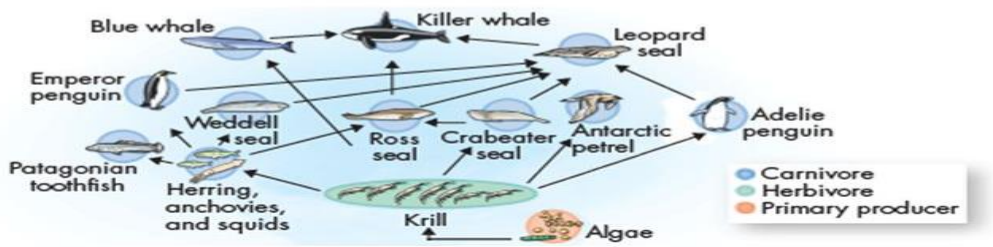
Ecology GPS Review

The Science of Ecology

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

Interactions within the biosphere produce a web of interdependence between organisms and the environments in which they live.



SCSh8. The Nature of Science: Students will understand important features of the process of scientific inquiry. Science Methods

- **Steps used to solve a problem**
- **Observation**
- **Questioning and stating problems**
- **Hypothesizing**
- **Theorizing**
- **Experimenting – including a control and experimental group**
- **Conclusion**

- **IV – independent variable (manipulated variable, controlled by researcher)**
- **DV – dependent variable (responding variable)**
- **CV - Controlled variables (should be the same in all samples)**
- **Control Experiment = experiment without IV**

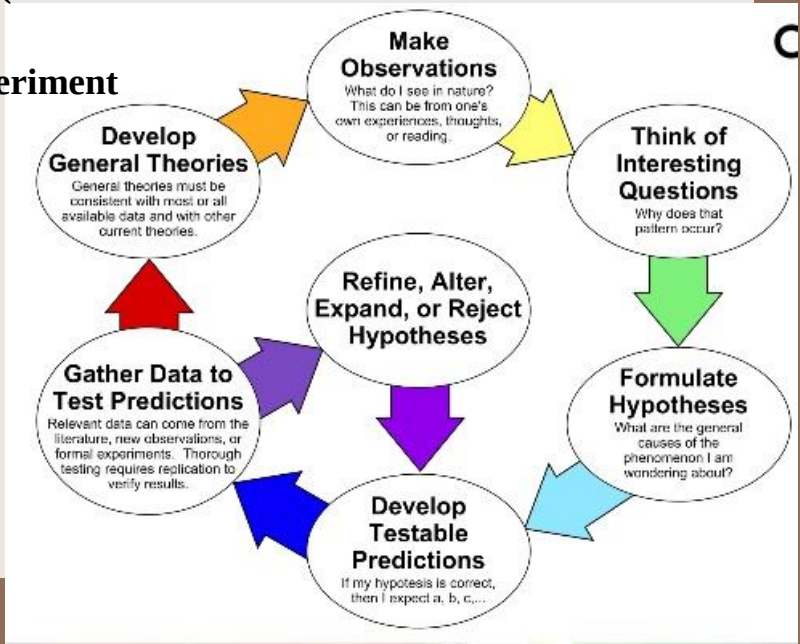
- **Tables and Graphs report quantitative data**
- **IV on x-axis and DV on y-axis of a graph**

Ex) Effects of pH on Tadpole Survival

IV – pH

DV-Number of Tadpoles

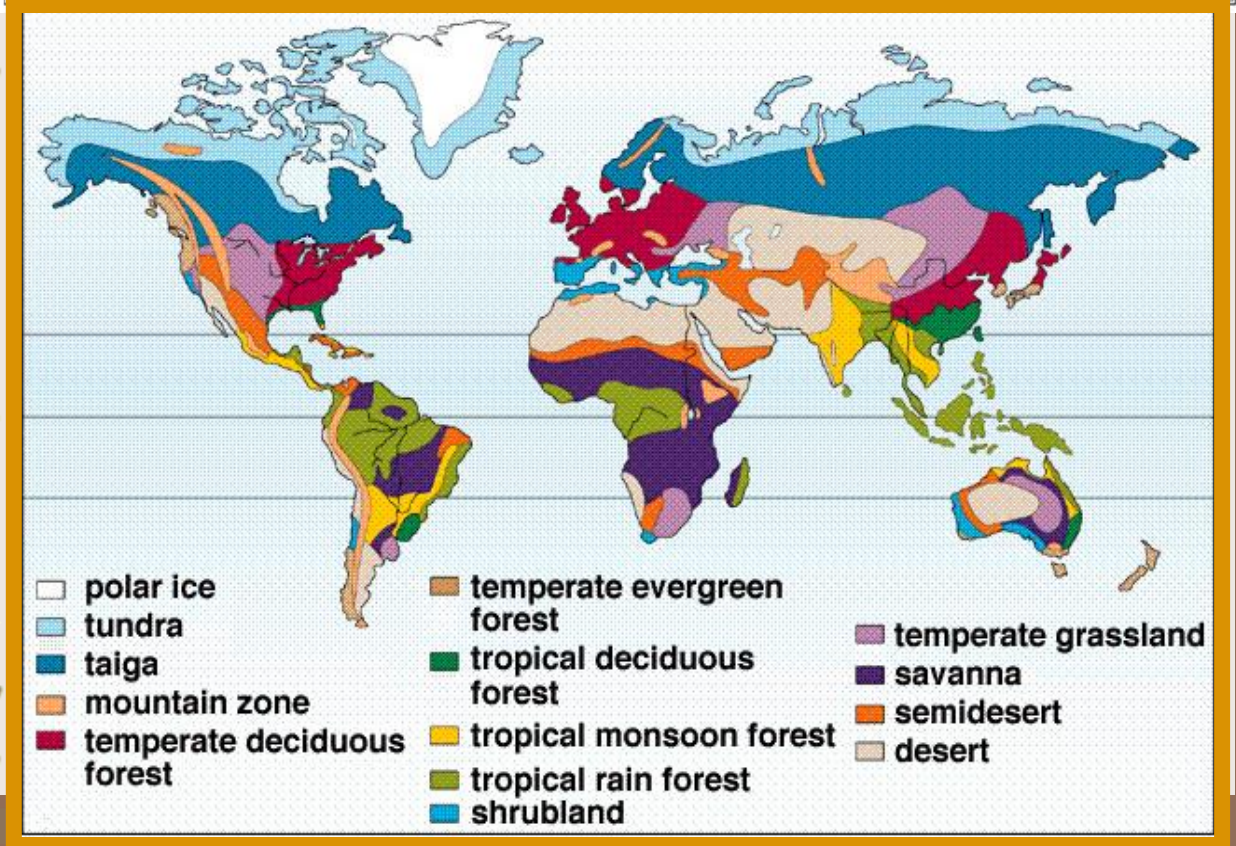
CV- temp of water, species of frog, amount of food



ECO#1→Biomes SEC1a. Characterize the biotic and abiotic components that define various biomes and aquatic life zones.

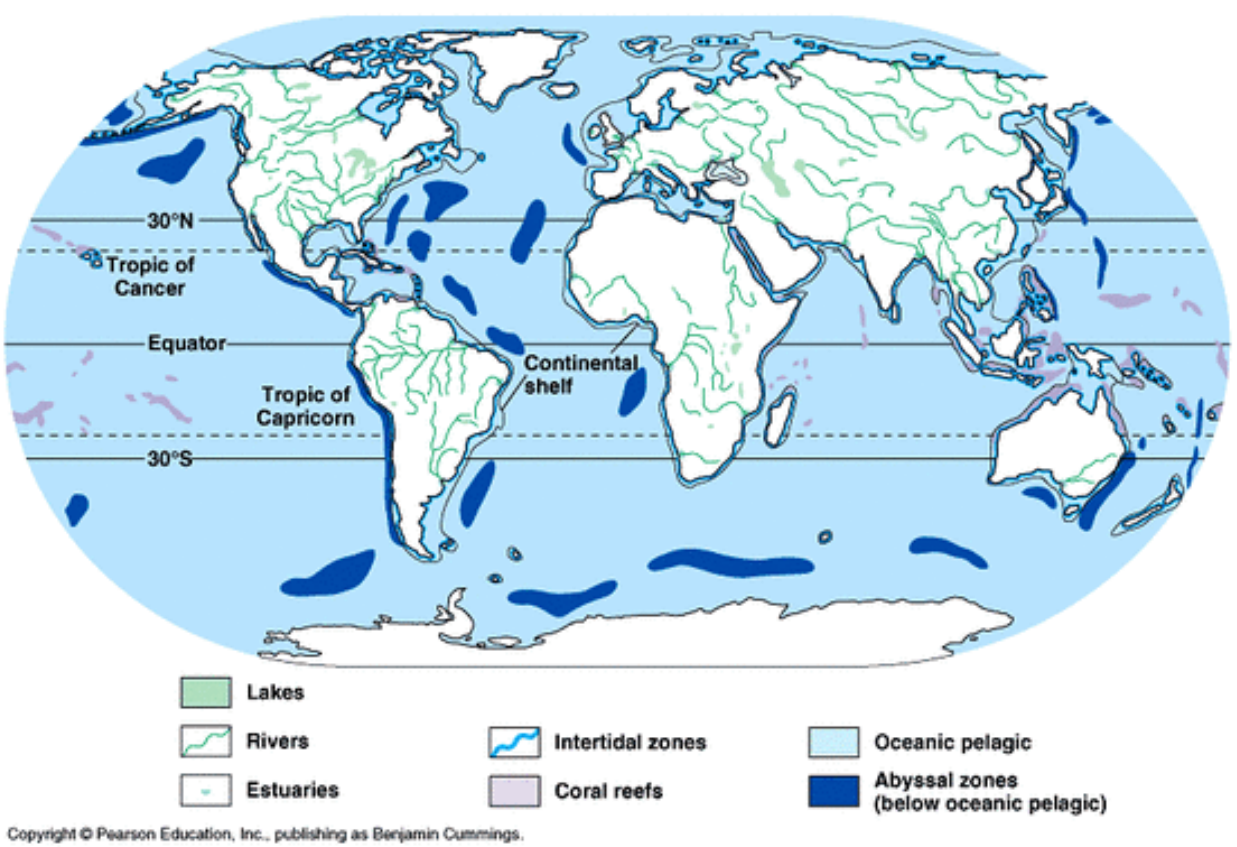
Some Land (Terrestrial) Biomes:

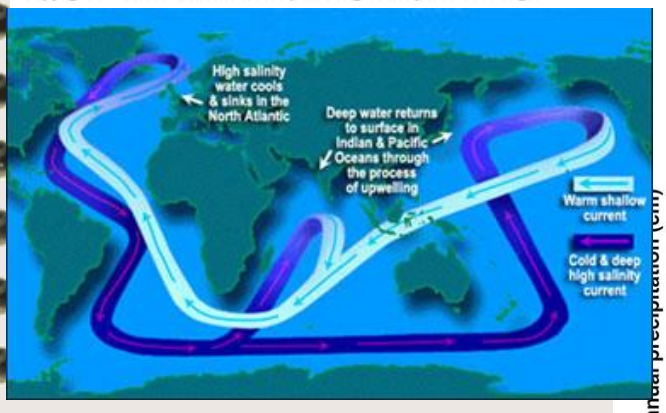
Biome	Water	Temperature	Soil	Plants	Animals
Desert	Almost none	hot or cold	poor	sparse - succulents (like cactus), sage brush	sparse - insects, arachnids, reptiles and birds (often nocturnal)
Chaparal (scrub)	dry summer, rainy winter	hot summer, cool winter	poor	shrubs, some woodland (like scrub oak)	drought and fire-adapted animals
Tundra	dry	cold	permafrost (frozen soil)	lichens and mosses	migrating animals
Taiga (coniferous forest)	adequate	cool year-round	poor, rocky soil	conifers	many mammals, birds, insects, arachnids, etc.
Temperate Deciduous Forest	adequate	cool season and warm season	fertile soil	deciduous trees	many mammals, birds, reptiles, insects, arachnids, etc.
Grassland	wet season, dry season	warm to hot (often with a cold season)	fertile soil	grasses (few or no trees)	many mammals, birds, insects, arachnids, etc.
Tropical rain forest	very wet	always warm	poor, thin soil	many plants	many animals
Swamp	very wet	warm	nutrient-rich soil	many plants	many animals
Cave (terrestrial)	variable	cool (and dark)	rocks	almost no plants	few animals
Biome	Water	Temperature	Soil	Plants	Animals

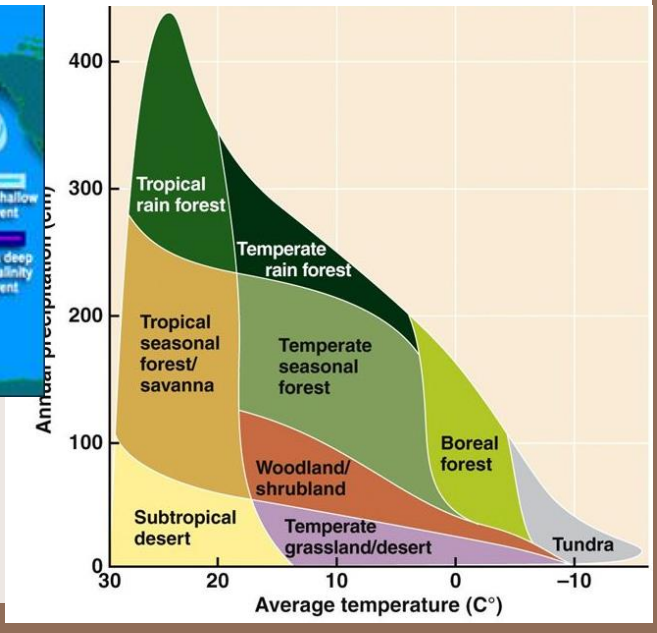


ECO#2→ Climate & BioGeography

SEC1b. Explore how global climate patterns and biogeography affect the distribution and abundance of species on Earth.







ECO#3→Biodiversity

SEC1c. Investigate factors that lead to the species richness of an ecosystem and describe the importance of biodiversity.

Threats to biodiversity

HIPPO Dilemma

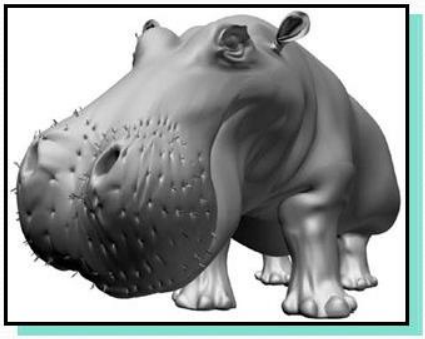
Habitat Loss

Introduced Species

Pollution

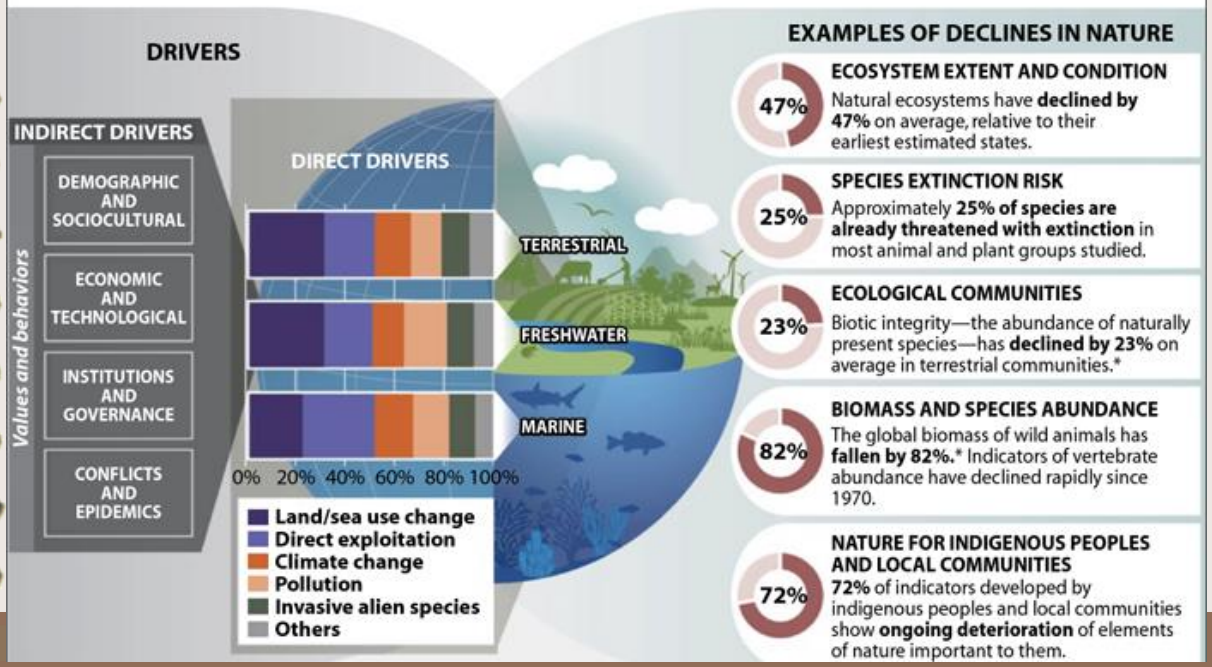
Population Growth

Over-consumption



The Human Drivers of World's Biodiversity Crisis

A report released by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) shows that many human-caused drivers are destroying plant and animal species worldwide.



ECO#4→Natural Selection

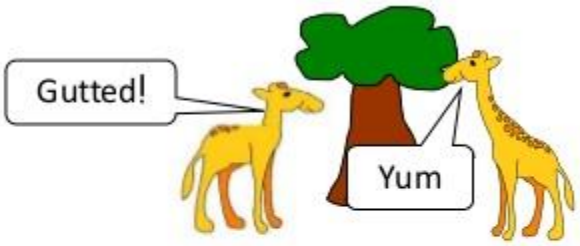
SEC1d. Relate the role of natural selection to organismal adaptations that are specific to their habitats and describe some examples of coevolution.

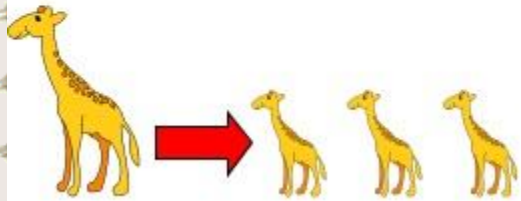
Natural Selection

1) Each species shows variation:

2) There is competition within each species for food, living space, water, mates etc.

3) The "better adapted" members of these species are more likely to survive – "Survival of the Fittest"



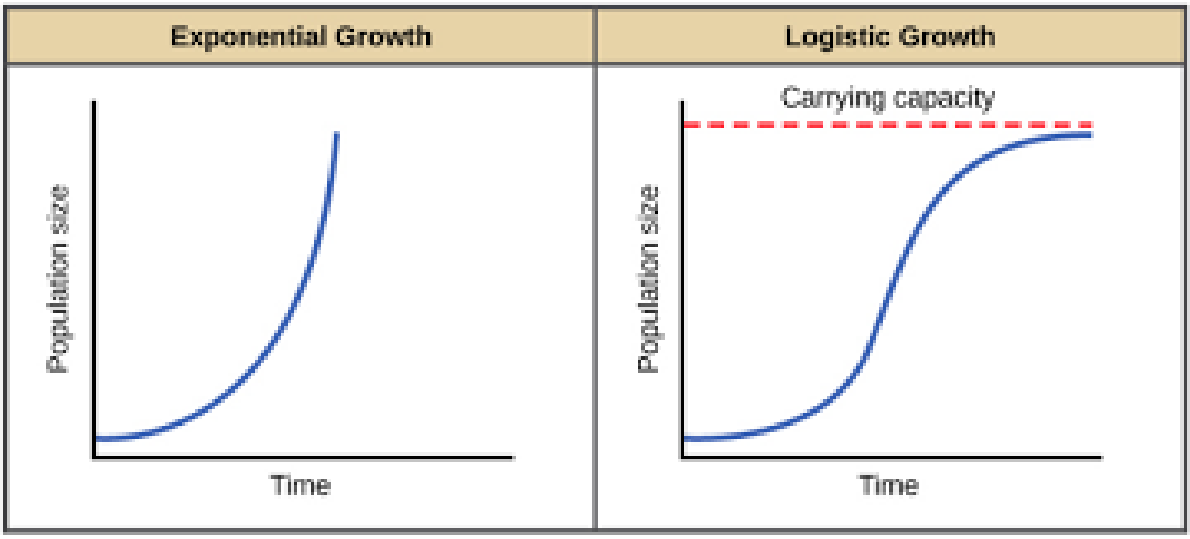


4) These survivors will pass on their better genes to their offspring who will also show this beneficial variation.

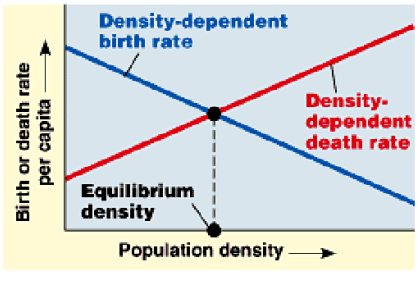
- Overproduction organisms produce more offspring than can survive
- Variation exists within a species
- Struggle for existence/ Competition
- Survival of the fittest/ fit enough

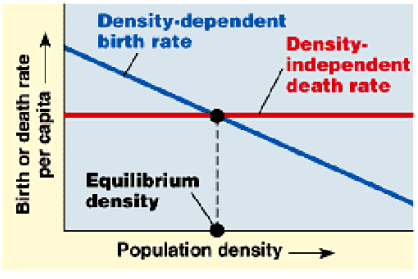
ECO#5→Population Density

SEC2a. Evaluate factors that regulate population growth to include intraspecific competition in population growth and population density.



- **Density-dependent** factors increase their affect on a population as population density increases.
  - This is a type of **negative feedback**.
- **Density-independent** factors are unrelated to population density, and there is no feedback to slow population growth.





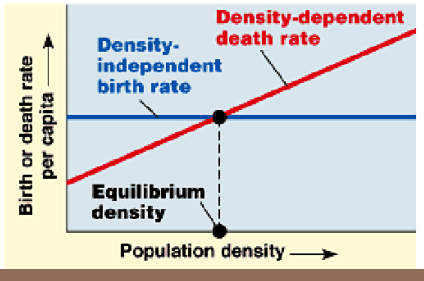
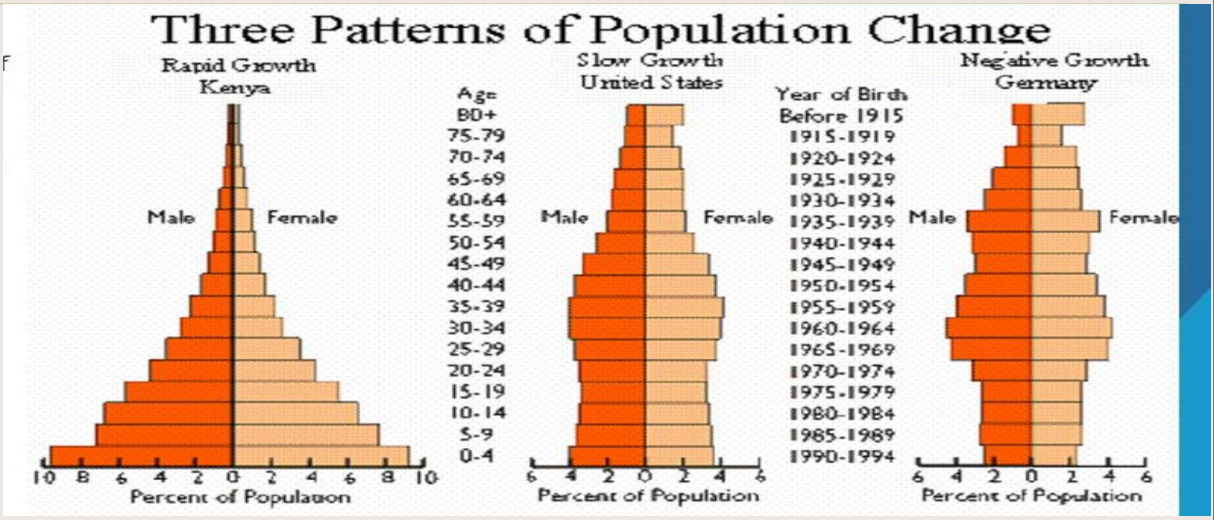
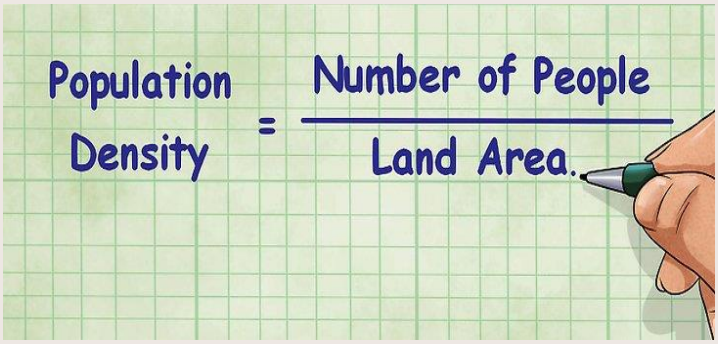


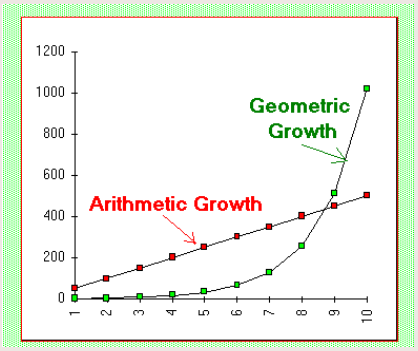
Fig. 52.13

ECO#6→Population Growth

SEC2b. Analyze models that predict population growth.







Rate and Growth

Rate
dY/dt

Population Growth
dN/dt=B-D

Exponential Growth

$$\frac{dN}{dt} = r_{max}N$$

Logistic Growth

$$\frac{dN}{dt} = r_{max}N\left(\frac{K-N}{K}\right)$$

dY= amount of change

t = time

B = birth rate

D = death rate

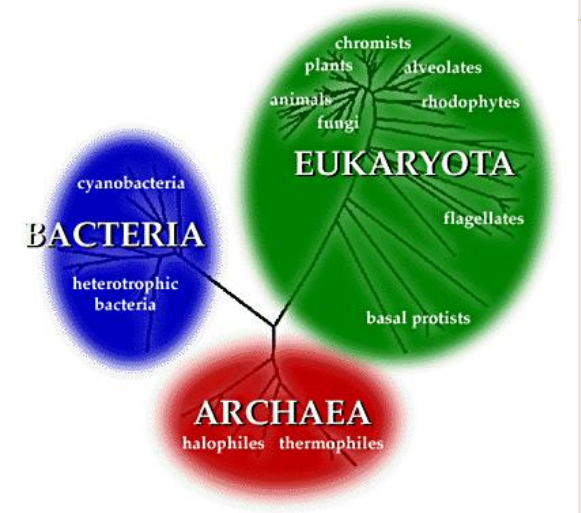
N = population size

K = carrying capacity

r_{max} = maximum per capita growth rate of population

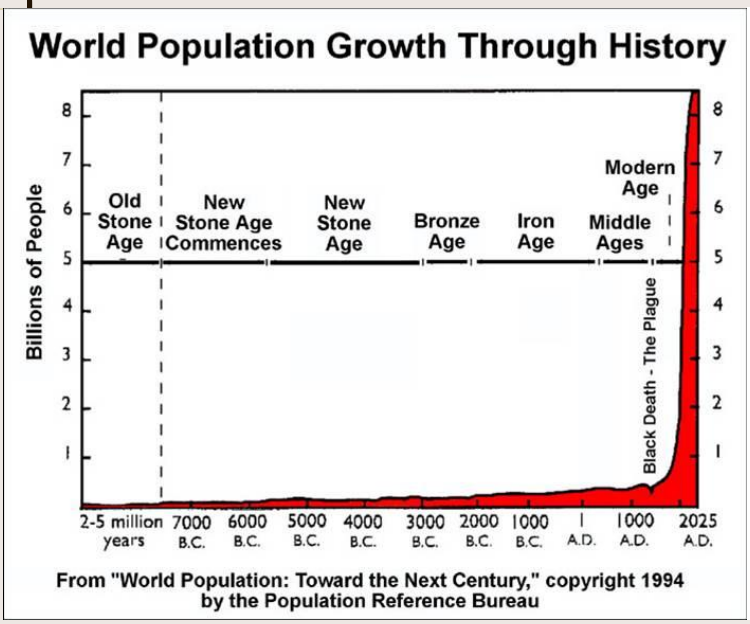
ECO#7→Phylogeny SEC2c.

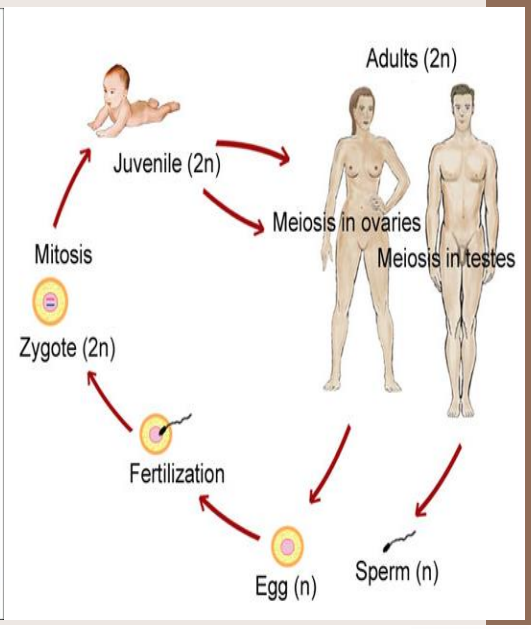
Describe the different life history and reproductive strategies that have evolved in organisms.

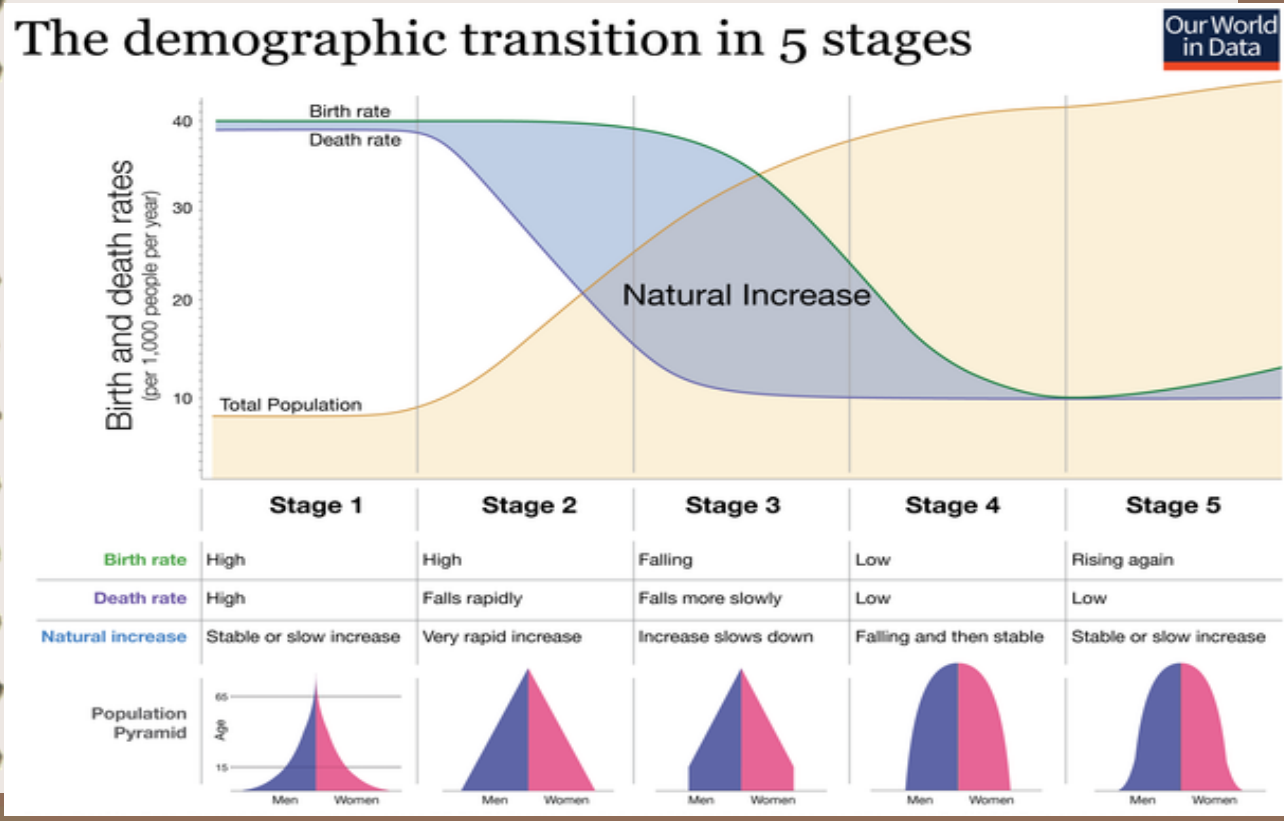


Domain Eu karya	
Kingdom	**Major Characteristics**
Animal	Ingestive hetero trophic, multicellular, lack cell walls and chlorophyll.
Plant	Usually auto trophic, cell walls (cellulose), usually multicellular
Protist	Autotrophic/heterotrophic, usually unicellular, some form colonies, some have cell walls (pectin and other compounds).
Fungi	Absorptive heterotrophic, lack chlorophyll, have cell walls (chitin).

ECO#8→Human Reproduction & Population SEC2d. Relate the rapid growth of human population to environmental problems







ECO#9→Symbiosis SEC3a. Compare and contrast species interactions (e.g. predation, parasitism, mutualism, commensalism, and competition) and adaptations that have evolved in response to interspecific selective pressures.

Symbiosis	Type of Relation-ship	Description
Mutual-ism	+/+	In this symbiosis both organisms benefit.
Commen-salism	+/0	In this symbiosis, one organism benefits, the other is neither helped nor harmed.
Parasite-Host	+/-	In this symbiosis, one organism benefits (parasite) and the other organism (host) is harmed usually gradually but not killed.
Predator-Prey	+/-	In this symbiosis, one organism benefits (predator) and the other organism (prey) is harmed usually dying immediately as it is eaten.
Compe-tition	-/-	While engaged in competition, both organisms are being harmed. •Intraspecific competition occurs within the same species •Interspecific competition occurs between different species

"Sym" means together.
"Bio" means life
"Symbiosis" means "living together"

ECO#10 → Adaptations

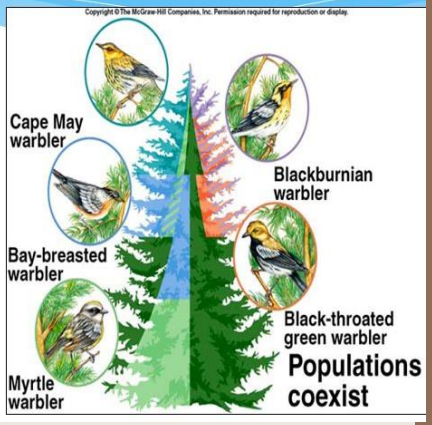
SEC3b. Explore ecological niches and resource partitioning.

SEC3 d. Analyze species diversity as it relates to the stability of ecosystems and communities.

Resource Partitioning

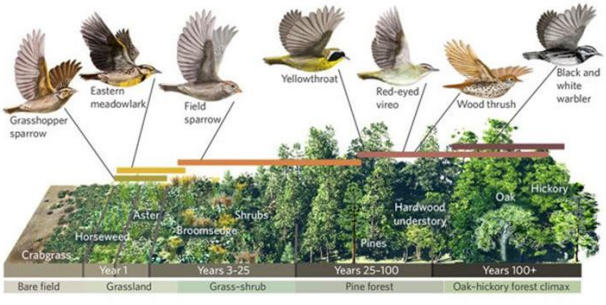
When two or more similar species coexist, such as these varieties of warbler, each species only uses part of the available resources. This is called **resource partitioning.**

(species sharing resources)



Ecological Niche

- **Ecological Niche** – the role a species serves in its ecosystem
  - including what it eats, what eats it, and how it behaves
  - No 2 species have the same ecological niche

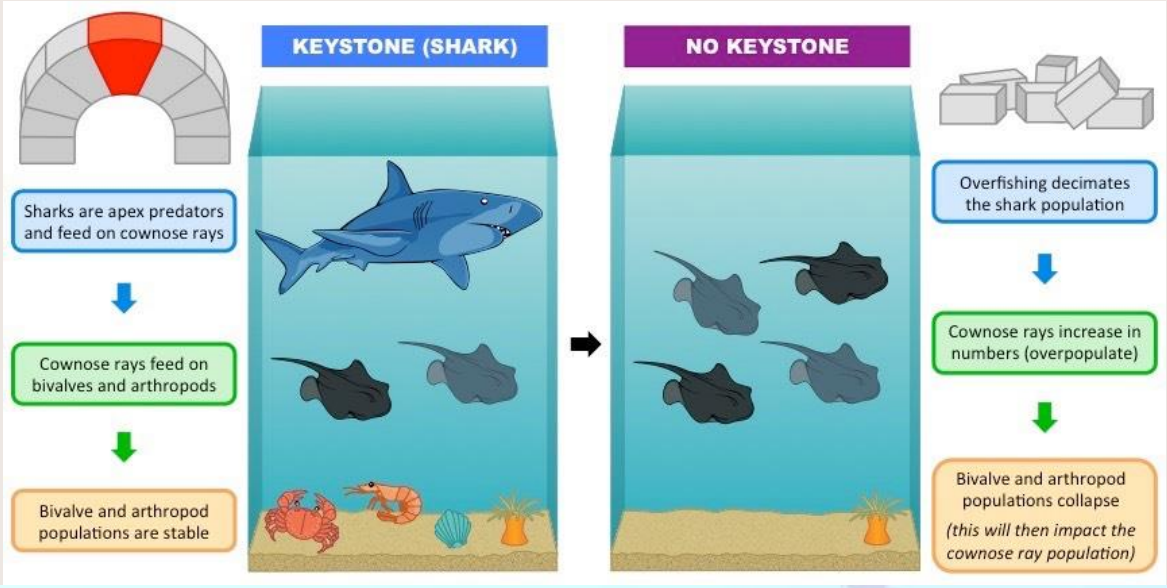


Ecological Niche

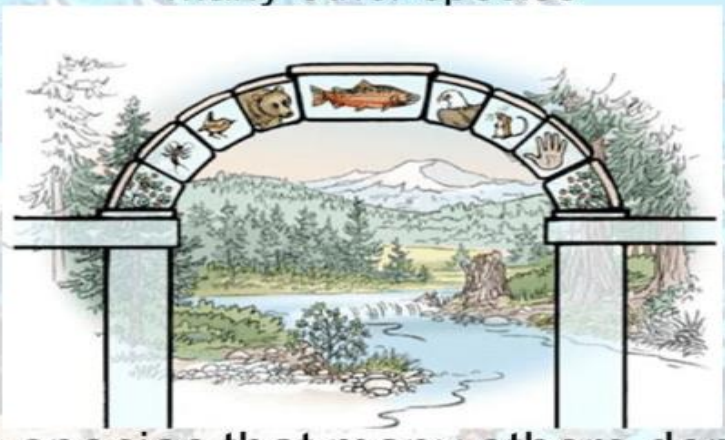
- The **ecological niche** describes the functional position of an organism in its environment.
- A niche comprises:
  - the **habitat** in which the organism lives.
  - the organism's **activity pattern**: the periods of time during which it is active.
  - the **resources** it obtains from the habitat.

ECO#11→ Keystone Species

SEC3c. Identify dominant, keystone, foundation, and endangered species and their roles in ecosystems and communities, locally and globally.



Keystone species – a species that is critical to the functioning of the ecosystem because it affects the survival and abundance of many other species



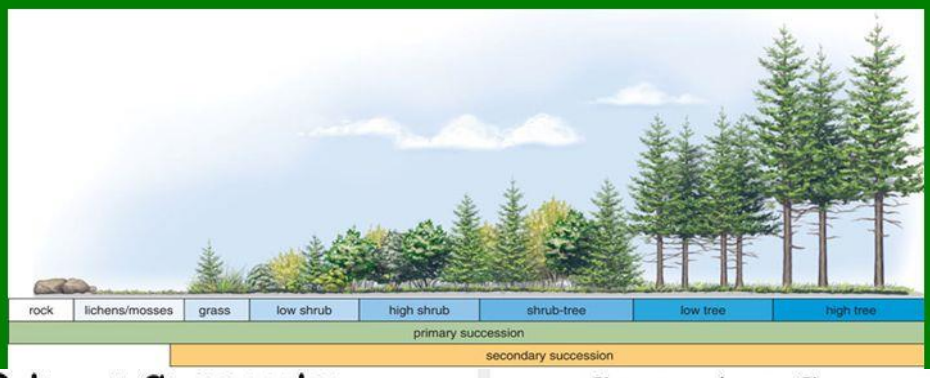
• – one species that many others depend on

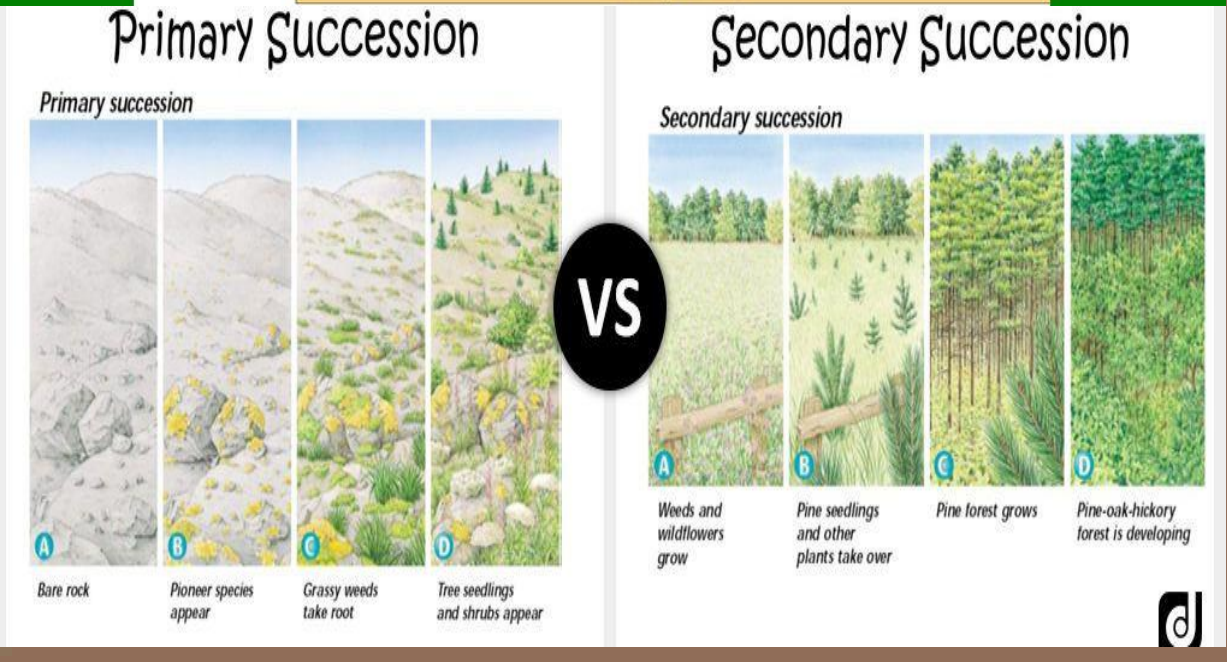
ECO#12→Succession SEC3e. Evaluate ecological succession in terms of changes in communities over time and the impact of disturbance on community composition.

Primary vs. Secondary

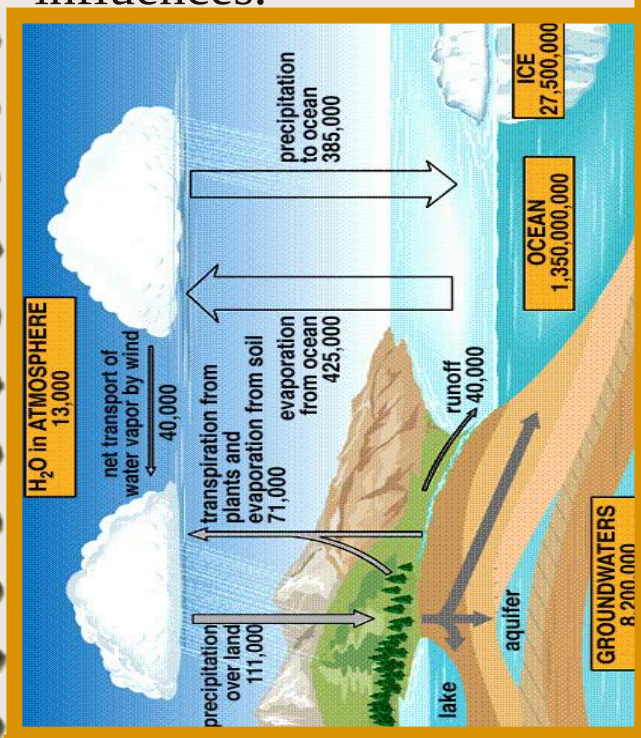
- **No soil**
- **Beginning → Pioneer species**
- **End → Climax community**

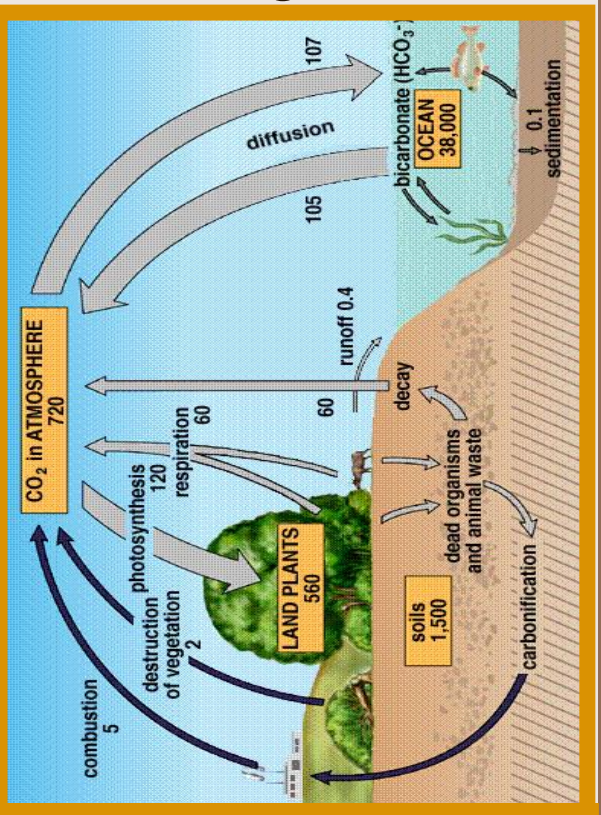
- **Soil already exists**
- **Seeds have suitable soil conditions.**
- **Occurs much faster**
- **End → Climax community**

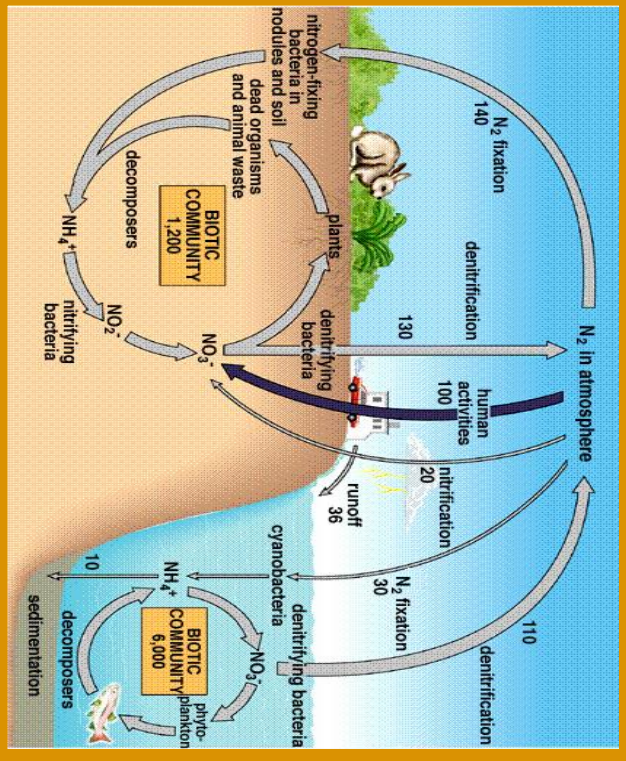


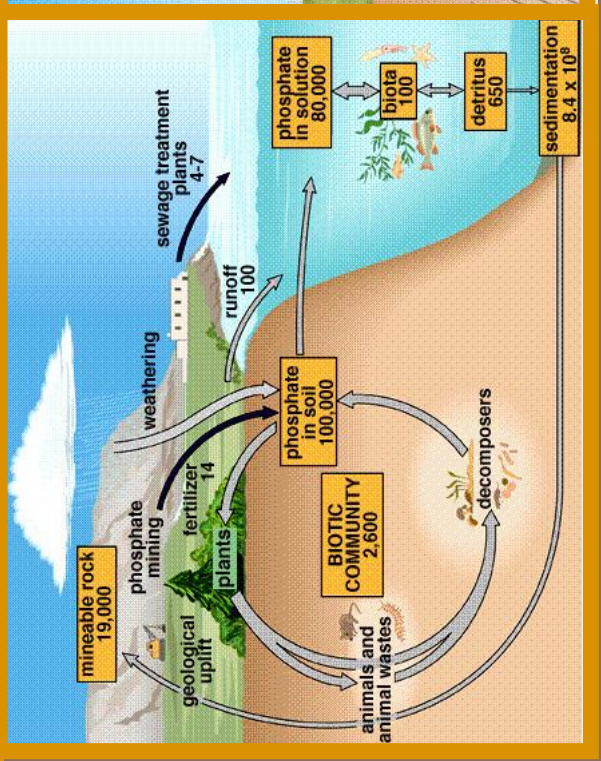


ECO#13 → Cycles SEC4a. Compare and contrast the carbon, water, oxygen, phosphorus, nitrogen, and sulfur cycles, describing their flow through biotic and abiotic pools, including human influences.



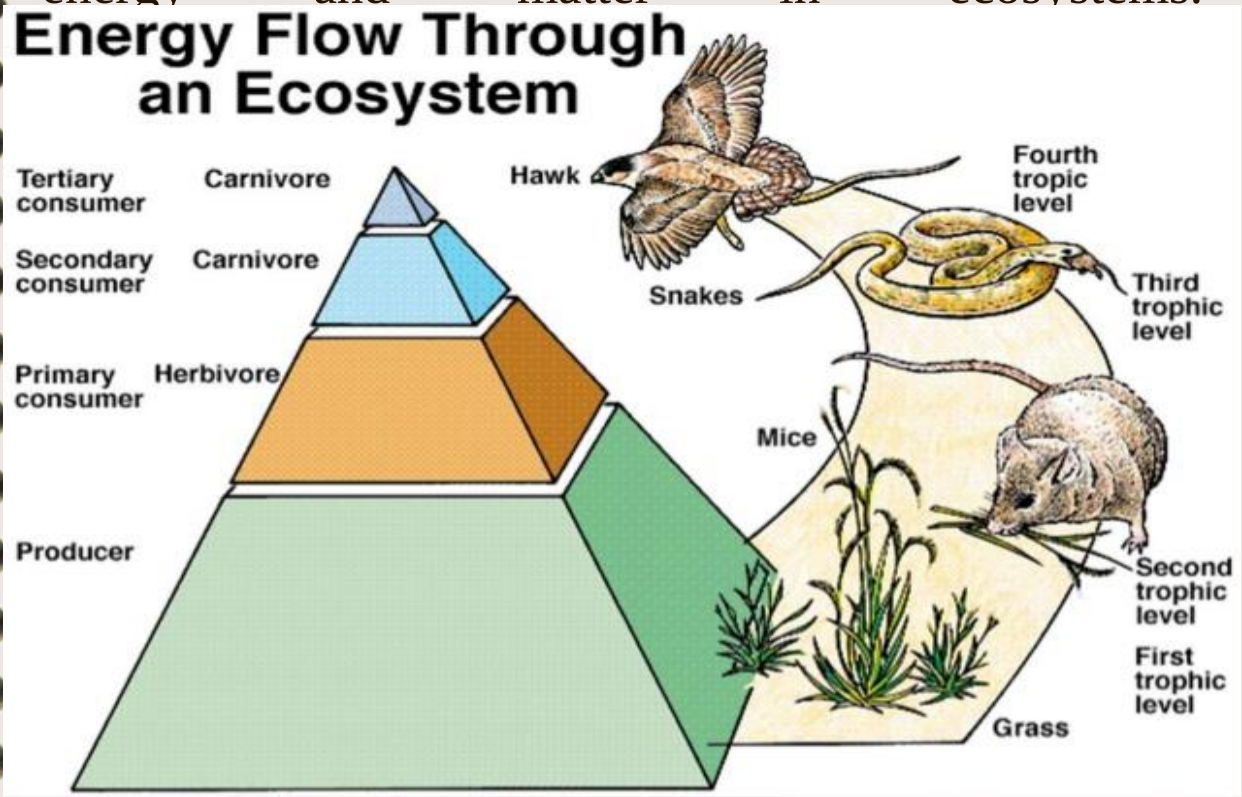


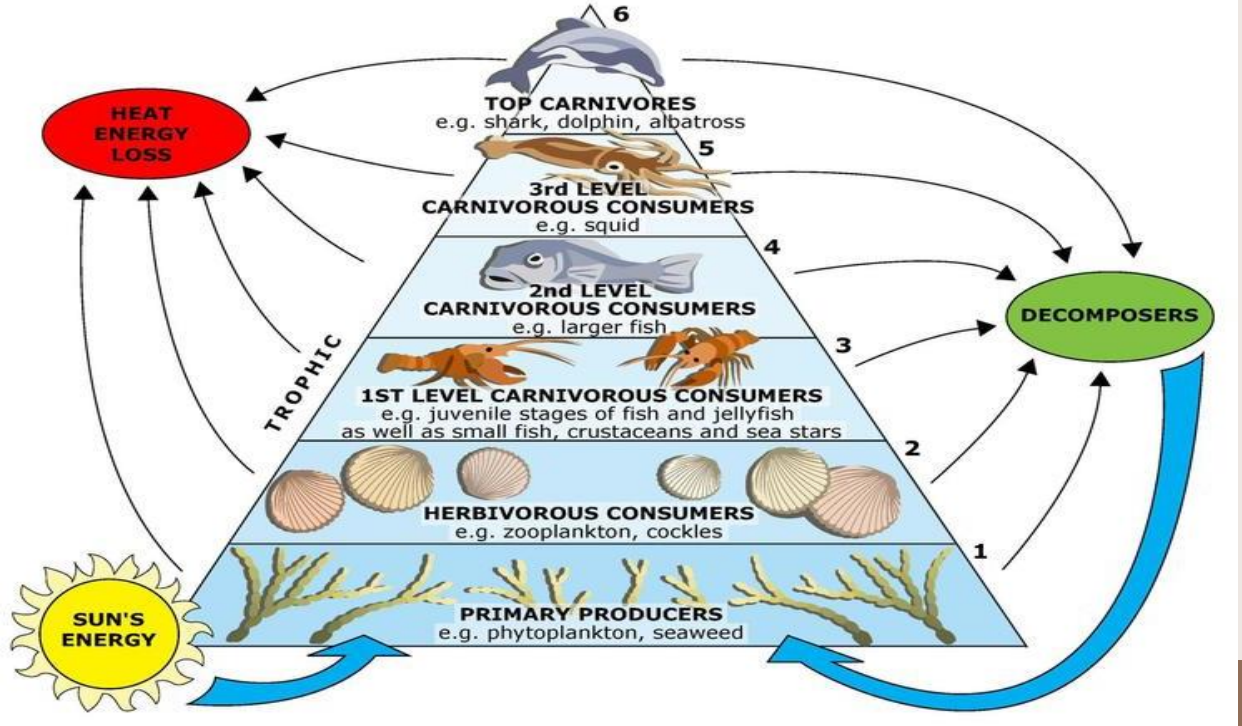




ECO#14→ Energy Flow SEC4b.

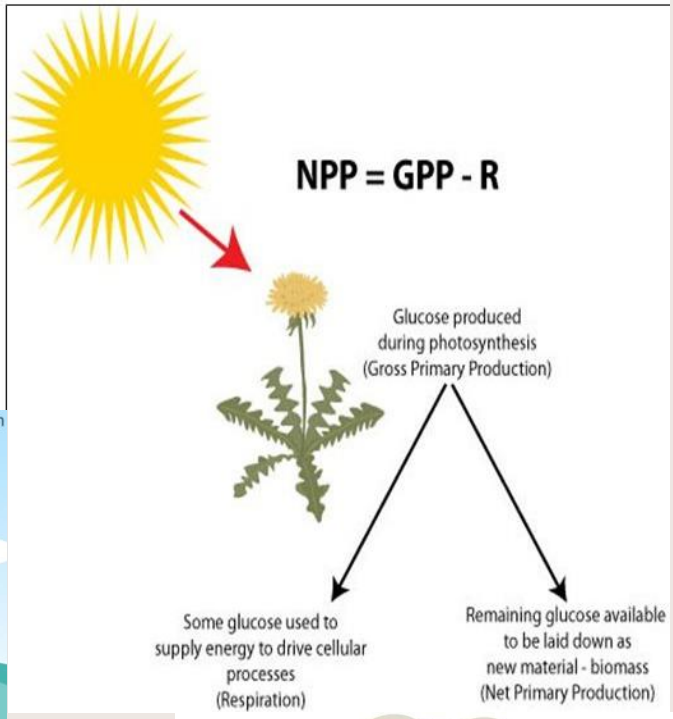
Apply the first and second laws of thermodynamics and the law of conservation of matter to the flow of energy and matter in ecosystems.

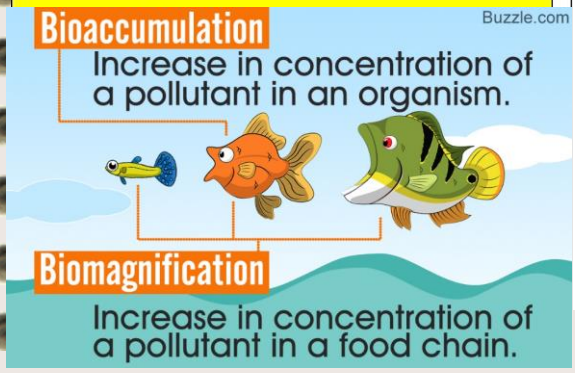


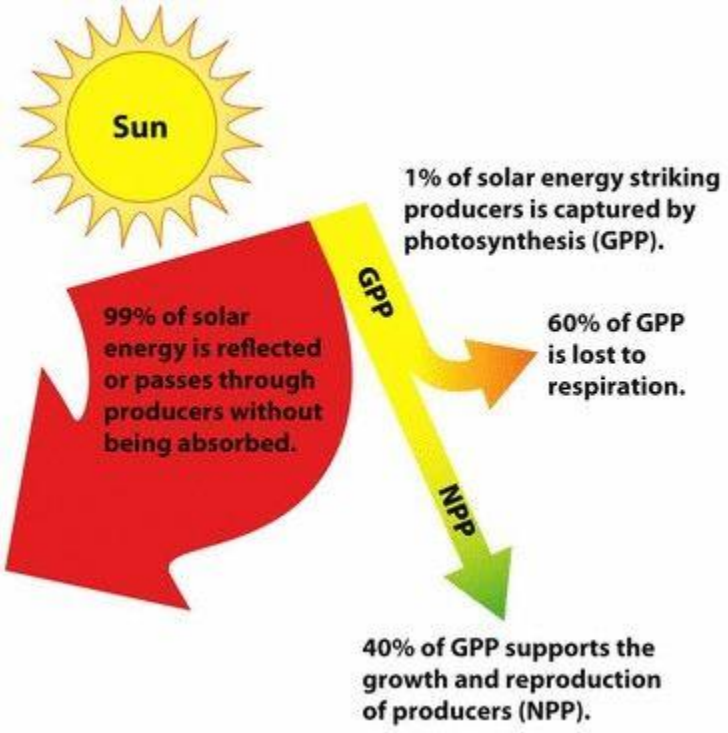


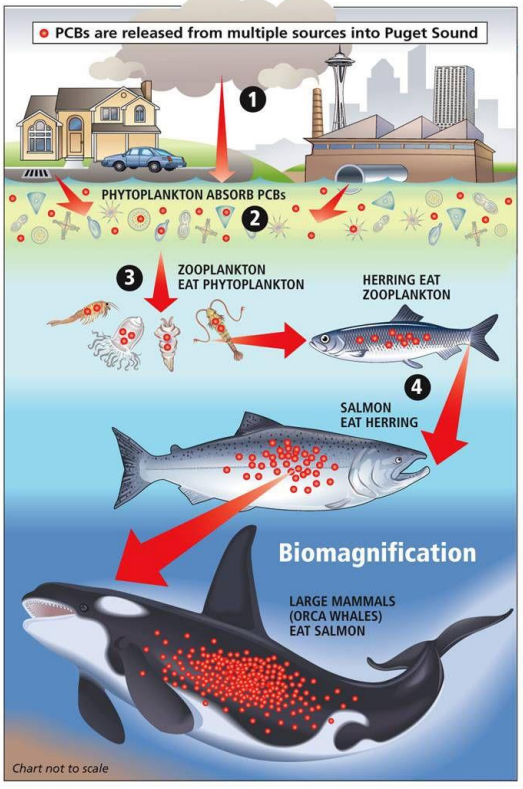
ECO#15 →Energy Pyramid SEC4c. Predict the flow of energy in the living world by constructing food chains, webs and pyramids for various ecosystems. SEC4d. Explore the importance of primary productivity in ecosystems.

- **Gross Primary Production** – the rate at which an ecosystem's producers (usually plants) convert solar energy into chemical energy as biomass found in their tissues
- **Net Primary Production** – GPP minus the rate at which they use some of this stored energy through cellular respiration.



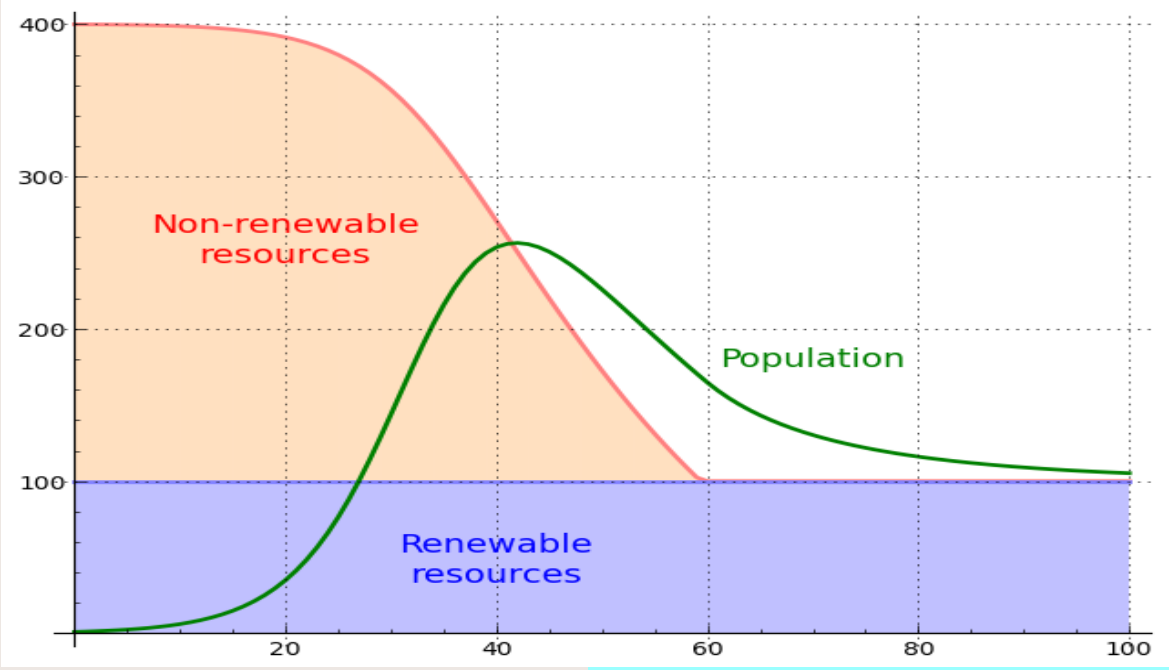


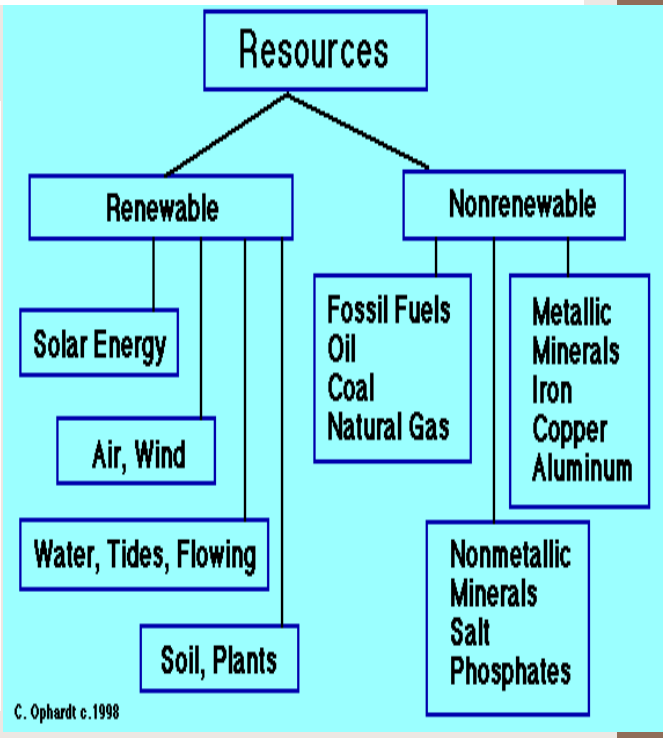




ECO#18→Resource Use SEC5b.

Compare and contrast the ecological impact of sustainable and non-sustainable use of resources, including soil, timber, fish and wild game, mineral resources, and nonrenewable energy.





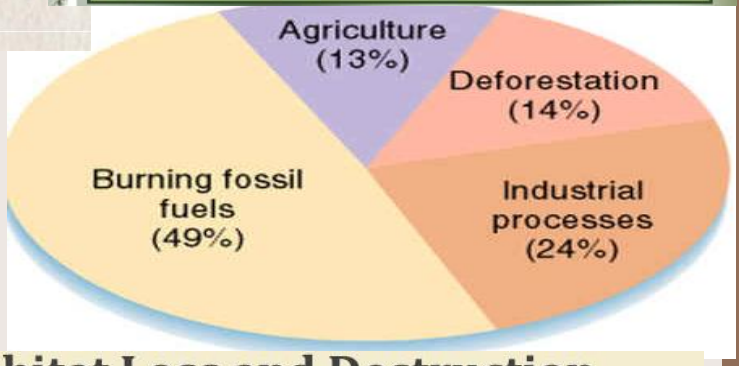
ECO#19→ Habitat Loss SEC5d. Explain the consequences of habitat fragmentation and habitat loss on biodiversity in relation to island biogeography, and apply island biogeography theory to the design of parks and nature preserves.

Habitat Loss happens when human activities destroy the ecosystems in which organisms live. This is caused mostly because of human population growth which leads to human expansions.

Habitat fragmentation is when habitats are divided into smaller or isolated fragments. This is caused often by road construction and affects plant pollinatio seed dispersal, wildlife movement and plant and animal reproduction

Reason For Habitat Loss

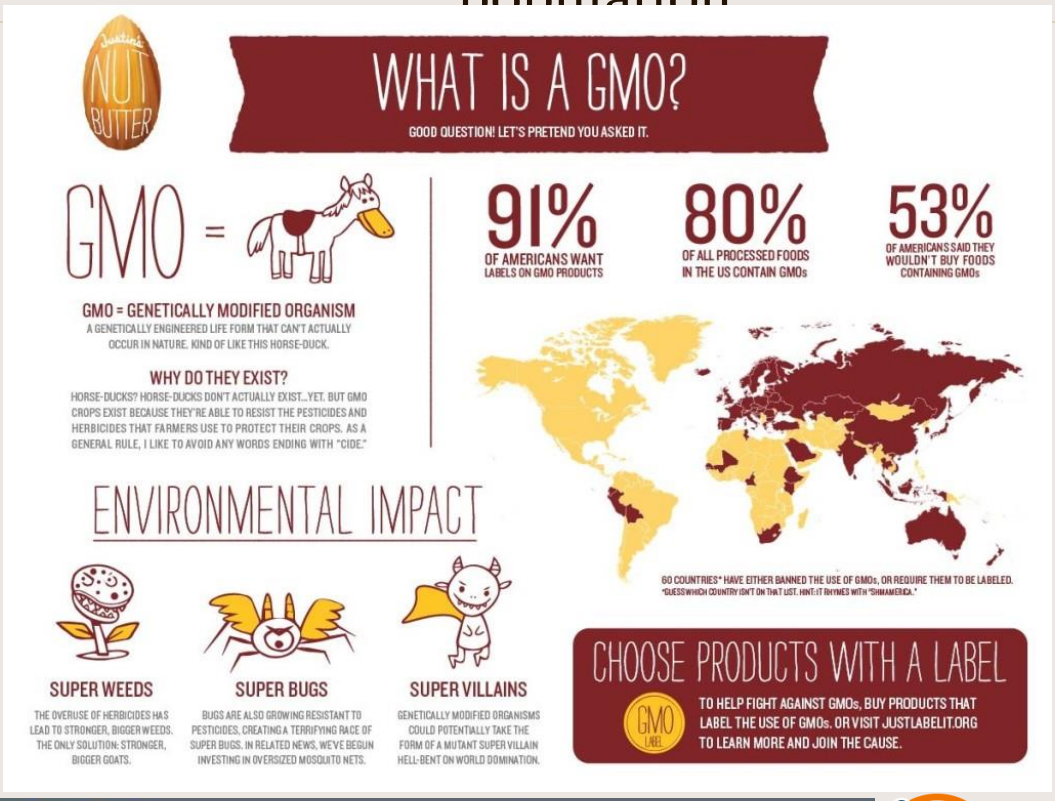
- To make more land available for housing and urbanization
- To harvest timber to create commercial items such as paper, furniture and homes
- To create ingredients that are highly prized consumer items, such as the oil from palm trees
- To create room for cattle ranching

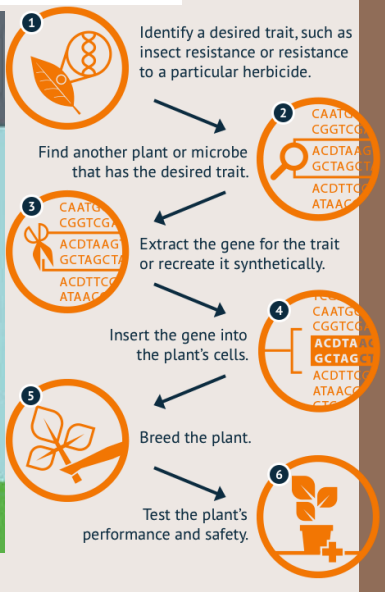


Solutions For Habitat Loss and Destruction

- We can combat habitat loss by preserving natural resources and learning how to use them in a way that does not require such frequent destruction of habitats. Regulation is equally important.
- We should also teach others the importance of biodiversity.
- Along with education, awareness should also be raised.
- As quickly as humans can destroy natural habitats, we should be just as willing to put forth the effort to rebuild and attempt to replace what is lost.

ECO#20 GMOs→ SEC5e. Research the ecological impact of agriculture (historical and modern) in the environment and its implications for feeding the world's population





Root Words

Element	Definition	Element	Definition
a-	without	*multi-*	many
ab-	away from	*mut-*	to change
ad-	near	*myco-*	fungi
aero-	air	*neco-*	corpse
alveus	cavity	*neur-*	nerve
arthron-	joint	*nomen-*	name
atrium-	entrance room	*niga-*	black
auto-	self	*oculo-*	eye
bacterio-	bacteria	*oligo-*	few
bi-	two	*-oma*	tumor
bio-	life	*omni-*	all
carnis-,carn-	meat	*oo, ovum*	egg
chele-	claw	*osteo-*	bone
chloro-	green	*paleo-*	old
chroma-	color	*ped, pod*	foot
-cide	killer of	*peri-*	around
con-	with	*pestis*	plague
cytis-	pouch	*phaeo-*	brown
-cyte, cyto-	cell	*phage-*	to eat
dermis-, derm-	skin	*-phore*	bearer
di-	two	*photo-*	light
ecto-	on the outside	*-phyll*	leaf
endo-	inner, inside	*-phyte, phyto-*	plant
epi-	upon	*pino-*	to drink
eu-	true	*plankto-*	drifting
exo-	outside of	*poly-*	many
feto-	fetus	*pseudo-*	false
gastro-	stomach	*primordis-*	original
-gen	producing	*pro-*	first
geo-	earth	*renes-*	kidney
gymno-	naked	*reptilis-*	crawling
halo-	salt	*rhiza, rhizo-*	root
hemato-	blood	*rodere*	to gnaw
hemi-	half	*sacchrum*	sugar
herb-	plant	*sapros-*	rotten
hetero-	other	*-scopy*	observation
histo-	tissue	*soma-*	body
homo-	same, like	*sonus-*	sound
hydro-	water	*sperma-*	seed
hyper-	over	*spirare*	breathe
hypo-	under	*-stasis*	position
inter-	between	*taxis*	arrangement
intra-	within	*telo-*	end
-itis	infection	*therm-*	heat
karyo-	nucleus	*thrombos*	clot
leuco-	white	*trans-*	across
locus	place	*tri-*	three
-logy	study of	*tricho-*	hair
lysis	to loosen, break	*troph-*	feed
macro-	large	*umbilicus*	navel
maxilla	jaw	*uni-*	one
mensis	month	*vasculum*	vessel
mesos-	middle	*vor-*	to eat, devour
meta-	between	*xero-*	dry
micro-	small	*zoo-, zoa-*	animal
mono-	one	*zygon-*	yoke
morph-	form		

Ecology GPS

ECO#1 → Biomes **SEC1a. Characterize the biotic and abiotic components that define various biomes and aquatic life zones.**	**ECO#2 → Climate & BioGeography** **SEC1b. Explore how global climate patterns and biogeography affect the distribution and abundance of species on Earth.**	**ECO#3 → Biodiversity** **SEC1c. Investigate factors that lead to the species richness of an ecosystem and describe the importance of biodiversity.**	**ECO#4 → Natural Selection** **SEC1d. Relate the role of natural selection to organismal adaptations that are specific to their habitats and describe some examples of coevolution.**
ECO#5 → Symbiosis & Population Density **SEC2a. Evaluate factors that regulate population growth to include intraspecific competition in population growth and population density.**	ECO#6 → Population Growth SEC2b. Analyze models that predict population growth.	ECO#7 → Phylogeny SEC2c. Describe the different life history and reproductive strategies that have evolved in organisms.	ECO#8 → Human Reproduction & Population SEC2d. Relate the rapid growth of human population to environmental problems.
ECO#9 → Symbiosis **SEC3a. Compare and contrast species interactions (e.g. predation, parasitism, mutualism, commensalism, and competition) and adaptations that have evolved in response to interspecific selective pressures.**	ECO#10 → Adaptations SEC3b. Explore ecological niches and resource partitioning. SEC3 d. Analyze species diversity as it relates to the stability of ecosystems and communities.	ECO#11 → Keystone Species SEC3c. Identify dominant, keystone, foundation, and endangered species and their roles in ecosystems and communities, locally and globally.	ECO#12 → Succession SEC3e. Evaluate ecological succession in terms of changes in communities over time and the impact of disturbance on community composition.
ECO#13 → Cycles **SEC4a. Compare and contrast the carbon, water, oxygen, phosphorus, nitrogen, and sulfur cycles, describing their flow through biotic and abiotic pools, including human influences.**	ECO#14 → Energy Flow SEC4b. Apply the first and second laws of thermodynamics and the law of conservation of matter to the flow of energy and matter in ecosystems.	ECO#15 → Energy Pyramid SEC4c. Predict the flow of energy in the living world by constructing food chains, webs and pyramids for various ecosystems. SEC4d. Explore the importance of primary productivity in ecosystems.	ECO#16 → Climate Change SEC5c. Evaluate the causes and impacts on ecosystems of natural and anthropogenic climate change.
ECO#17 → Pollution **SEC5a. Describe the sources, environmental impacts, and mitigation measures for major primary and secondary pollutants.**	ECO#18 → Resource Use SEC5b. Compare and contrast the ecological impact of sustainable and non-sustainable use of resources, including soil, timber, fish and wild game, mineral resources, and nonrenewable energy.	ECO#19 → Habitat Loss SEC5d. Explain the consequences of habitat fragmentation and habitat loss on biodiversity in relation to island biogeography, and apply island biogeography theory to the design of parks and nature preserves.	ECO#20 → GMOs SEC5e. Research the ecological impact of agriculture (historical and modern) in the environment and its implications for feeding the world's population.