

Introduction to Ecology Notes

Ecology is the scientific study of interactions among organisms and between organisms and their environment.

1. Some cool facts about Ecology

- 75% of all animals are beetles.
- Cockroaches can live weeks without their head (and their heads can stay alive without their bodies!).
- 70% of the world's fresh water is stored in Antarctica's ice.
- Homeowners use up to 10 times more toxic chemicals per acre than farmers
- In Peru a single bush may contain more ant species than in the British Isles.
- A single porcupine is known to kill 100 trees in one winter
- Projections for the 21st century indicate that the earth's average temperature will rise by anything between 1.4 and 5.8°C

2. Levels of Organization

Species → Population → Community → Ecosystem → Biome → Biosphere

The Biosphere is HUGE, which is why we usually study smaller divisions like biomes and ecosystems. Biomes can be subdivided into smaller divisions called ecosystems.

3. What is a biome?

Well biomes are environments that have characteristic climax communities (don't change too much over time). Some people think that there are over 30 different types of biomes in the world..... But here are a few

a. Aquatic:

- | | |
|-------------------|-----------------|
| • rivers | • neritic zone |
| • streams | • open-sea zone |
| • lakes | • deep-sea zone |
| • intertidal zone | • estuaries |

b. Terrestrial

- tundra
- taiga
- temperate deciduous forests

- grasslands
- tropical rainforests
- desert

4. **Ecological Methods:**

Regardless of the tools they use, scientists conduct modern ecological research using three basic approaches:

- Observing
- Experimenting
- Modeling

5. **Ecosystems:**

An ecosystem is the combination of an area's abiotic and biotic factors.

Abiotic Features:

- | | |
|---------------|-------------|
| • air | • soil |
| • water | • rocks |
| • rainfall | • elevation |
| • temperature | • humidity |

Biotic Features:

ANYTHING LIVING!!!

Now let's think of your house like an ecosystem! What are the abiotic factors of your home and the biotic ones?

6. **Energy Flow within an Ecosystem**

All of the energy that comes to earth, comes from the sun. Which means the process has to start with some kind of plant, doing photosynthesis.

From there herbivores eat the plant and carnivores eat the herbivores. It is a simple interaction that passes energy up the food chain.

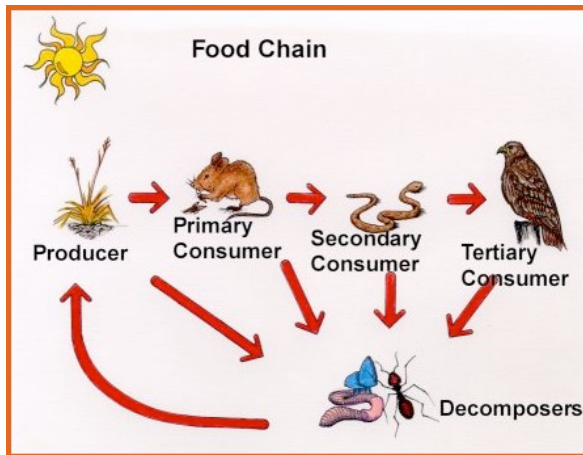
In the absence of light, organisms can use chemical energy to produce carbohydrates, which is called chemosynthesis. This happens in deep ocean plant, which cannot get sunlight from the sun!

Definitions:

Biomass	Refers to the total mass of living plants, animals, fungi, and bacteria in a given area
Energy Flow	Flow of energy from an ecosystem to an organism and from organism to organism
Producers	Produce food in the form of carbs during photosynthesis
Consumers	Eat food produced by producers. Consumers can become energy for other consumers if they are eaten
Decomposition	Breaking down of organic wastes and dead organisms
Biodegradation	The action of living organisms such as bacteria to break down dead organism.
Decomposers	Changes waste and dead organisms into useable nutrients.
Autotrophs	Use energy from the environment to fuel the assembly of simple inorganic compounds to complex organic compounds.
Herbivores	Eat Plants only
Carnivores	Eat meat only
Omnivores	Eat both
Detritivores	Feed on plant and animal remains and other dead material (Earthworms, snails, crabs)
Decomposers	Break down organic matter (Bacteria or Fungus)

7. Feeding Relationships

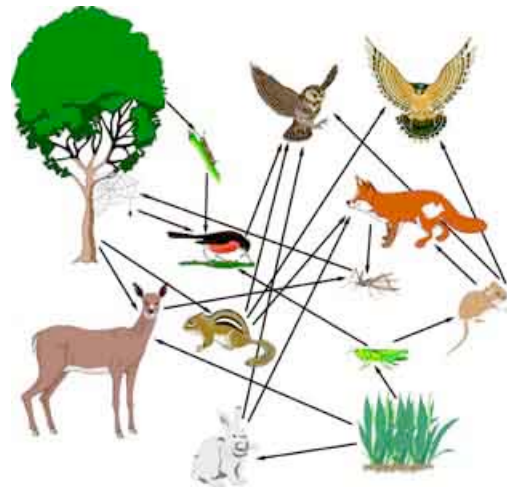
a. Food Chain



Shows one interaction that passes energy from one organism to the next in an ecosystem.

b. Food Web

A food web links all of the food chains in an ecosystem together, showing a more holistic view of energy transfer in the ecosystem.

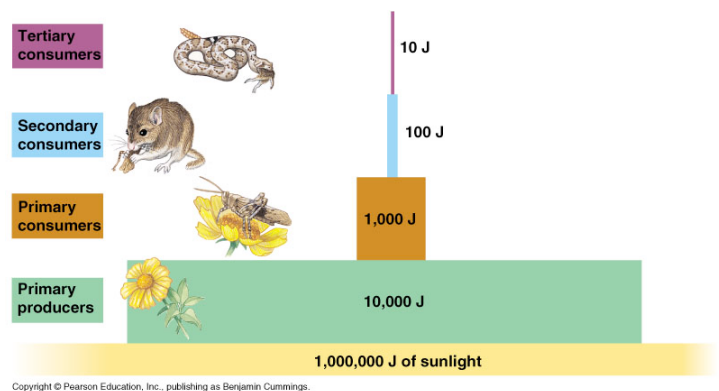


c. Trophic Levels

Each step in a food chain or food web is a trophic level. As you increase trophic level, the amount of energy decreases. Why do you think that is?

d. Ecological Pyramids:

Pyramids can come in the energy one as we have seen above, or they can come in a biomass pyramid, or a pyramid of numbers.



In all three examples the number decrease as you go upwards. Why is that for the biomass pyramid and the pyramid of numbers?

8. How do Ecosystems change over time?

Any change in an ecosystem can be referred to as Ecological Succession.

There are two different types of succession that we learned about in Gr

10. What are they? Two gold stars for who ever can remember!

- a. _____
- b. _____

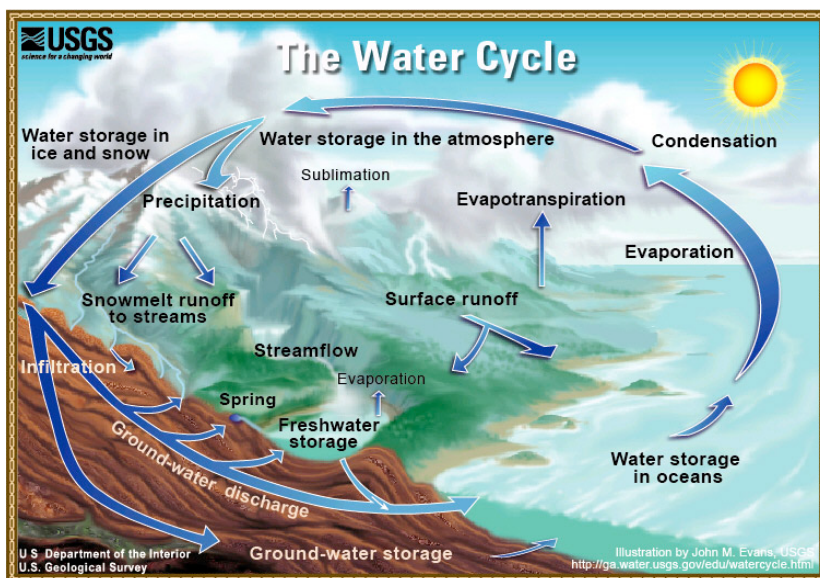
Five Gold stars if you can remember what the difference between them is!

Sometimes ecosystems change dramatically into others, but for the most part the changes are so small over time!

9. Cycles of Matter:

Matter is recycled within the ecosystem and it is done through Biogeochemical Cycles. This is the way that water, carbon, nitrogen, and phosphorus cycle through the atmosphere.

a. Water



All living things depend on water. It is through the processes of condensation, evaporation, and precipitation that water cycles through the atmosphere.

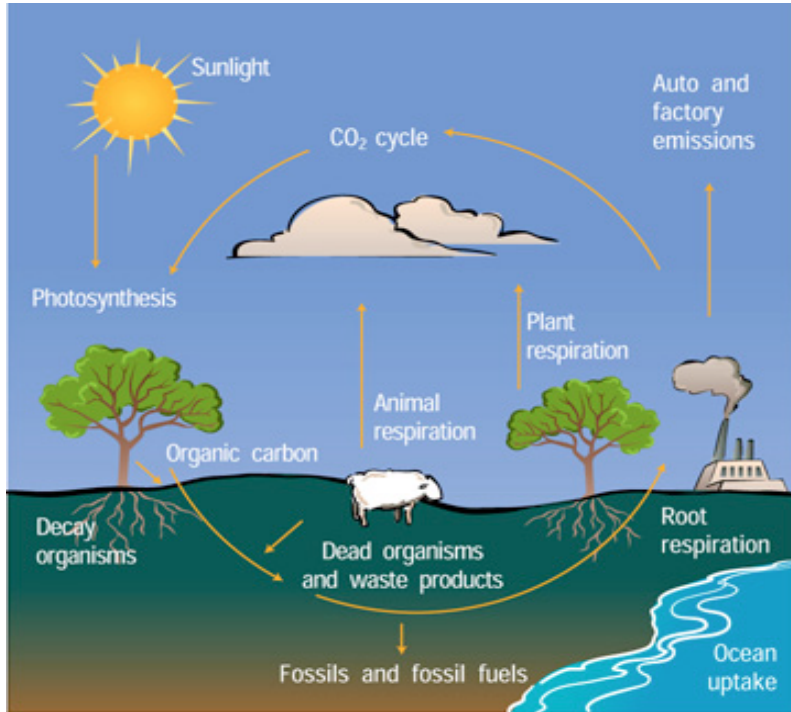
Did you know it takes one water molecule about 4000 years to make it through the cycle!

b. Carbon:

All living things are made up of carbon, which makes it pretty darn important!

In the carbon cycle, make sure you take note of 4 major processes

i. photosynthesis, respiration, and decomposition



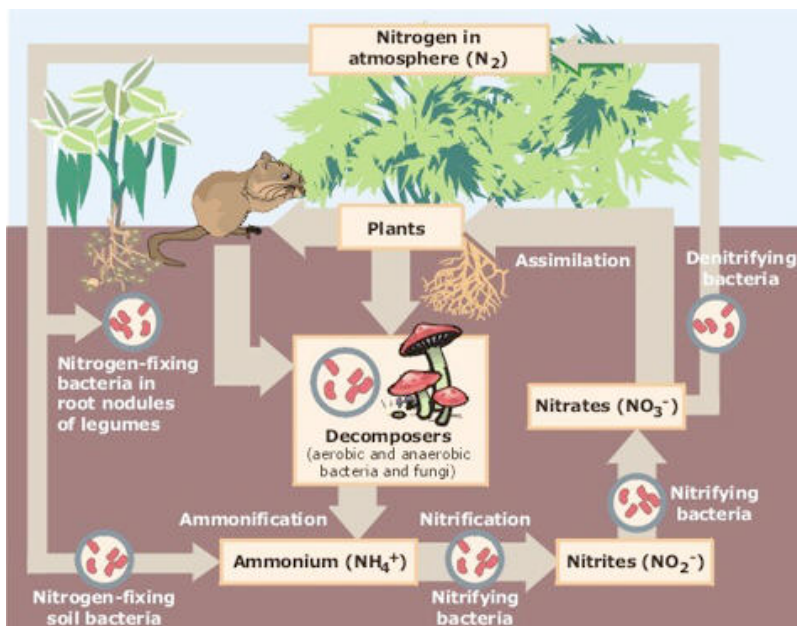
ii. Erosion and volcanic activity

iii. Burial and Decomposition of dead organisms and their conversion into coal and petroleum

iv. Human activities such as mining, cutting and burning forests, and burning fossil fuels, releasing carbon into the atmosphere as carbon dioxide.

c. Nitrogen:

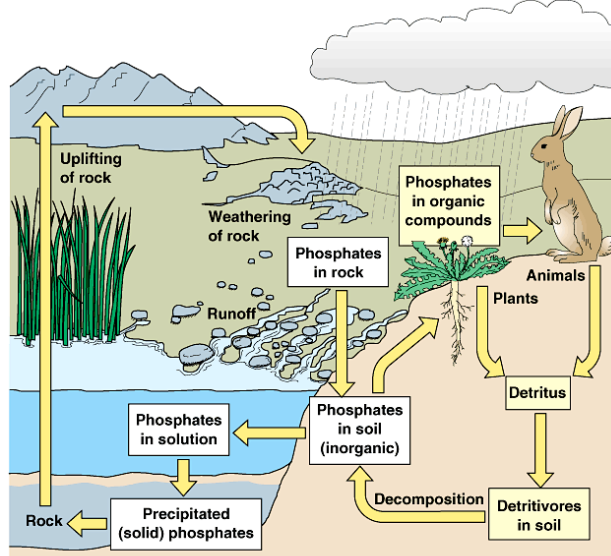
In the nitrogen cycle there are two processes which help gaseous nitrogen come into our soil.



Nitrogen fixation: Bacteria which turns nitrogen gas into ammonia. This ammonia is then converted to nitrates and nitrites by other bacteria.

Denitrification: Process where bacteria convert nitrates into nitrogen gas.

d. Phosphorous



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- Phosphorus helps form DNA and RNA
- Phosphorus does NOT enter the atmosphere (like water, carbon, oxygen and nitrogen)
- Phosphorus exists as phosphate and is found in rocks, soil and ocean sediments (sand)
- Phosphate is used by producers and then moves up through the food chain

e. Limiting Nutrients

When nutrients are needed in an ecosystem, but not in large amounts they are called limiting nutrients. That is because they are released slowly through cycles, instead of all at once.

When you get an influx of nutrients into an ecosystem it can result in the killing of organisms because they absorb too much, or it can make algal blooms. This is an increase in Algae because they are a primary producer which absorbs the nutrients.

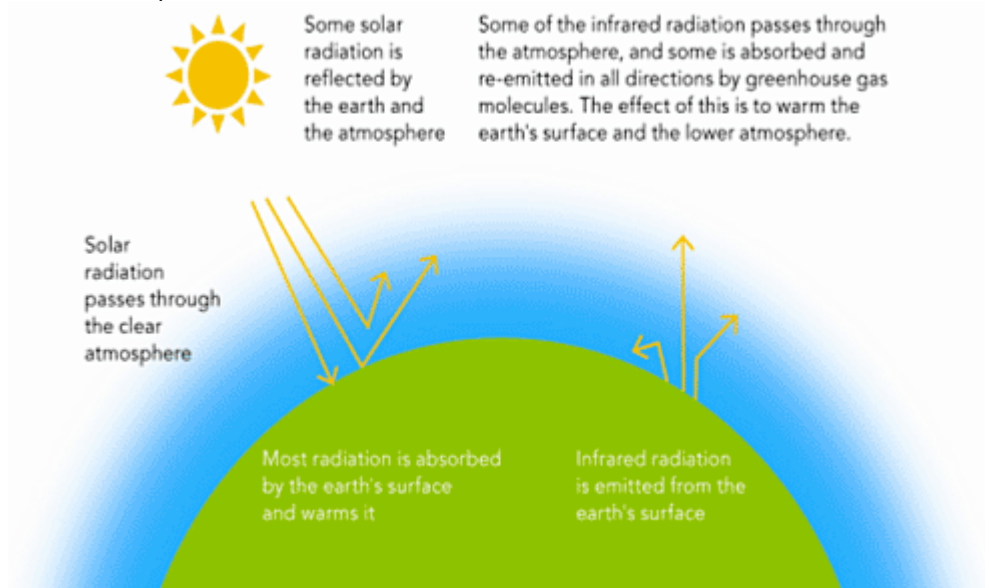
10. Climate

There are a few things which contribute to climate, which refers to the average, year after year conditions of temperature and precipitation.

1. temperatures and precipitation
2. latitude
3. elevation
4. ocean currents

a. The natural greenhouse effect

Carbon dioxide, water vapour, methane gas and other atmospheric gases contribute to the greenhouse effect. This is how the earth is naturally heated.



b. Latitude

The earth can be divided into zones depending how much sun exposure they receive.

1. Polar zones
2. Temperate Zones
3. Tropical Zones

c. Heat Transport:

Heat is transported through the earth in a few different ways.

One of which being ocean currents, and the other being winds.

Remember the way which heat is always transported, it moves from hot to not!

11. Population Growth/Control

If you have two dogs, and those two dogs have 6 puppies a year, how many dogs would you have in 5 years?



a. Population is controlled by density-dependent limiting factors like:

- i. competition
- ii. predation
- iii. parasitism
- iv. migration and immigration

The density-dependent limiting factors are all related to each other and can exacerbate each other.

For example:

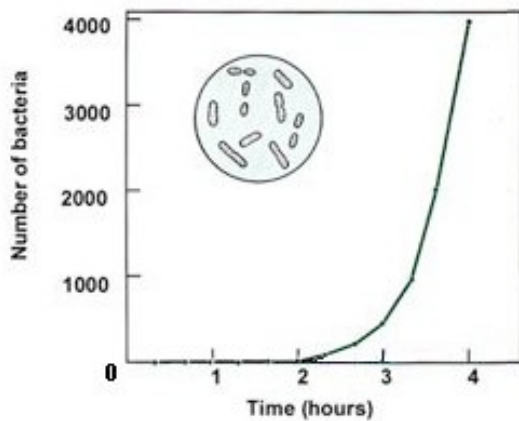
crowding makes it easier for parasites to infect more hosts, which causes more stress to parasitized animals, which can make them more vulnerable to predation and less able to compete with other animals for resources

b. Populations can also be affected by density-independent factors:

- i. flood
- ii. tsunami
- iii. draught
- iv. fire

c. Types of Growth

Populations can have two different types of growth (Exponential and Logistic)

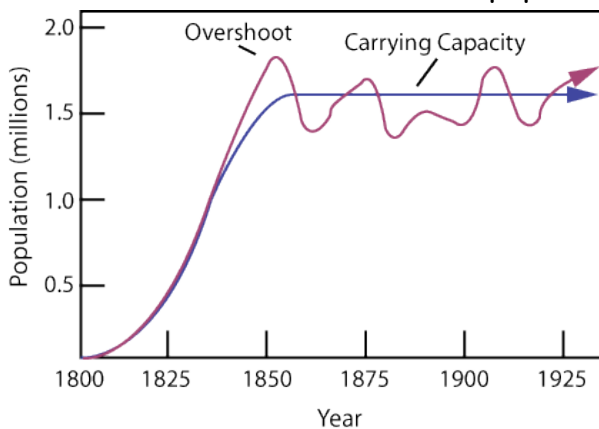


i. Exponential Growth:
With unlimited resources a population will grow exponentially to huge numbers.

Is this realistic?

ii. Logistic Growth

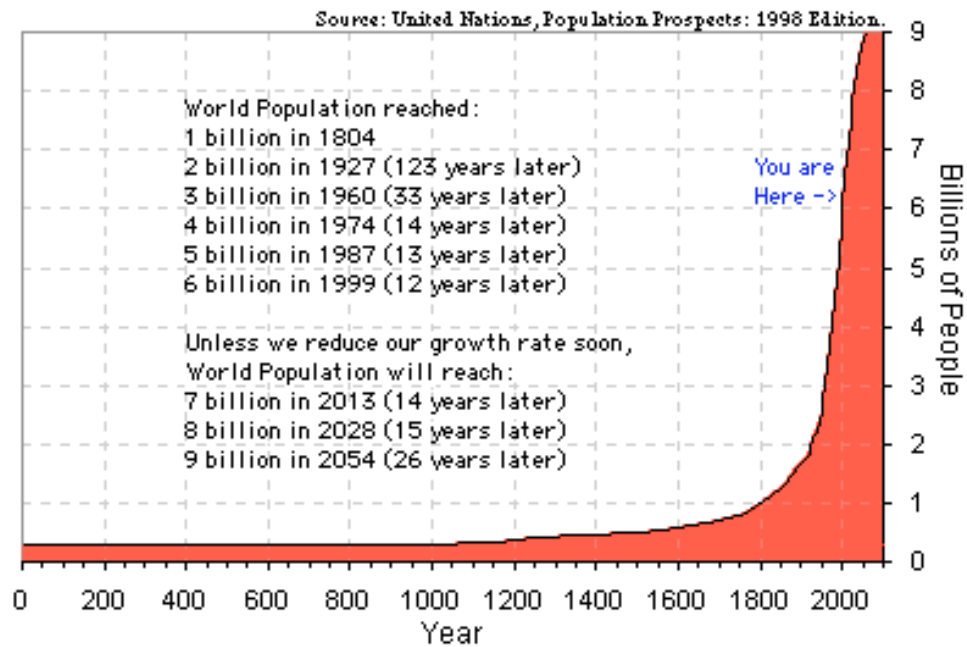
As resources and population play a game of balance, the population



growth stops when it reaches carrying capacity. If population exceeds the carrying capacity, then death occurs. If it drops below it, then growth occurs.

iii. What about the humans?

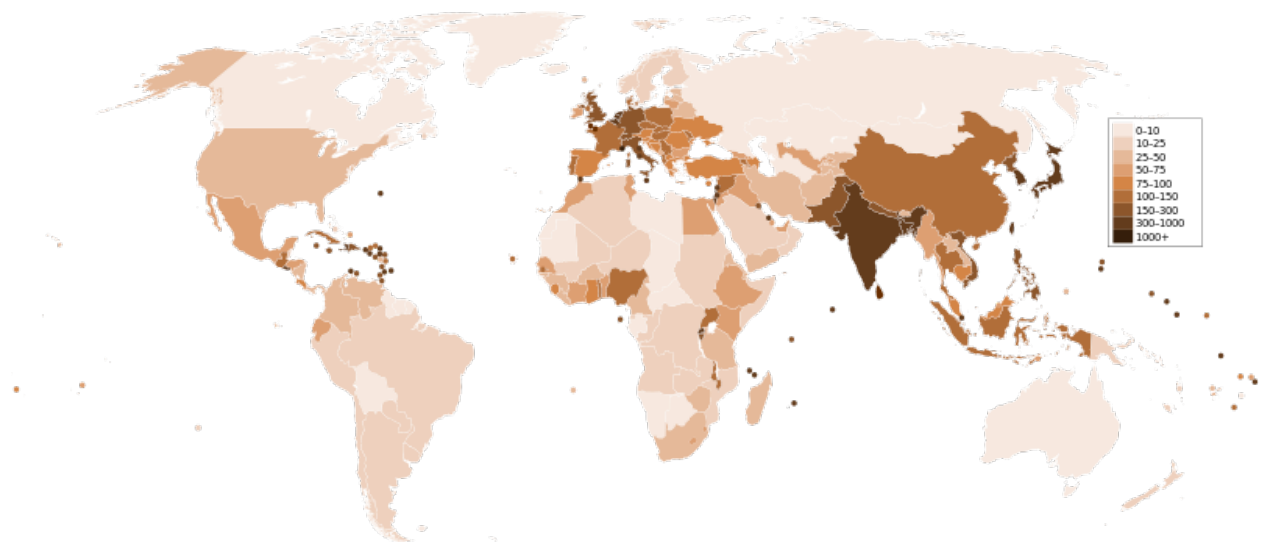
Well, let's take a look at human population growth over the past 2000 years



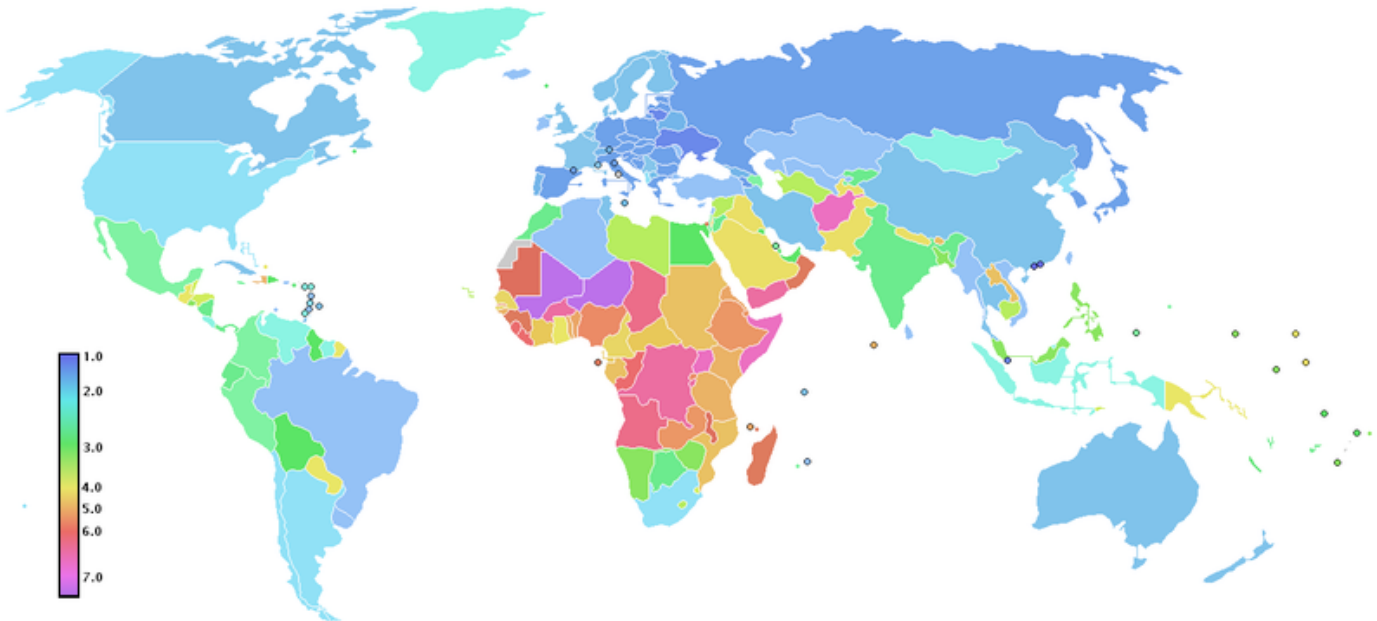
What's happening?

Have we reached our carrying capacity (K)?

Here is a map of population densities for the world...

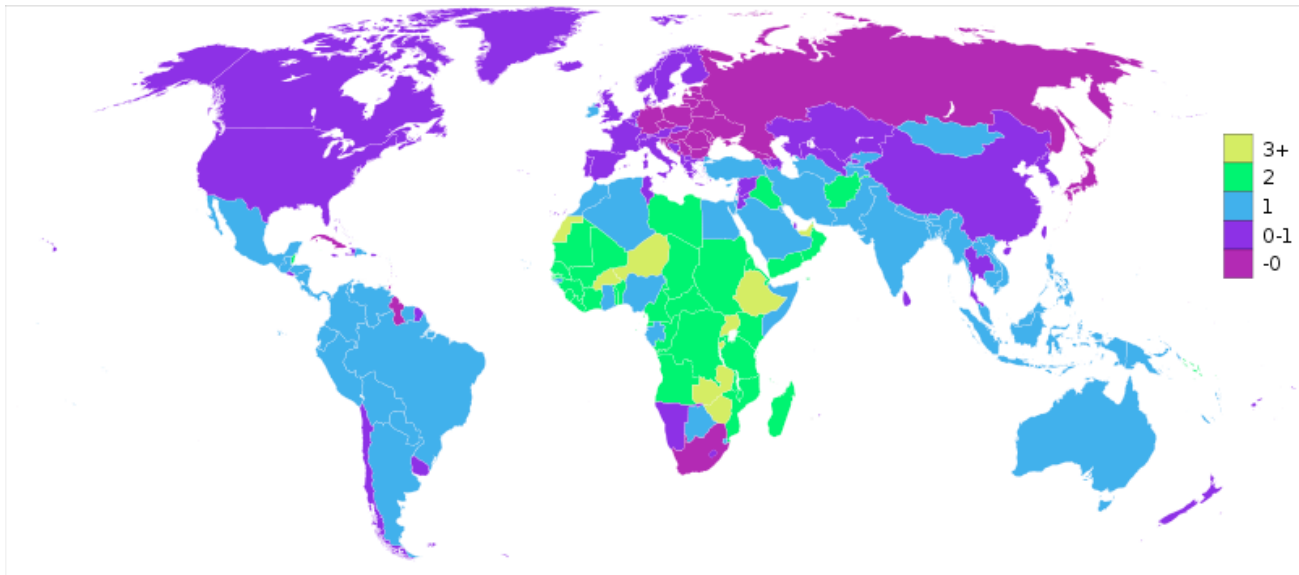


Here is a map of the birth rates and fertility around the world



Where is fertility the highest????

Ok last one.... This is the population growth rate by country



What's happening in this map????

The world is an ever changing place and dealing with human expanding and shrinking population growth on global level is difficult to say the least.....