Ecology Unit   Individual → Population → Community → Ecosystem → Biome

Individual:

1.) Pill Bugs Investigation

a. Experimental Design

- Control: "Normal behavior," all factors controlled.
- Constant: Things you keep the same (i.e. light, temp.)
- Variable: Things you change (i.e. color, noise)
- H_0: Null. control/default hypothesis. "No relationship"
- H_A: Alternative. Opposite of the null - what you think will happen.

b. Mathematical Modeling

.V > χ^2 = fail to reject H_0
.V < χ^2 = reject H_0

- Chi-Square Analysis: Determines if your observed data is close to the expected data. We can use χ^2 to determine if the difference btw obs + exp is statistically significant when compared to H_0.

2.) Direct Textbook Content

a. Discrete sensory inputs can stimulate both simple and complex behaviors

- Behavior: response to stimuli (internal/external) - learned (aquired) or innate (born with it)

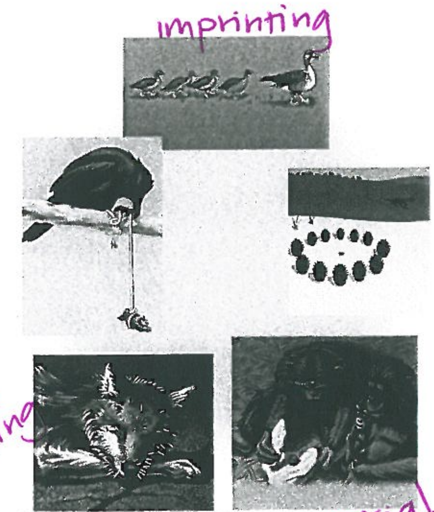
*pill bugs ex. wet/dry: show oriented movement → kinesis (Δ in activity due to a stimulus Δ)

ehavior an be connected ith rhythms - light/dark - seasons - circadian ←

- Communication: - visual, auditory, chemical

b. Learning establishes specific links between experience and behavior.

- Imprinting (↗ learn what they see right away), Cognition, Learning and Problem Solving, Associative Learning, Social Learning



c. Selection for individual survival and reproductive success can explain most behaviors.

i. Foraging Behavior: ↓ work for ↑ benefit: good
↳ search resources

ii. Mating Behavior & Selection

1. Monogamous (→ one partner) & Polygamous (→ multiple)
2. Mating Choice → fight, looks, dance
3. Parental care differences
   - mom/dad
   - assist youth/on their own

<u>Population</u>

1.) Hoots Woods

a. A complete graph includes: Title, Labels, even scale, etc..

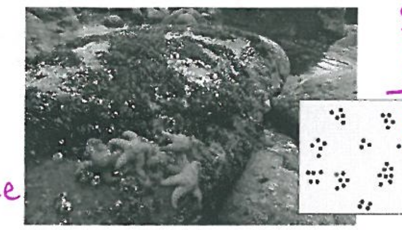
b. Carrying Capacity: # of organisms an environment can support over time.
→ There is a limit to the # of organisms! (unless the environ. Δ's)

c. Density dependent factors: Factors that do depend on population size.
- competition (more competition w/ more organisms), territory, disease (spreads quickly in larger groups)
- ex. garden ↑ density plants, ↓ reproduction rates b/c of lack of nutrients.

d. Density independent factors: Factors that affect populations regardless of their size.
- Flood in classroom example.
- Storm, Fire

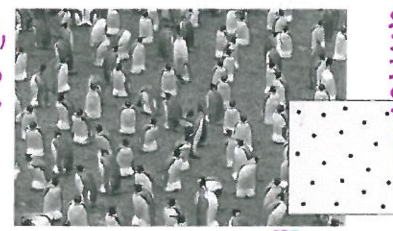
2.) Direct Textbook Content

a. Dynamic biological processes influence population density, dispersion, and demographics.



clumped

- abiotic verse biotic factors
  - biotic → living: competition, predation
  - abiotic → non-living: temperature, weather, rainfall, sunshine

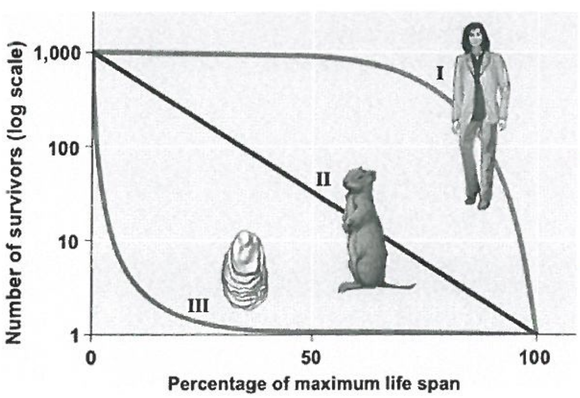


uniform

- dispersion patterns (clumped, uniform, random)
  - clumped → gather around resources *most common*
  - uniform → evenly spaced - penguins, some plant species
  - random → no pattern, not common, - wind blown seeds.

random

- survivorship curves (type I, II, III)

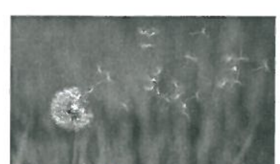


Type I: Humans, Large Mammals
- ↓ death rates as youth
- assume ↑ parental care but few offspring.

Type II: Rodents, Lizards
- constant death rate over time

Type III: Fish, Plants, Oysters
- ↑↑ death rates in youth
- assume multiple offspring with ↓ parental care.

b. Life history traits are products of natural selection.

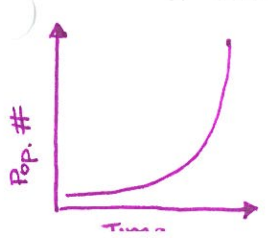


semelparity

iteroparity

- Semelparity "Big Bang Reproduction"
  - hundreds offspring @ once
  - no care.
- Iteroparity "Repeated Reproduction"
  - depends on carrying capacity
  - care involved

c. The exponential model describes population growth in an idealized, unlimited environment.



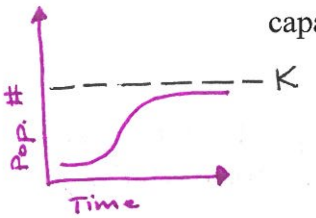
- "J" curve
- $\frac{dN}{dt} = r_{max} N$

  or ↓

  Δ in population = maximum reproduction × everyone in population

- unrealistic, cannot be supported in an environment for long.

d. The logistic model describes how a population grows more slowly as it nears its carrying capacity. • "S" curve

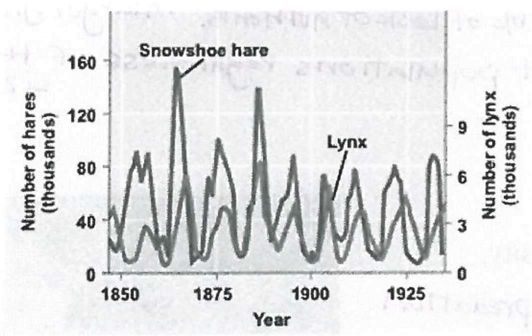


• $\frac{dN}{dt} = \frac{r_{max} N (K-N)}{K}$ → not important

↓

Population will level off as the population approaches carrying capacity.

e. Many factors that regulate population growth are density dependent. *(density dependent factors verse density independent factors)*



→ see populations fluctuate.

→ Hoots Woods

- ↑ mice, more food for owls, = ↑ owls
- ↑ owls, ↓ mice.
- ↓ mice, ↓ owls.
- ↓ owls, ↑ mice ....

Community

1.) Competition & Predation Picture/PWPT Notes

(See PWPT)

2.) Direct Textbook Content

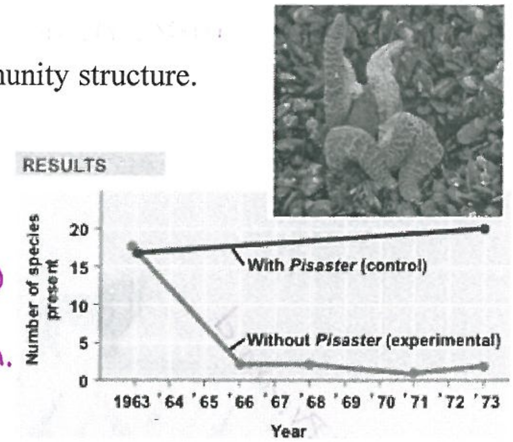
a. Community interactions are classified by whether they help, harm, or have no effect on the species involved. (diff. species) (same species)

- interspecific competition verse intraspecific competition
- symbiosis

b. Dominant and keystone species exert strong controls on community structure.

- dominant species –
- keystone species *(Pisaster Example)*: species that maintain the structure of the community (have a large effect but not necessarily ↑ #'s)

→ Starfish eats mussels and sea urchins but they are not the most abundant in the comm.
- Take them out and ecosystem crashes.
- ↑ mussels/sea urchins, ↓ plants, ↓ . . .

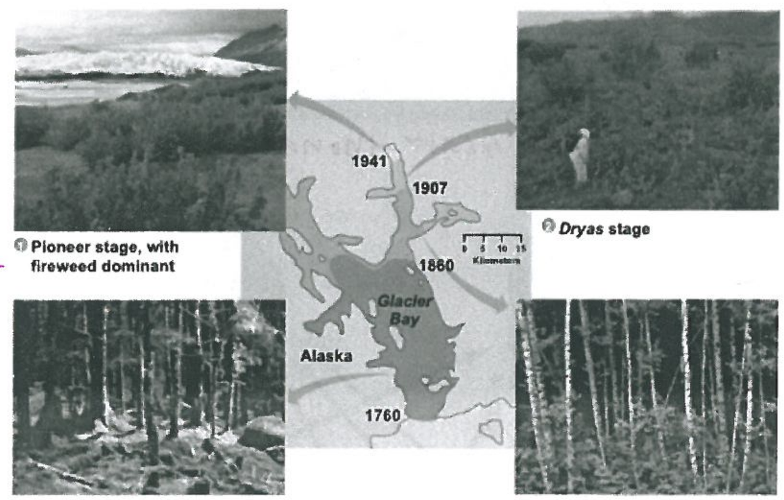


c. Disturbance influences species diversity and composition.

- disturbance: any event that disrupts the community (storm, fire, drought)
- succession: gradual replacement of life after the disturbance

moss/plants/shrubs/small trees/large trees

——→ Time



Pioneer stage, with fireweed dominant

Dryas stage

Spruce stage

Alder stage

d. Biogeographic factors affect community biodiversity. Species richness on islands depends on island size + distance to mainland.

? Describe the size and location of an island that has the most biodiversity?
→ large
→ near mainland

(a) Immigration and extinction rates (b) Effect of island size (c) Effect of distance from mainland

e. Community ecology is useful for understanding pathogen life cycles and controlling human disease.

- zoonotic diseases: pathogens passed to humans from other organisms.

* Understanding species interactions will help us limit transmission. (community)

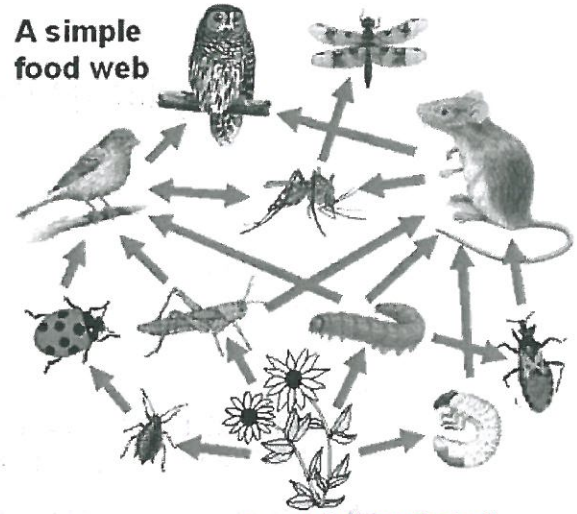
– swine flu
– HIV
– bird flu

Ecosystem:

1.) Energy Flow Diagrams

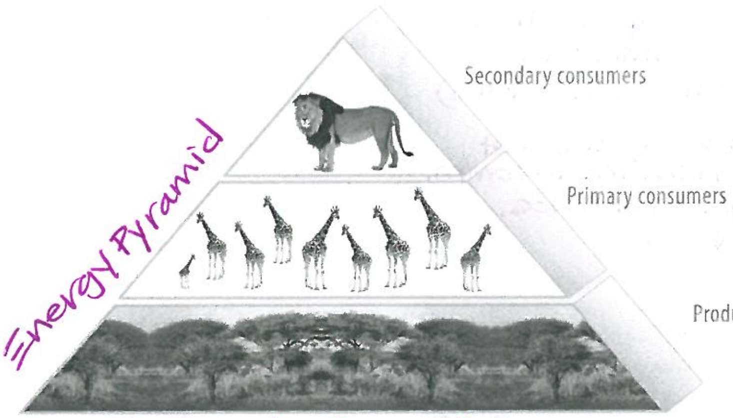
a. Vocab:

producers: make own energy from sun.
consumers: cannot make own, eat.



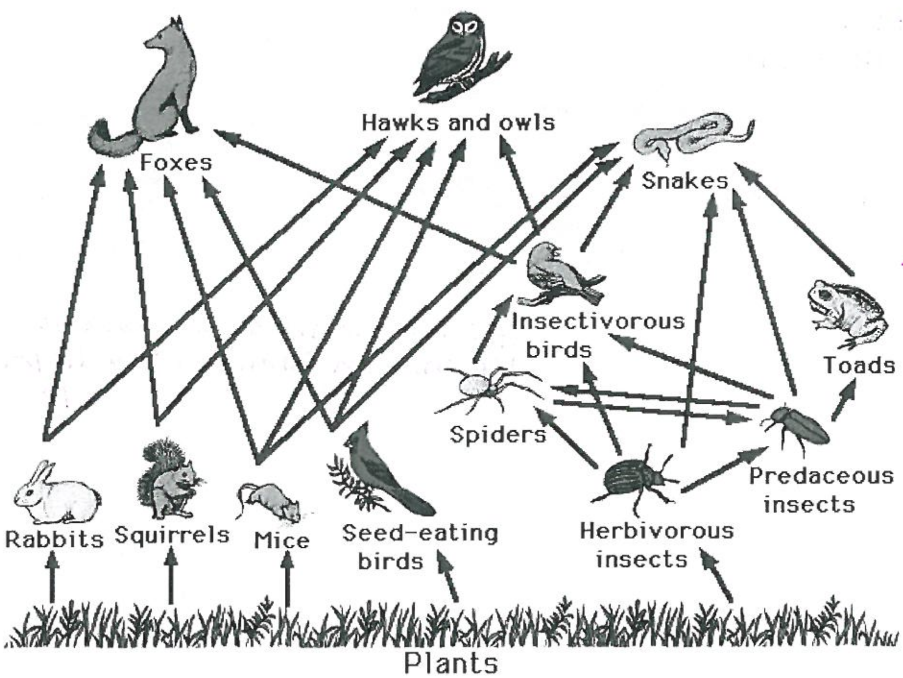
arrows show energy transfer not who-eats-who.

Energy Pyramid



(not to scale though)

→ takes a lot of producers (plants) to support a small # of consumers.



→Q: what if spiders were removed?

2.) Direct Textbook Content

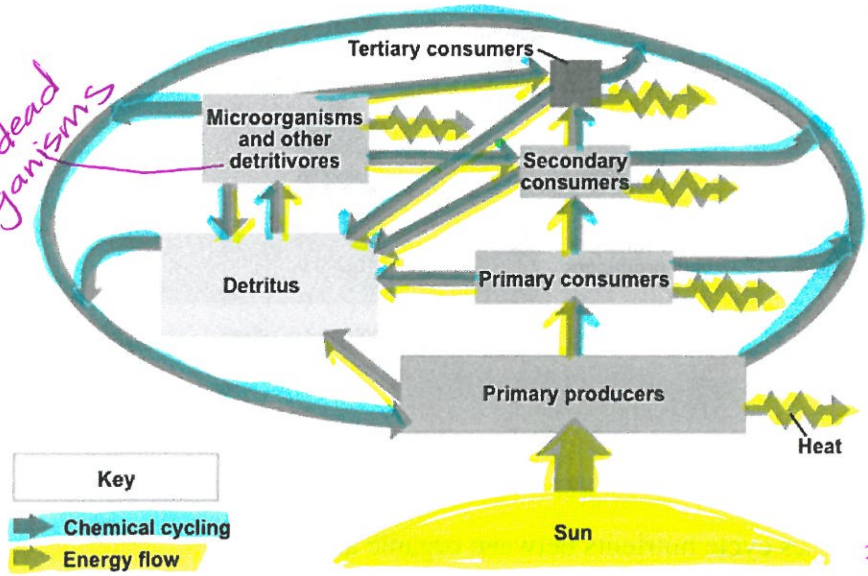
a. Physical laws govern energy flow and chemical cycling in ecosystems.

- Conservation of Mass & Energy

*All energy is conserved! Never lost → just transformed.

*Laws of Thermodynamics

eats dead organisms



= all connected "Butterfly Effect"

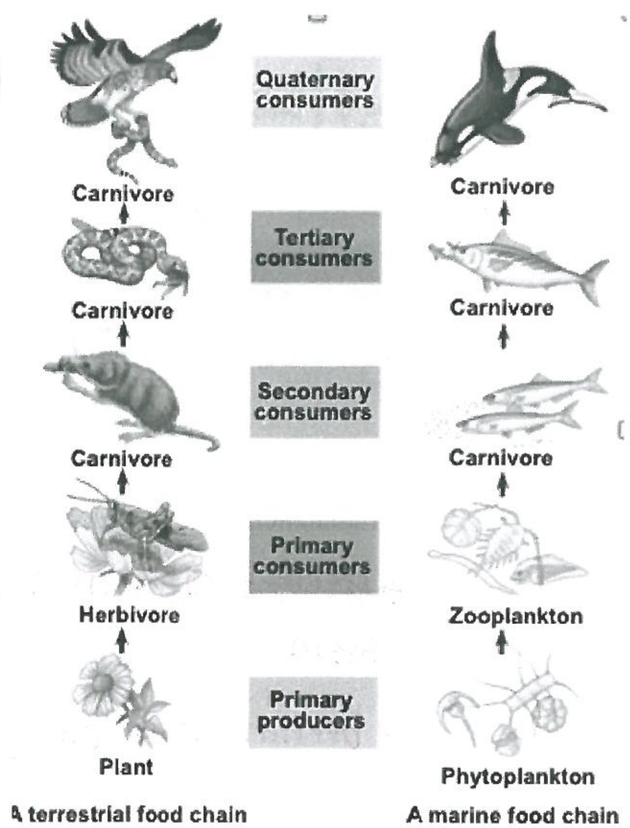
b. Energy and other limiting factors control primary production in ecosystems.

- Primary production: amount of light converted into chemical energy

- Net primary production: energy available to next trophic levl (total - energy used by that organism)

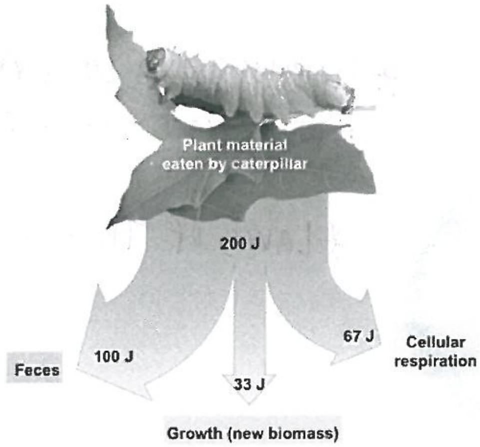
- Light limitations

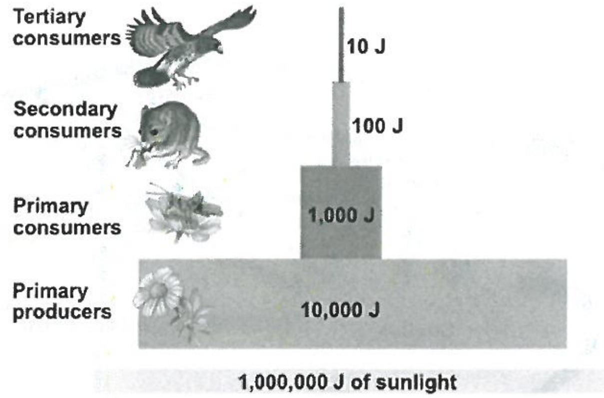
  *light is the main source of energy!



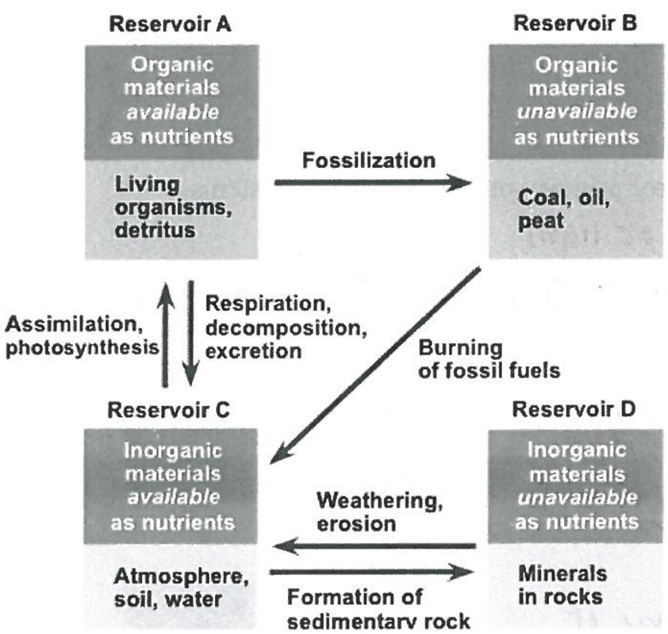
*Most of the energy an organism gets – it uses!

c. Energy transfer between trophic levels is typically only 10% efficient.





d. Biological and geochemical processes cycle nutrients between organic and inorganic parts of an ecosystem.



many cycles present:
· moves unavailable nutrients to avaliable + vise versa

e. Human activities now dominate most chemical cycles on Earth

→ Excess fertilization has created dead zones in the Mississippi Basin.

→ Burning fossil fuels, releasing CO_2, CH_4, etc.