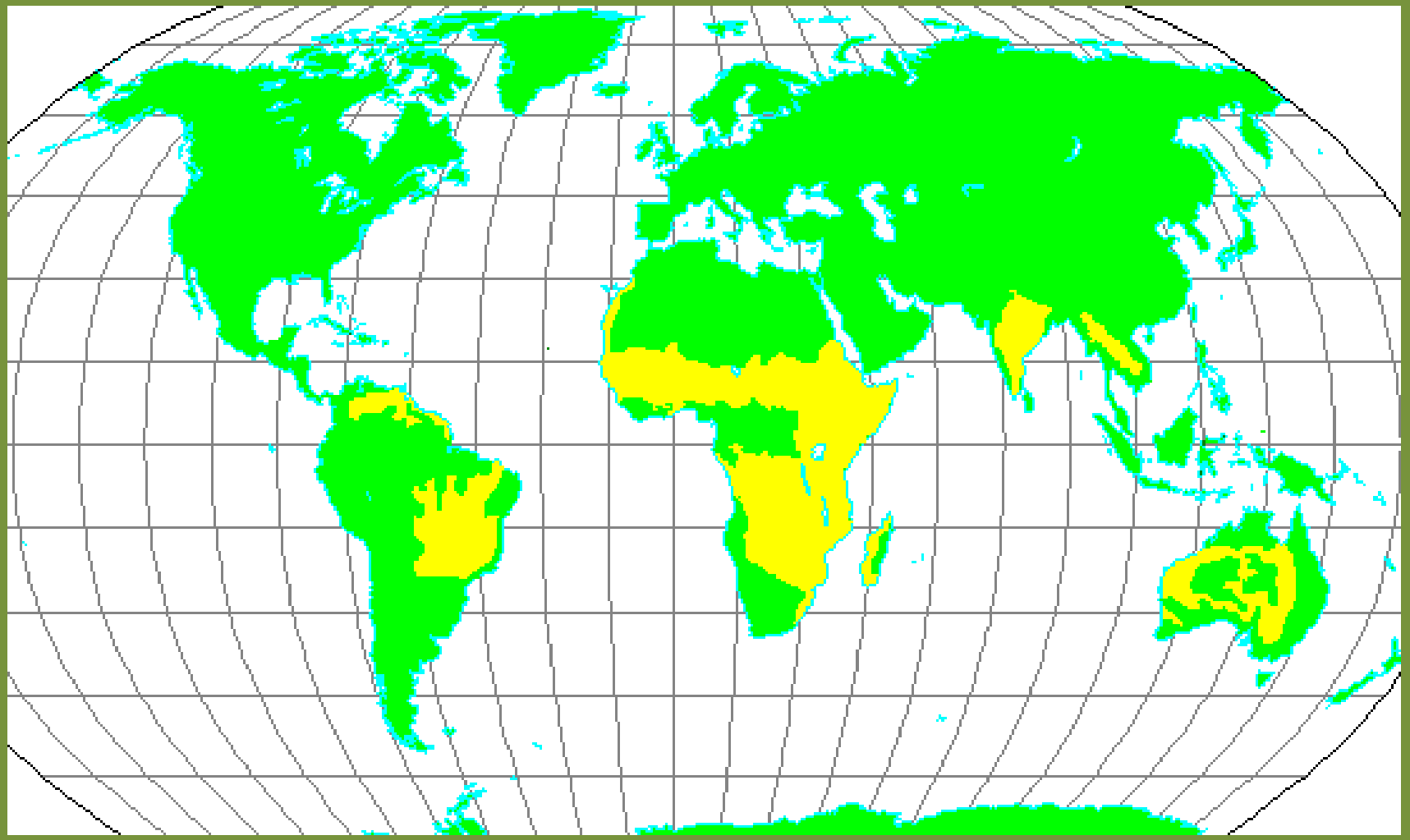
- **Location-** mid-latitudes, interior of continents
- **Climate-** cool in winter and hot in summer, semi-arid, 10- 20 inches of precipitation a year.
- **Soil-** rich topsoil, world's most fertile soil

Grasslands

- **Plants-** mostly grasses and small shrubs, some trees near water
- **Animals-** prairie dogs, foxes, small mammals, snakes, insects, various birds

Savanna (Tropical Grasslands)

- **Location**: tropics…near equator, low latitudes



Savanna (Tropical Grasslands)

- **Climate**: tropical wet and dry climate. Average temperature is ~64° F and annual precipitation averages between 30-50”.
  - Rainy and dry season
  - Fire plays a large role in this ecosystem

Savanna (Tropical Grasslands)

- Grasslands with a few scattered trees
- Plant adaptation:

- trees pump chemicals in their leaves when threatened by biotic factors
- thorns and sharp leaves
- precipitation supports tall grasses

Savanna (Tropical Grasslands)

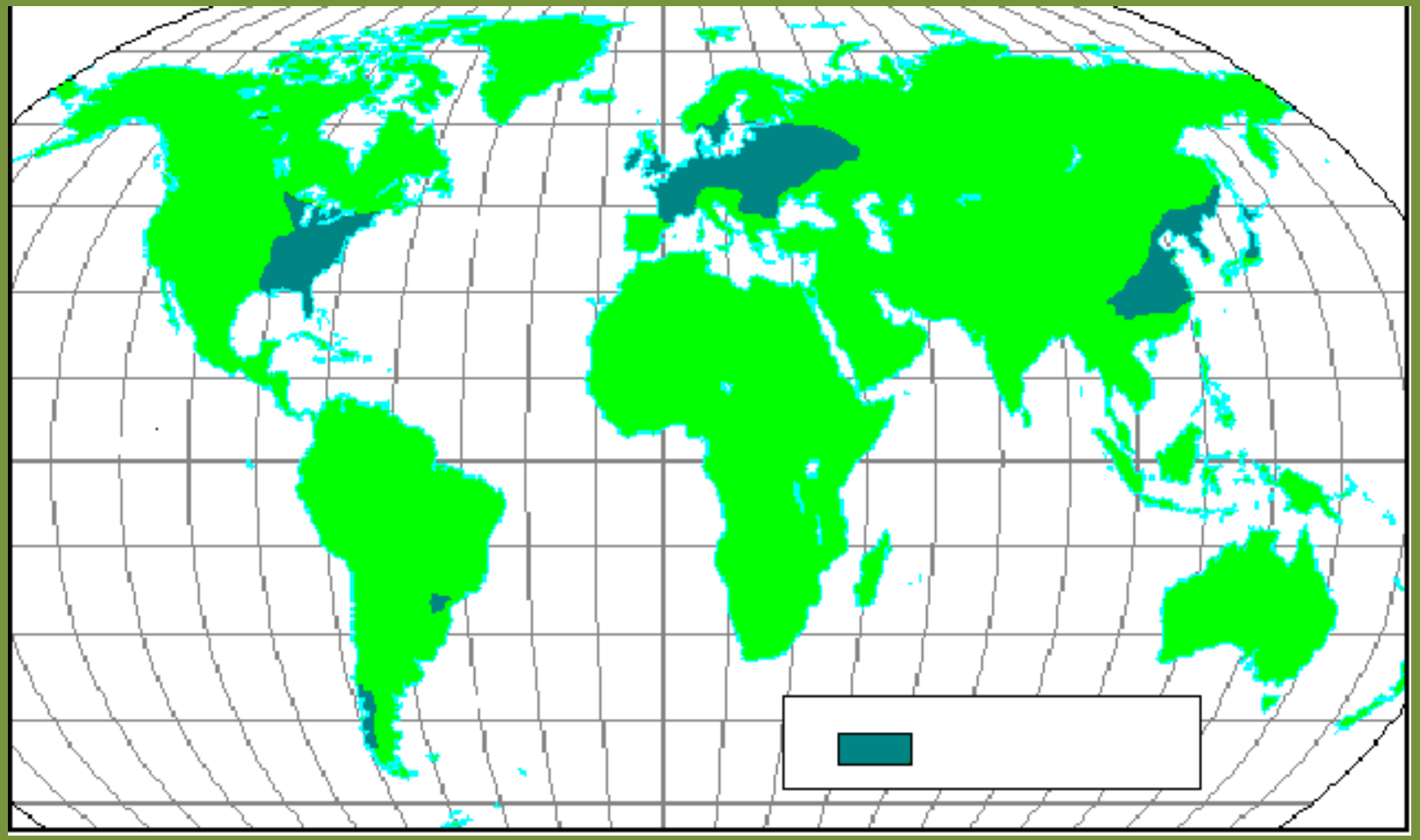
- Animals Adaptations:
  - Short rainy season- migrate as necessary
  - Reproduce during rainy season for offspring survival

Savanna (Tropical Grasslands)

- THREATS
  - Invasive species
  - Changes in fire management
  - Low elevation= flood from rising sea level
  - Poaching

Temperate Deciduous Forest

Locations: mid-latitudes, 48 degrees North latitude, most of human population



Temperate Deciduous Forest

- **Climate-** mild summers and cold winters
  - Precipitation: 30–100”/yr. all forms (snow, rain, hail, fog, etc.)
  - 4 seasons: abundance of deciduous (leaf bearing) trees
- **Soil**: nutrient rich topsoil over clay, deep layers

Temperate Deciduous Forest

Plant Adaptations

- Greater diversity than coniferous forests b/c increased sunlight
- Greater ground dwelling plants than rainforest
- Forests grow in layers
- Trees adapt to varied climate- dormant in winter

White Birch

Lady Fern

Temperate Deciduous Forest

Animal Adaptations:

- Lose winter coat
- Adapt to many seasons
- Eat from different layers of the forest

Temperate Deciduous Forest

THREATS:

- Forests cleared to provide housing for humans
- A potential renewable resource when carefully managed

Temperate Boreal Forest (Taiga)

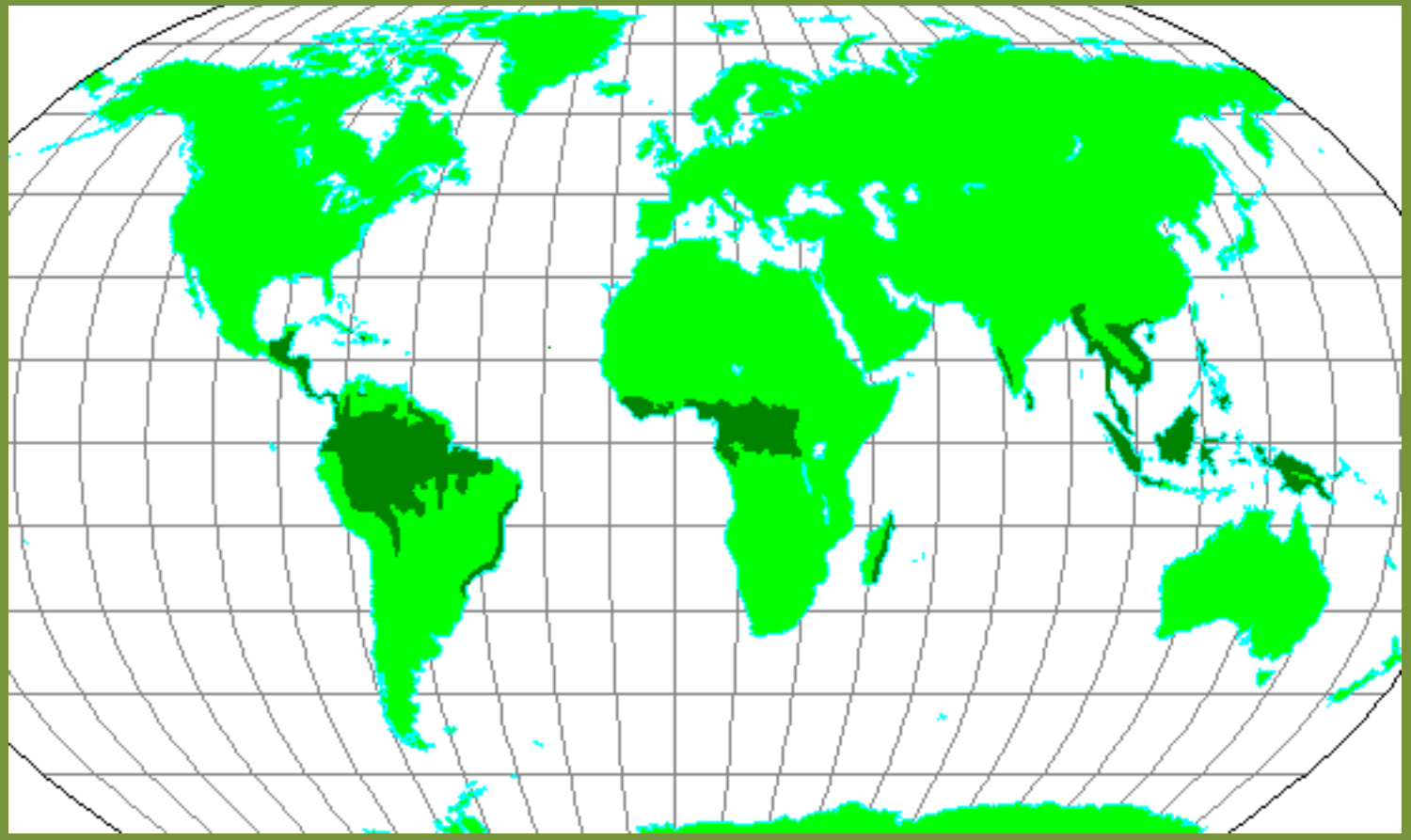
- Location: mid- to high latitudes
  - A nearly continuous belt of coniferous trees across North America and Eurasia, “snow forests”

Temperate Boreal Forest (Taiga)

- Climate: very cold, severe winters and short cool summers
- Soil- acidic, mineral-poor, decayed pine and spruce needles on surface
- Plants- spruce, fir, and other evergreens
- Animals- rodents, lynx, bears, wolves

Tropical Rainforest

- Location: Near equator…little variation in temperature
- 2 seasons- wet and dry



Tropical Rainforest

- **Climate-** hot and moist all year round, 80-100 inches of rain a year
- **Soil-** nutrient-poor, <1cm of topsoil

Tropical Rainforest

- Earth's most complex biome in terms of both structure and species diversity.
  - high biodiversity and biomass
  - As many as 50% of all the world's animal species may be found here
- ideal for bacteria and other microorganisms; decompose matter on the forest floor allowing nutrients to be recycled.

Tropical Rainforest

Plant Adaptations:

- Sunlight- major limiting factor, not as many plants on forest floor
- Plants grow in layers (canopy receives most light)
- Shallow, wide roots since soil is so thin and poor in nutrients
- Plants live on branches of taller trees to get light -epiphytes

Bangul Bamboo

Tropical Rainforest

Animal Adaptations:

- Symbiotic relationships
- Live in different canopy levels
- Camouflage is common
- Specialists and require specific habitat components to survive

Silvery Gibbon

Wagler's pit viper

Slender Loris

Tropical Rainforest

THREATS:

- Deforestation- strip the land for logging and cattle ranching
- Civilizations, medical advances, and new species LOST

Major Biomes of the World

- In addition to terrestrial biomes, there are also 5 aquatic (water) biomes.
- Ponds and lakes
- Rivers and streams
- Oceans
- Coral reefs
- Estuaries

Feeding Relationships

- Organisms must "eat" to get energy to reproduce, grow, find food, and defend themselves.
- Ultimate source of energy for all life: *sun*

Feeding Relationships

- Autotrophs /Producer- uses light to make their own food EX: plants, green algae

Feeding Relationships

- Consumers/Heterotrophs depend upon autotrophs for nutrients and energy
- EX: deer, mice, lions, birds

Types of Heterotrophs

- Herbivore-eats only autotrophs. Ex: deer
- Carnivore-eats only other heterotroph Ex: lion
- Omnivore-eats both autotrophs and heterotrophs. Ex: Bears

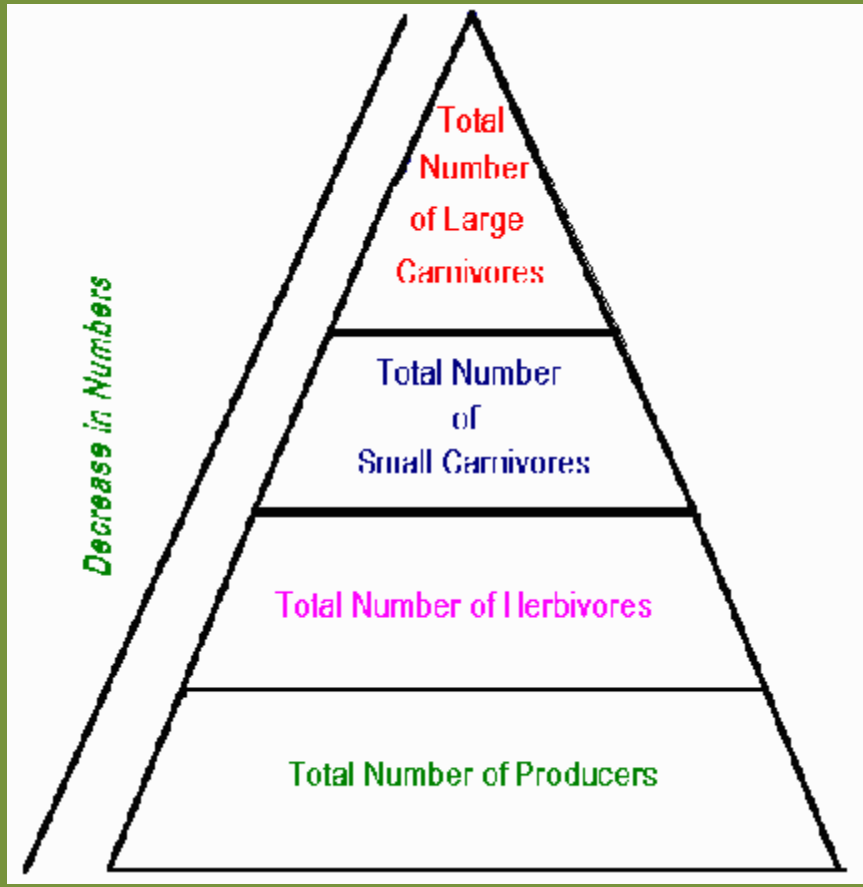
Types of Heterotrophs

- Scavengers-eat heterotrophs that have died
  Ex: vultures
- Decomposers-break down dead animals into simpler molecules that can be absorbed.

  Ex: Worms

Trophic Levels and Food Chain

- Trophic level: A feeding level in an ecosystem
- Food chain: lineup of organisms that shows “who eats who”
- Shows how matter and energy move through an ecosystem



Trophic Levels and Food Chain

Eaten by

1st trophic level: producers (make their own food)

Eaten by

2nd trophic level: primary consumer

(eats plants)

Eaten by

3rd trophic level: secondary consumer (eats meat)

Eaten by

4th trophic level: tertiary consumer (eats meat)

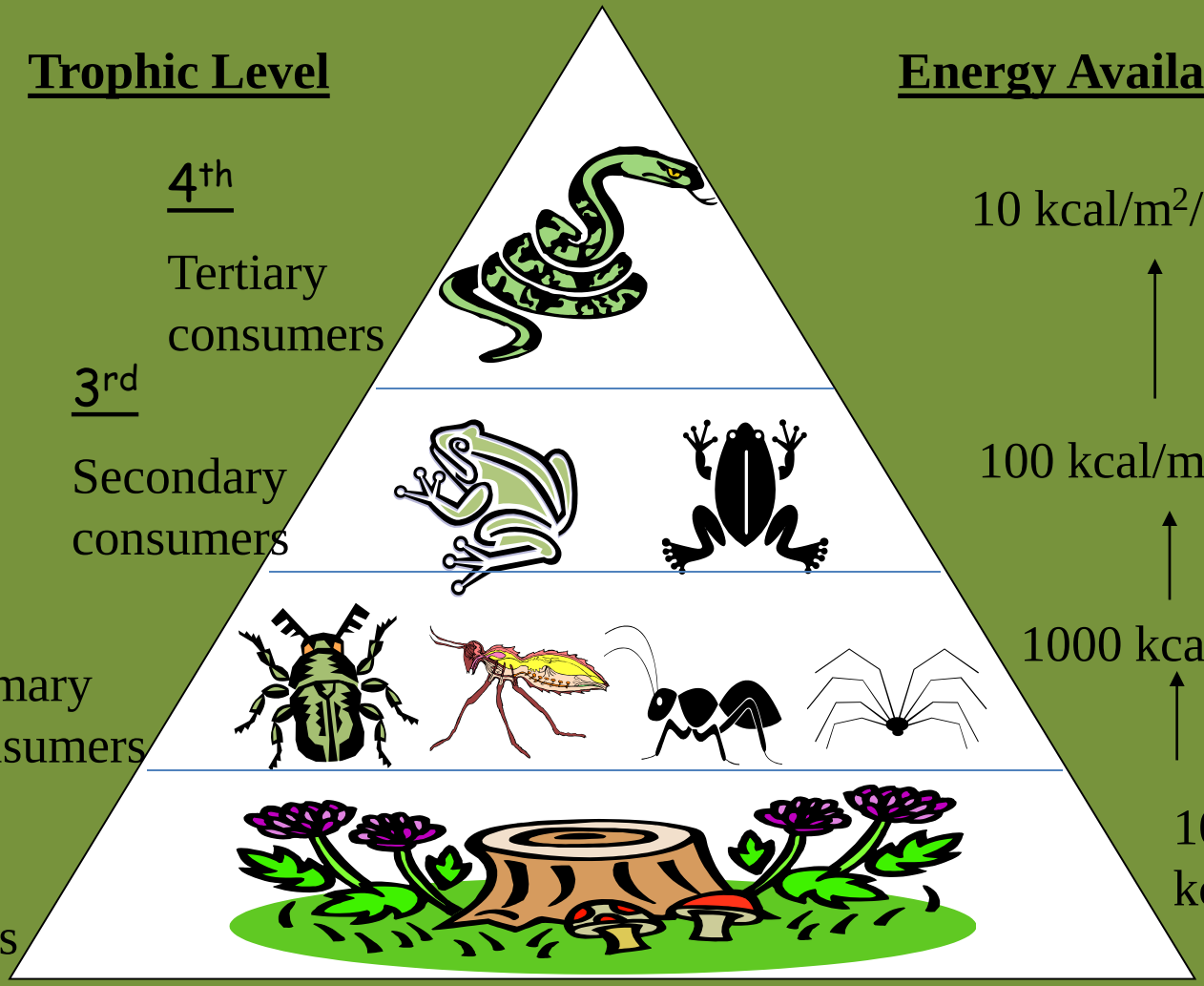
Bacteria

Last trophic level: decomposer (eats dead animals)

Energy Pyramid

- Every time an organism eats, it obtains energy from its food
- *Energy pyramid* - picture showing how much energy is transferred to the different trophic levels in a food chain The higher the trophic level, the lower the amount of energy present.

Energy Pyramid



Energy Pyramid

- When the producer is eaten by the consumer, it is an exchange of energy. The consumer only receives 10% of the energy present in the producers. Therefore, to get enough energy to survive, the consumer must eat more producers, meaning that, to sustain the consumers, there must me many more producers.
- Also, there is much more energy to available to producers, which facilitates faster growth and larger numbers of producers

Limiting Factors

- A **limiting factor** or **limiting resource** is a factor that controls a process, such as organism growth or species population size or distribution
- Examples of limiting factors include: availability of food, predation pressure, or availability of shelter

Balance in Ecosystems

- Many ecologists believe that a balance must exist between predators and prey for ecosystems to be deemed “healthy”
- This “balance of nature” hypothesis has been criticized by some scientists because it implies a relationship between predators and prey that is good and necessary.
- Why is death by predators more natural or “right” than death by starvation?
- How does one determine when an ecosystem is in “balance”?
- Do predators really only kill the old and sick prey? What evidence is there for this statement?
- What is your opinion of the balance of nature hypothesis? Would the deer on your island be better off, worse off, or about the same without the wolves. *Defend your position.*

Biodiversity

- Biodiversity is genetic variation within populations and variation of populations within ecosystems; the variety of species in one area. The greater the biodiversity within an area, the greater the resources available to support the ecosystems.

Biodiversity

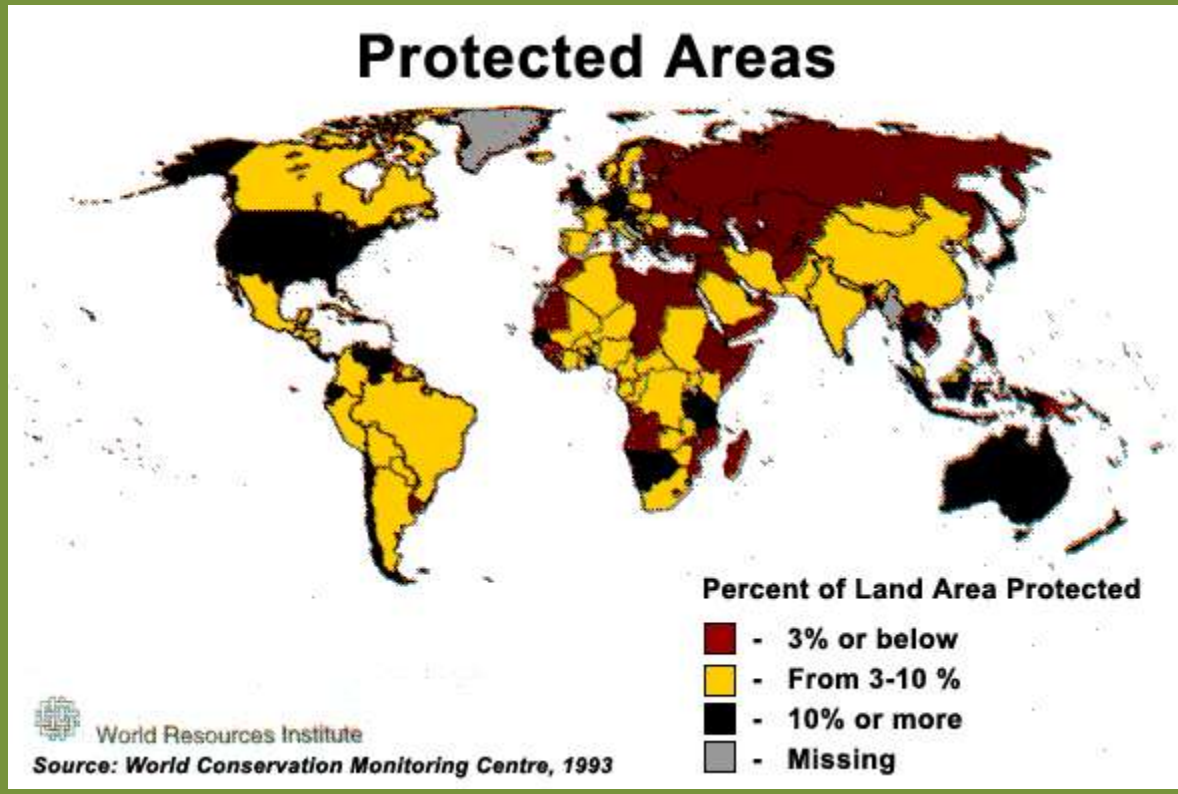
- *Simplest measure of biodiversity is the number of different species that live in a certain area*
- *EX: 1 hectare of US contains about 30 different tree species VS 1 hectare of Amazon rainforest that contains 300 species of trees*
- *Which has the greatest biodiversity?*

Why is biodiversity important?

- **All living things are interdependent**-any given species depends on the services of another species to survive.
- **Limits chances of a species extinction**-genetic variation in a population prevents one pest or disease from completely wiping out the population.
- **Variety of organisms help to maintain an ecosystem**-organisms collectively can contribute to soil formation, pollution breakdown, nutrient storage, or contribute to climate stability.
- **Greater biodiversity provides larger pool of resources**-more organisms we can use for food, medicinal purposes, wood products, animals for breeding stocks, etc.

Threats to Biodiversity

- Human population growth
- Invasive species
- Habitat alteration
- Pollution – air, water, trash, etc
- Overharvesting
- Poaching
- Exotic Species Trade



Human Population Growth

- Birth Rate > Death Rate
- Demand for resources > amount of resources
- Population may surpass carrying capacity

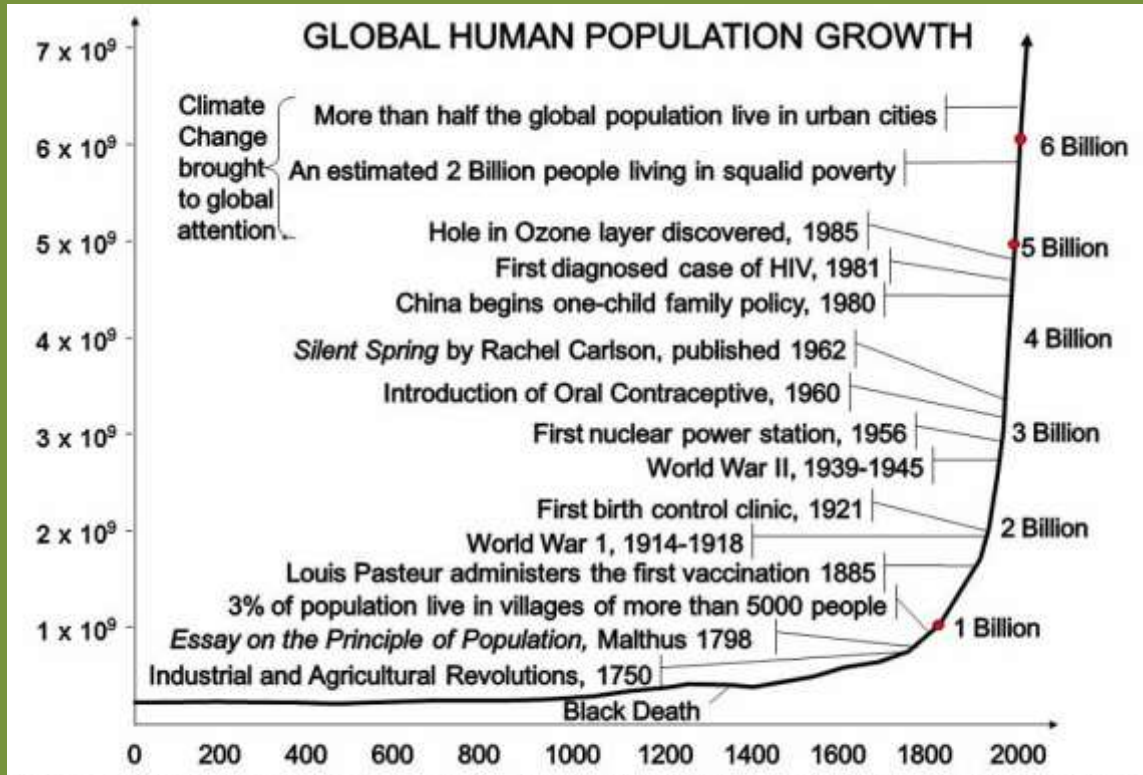


Image 10 : Les contrôles sur la Population Humaine Population vs Les Catalyseurs de l'augmentation de la Population

Invasive Species

- A nonnative species whose introduction causes economic, environmental, human health issues by disrupting ecosystem.
- Take resources from native species.

Invasive Species

- *Kudzu introduced intentionally to US as an ornamental plant and to help reduce soil erosion. However, it grows rapidly, smothering areas of native plants.*
- *Zebra mussels were introduced unintentionally to Great Lakes from ballasts of ships. These fast growing mussels clear the water, but block many food chains.*

Invasive Species Present in NC

- *Kudzu, Japanese Honeysuckle, Queen Anne's Lace, Chinese Privet*

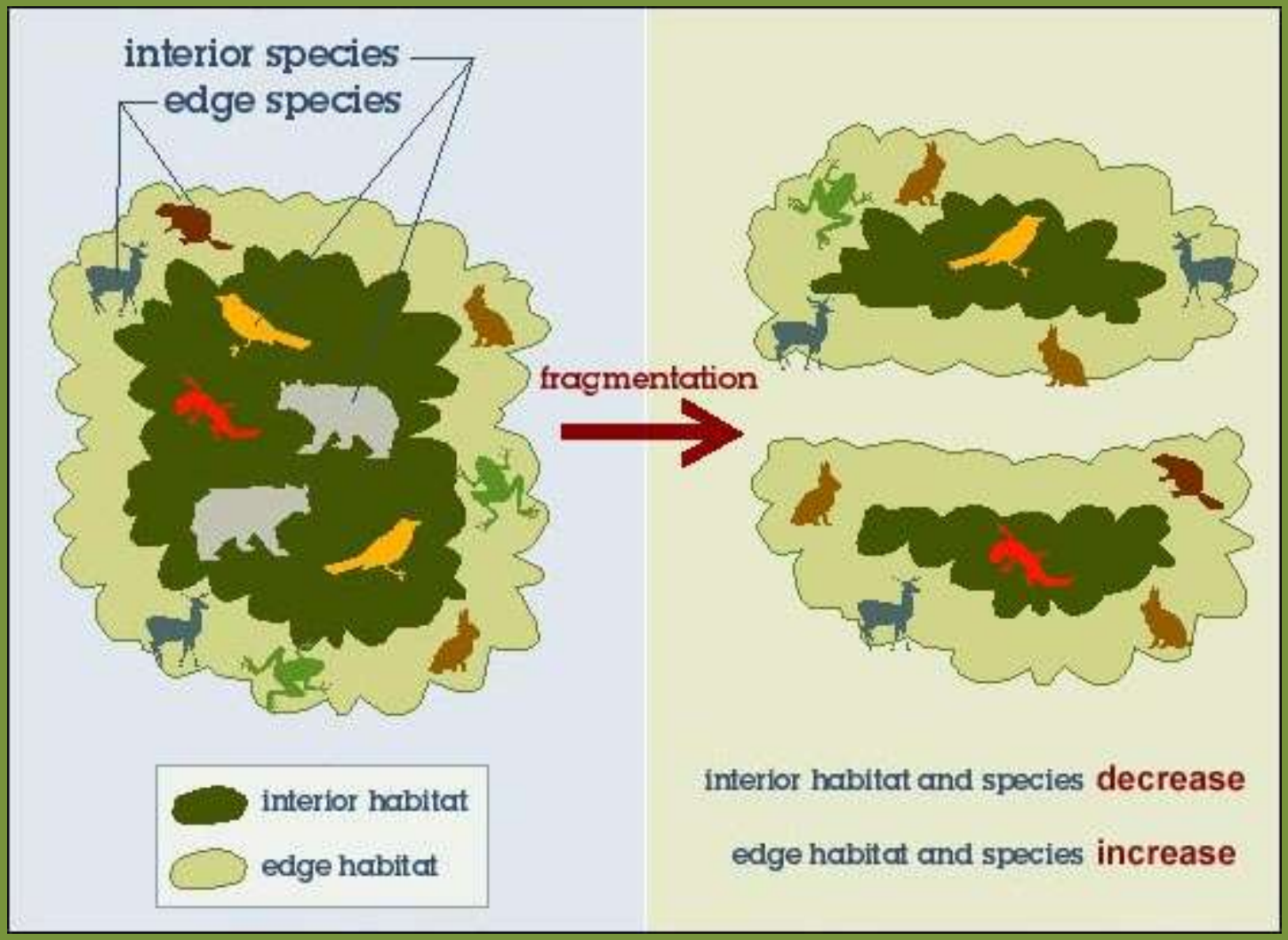
Invasive Species Present in NC

- *African Clawed Frog*
- *Asian Shore Crab*
- *Asian Tiger Shrimp*
- *Rock bass*
- *Blueback herring*
- *Blue tilapia*
- *Nile tilapia*

Habitat Alteration

- Any change that occurs to an existing habitat.
- Ex:
  - Clear cutting-removing all plants, destroying habitats
  - Selective cutting-removing only parts of a region, causing, habitat fragmentation, separating species from one another, increasing or decreasing populations as a result.

Habitat Fragmentation



- *Larger species in greater danger; large predators may not find enough food if restricted to too small an area.*

Overharvesting

Consuming too much of a population severely decrease their numbers, therefore causing a disruption in food chain.

Pollution – Habitat Degradation

- Habitat degradation is the damage done to a habitat by pollution – air, land, or water.
- Examples of causes are acid rain, eutrophication and trash.

Acid Rain

- Acid rain is any precipitation that has a low pH value
- Water in atmosphere becomes acidified due to: coal burning factories, car exhaust, etc
- Results in damage to plant tissue and can affect aquatic species ability to survive

Eutrophication

- Fertilizer and animal waste runoff are carried into hydrosphere. These nutrients allow algal blooms to occur. As the algae dies and decays, it removes oxygen from the water, killing the fish and creating dead zones.

Trash Pollution

- Trash and abandoned nets are the cause of death of many aquatic animals.

Consequences of Loss of Biodiversity

- Extinction – disappearance of a species; current rate of extinction has accelerated
- Ecosystem collapse – if keystone species is removed, the entire ecosystem could collapse (EX: sea otter in kelp forests)
- Possible Medicinal cures for diseases – unknown how many or what types of plants could contribute to medicine
- *Unknown – many ecosystems are so complex that ecologists cannot begin to predict ramifications of biodiversity loss*

How to Protect Biodiversity?

- Conservation biology – the study and implementation of methods to protect biodiversity
- Legislation designed to preserve habitats
- Reintroduction and Captive Breeding Programs
- Reducing “ecological footprint”