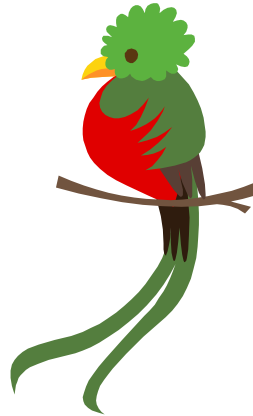




*I am the Lorax.  
I speak for the trees.  
I speak for the trees,  
for the trees have no tongues.*

- Chapter 59 ~  
*The Biosphere*
- *How biotic and abiotic factors interact in an ecosystem*

QOD



- What strategies do different organisms use for seasonal reproduction? Choose one of the following examples and explain:

1. Annual plants
2. Perennial plants
3. Butterflies
4. Migratory Birds
5. Bears
6. Lizards
7. Frogs
8. Penguins



# Energy



- Energy is perhaps the most critical abiotic factor in an ecosystem
- How do individuals react to excess/limited free energy?
- How do population react to excess/limited free energy?
- How do communities react to excess/limited free energy?

# BMR

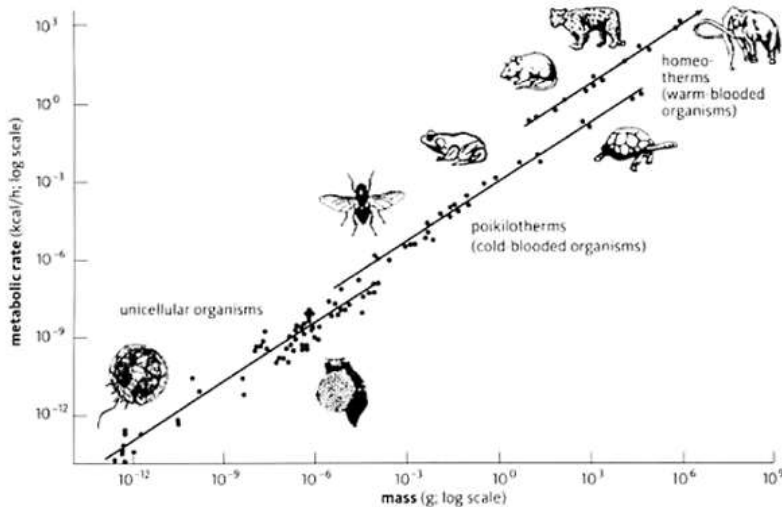
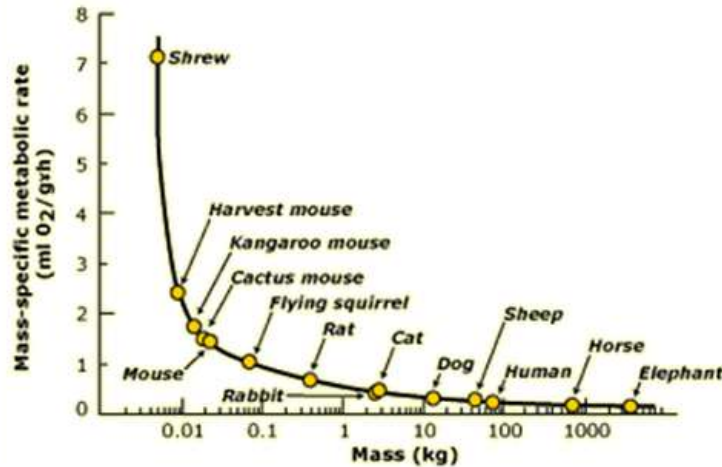
- Basal Metabolic Rate
  - Energy needed to carry out life processes even if we aren't doing anything
- Much higher for endotherms than ectotherms
- $P = (10.0 * m / 1 \text{ kg}) + (6.25 * h / 1 \text{ cm}) - (5.00 * a / 1 \text{ year}) + s$
- Where 'P' is total heat production when completely at rest, 'm' is the weight of the individual in kilograms (kg), 'h' is the height of the individual in centimeters (cm), and 'a' is the age of the individual in years. 's' is a constant, which is +5 for males, and -161 for females

# Practice Problem

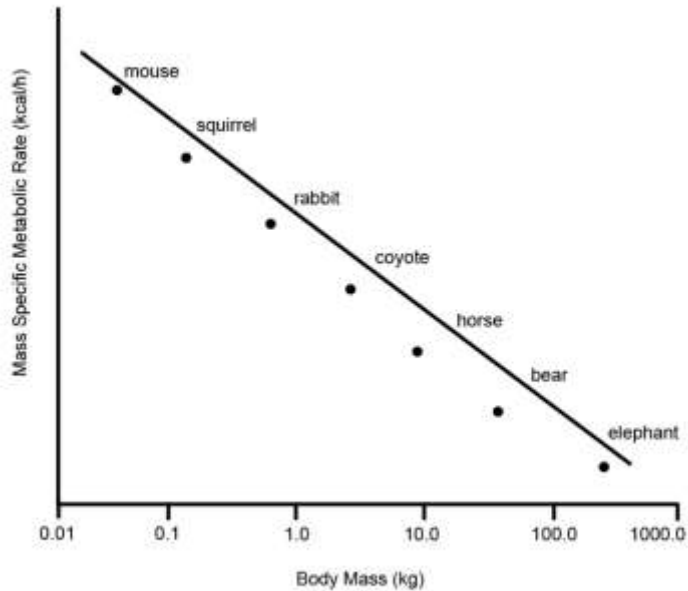
- So let's say we have a woman who is 30 years old, 5'3" tall (or 63 inches, remember there are 2.5 centimeters in one inch!) and weighs 130 pounds, (There are 2.2 lb in 1kilgram, which means our volunteer weighs approximately 59 kg).
- Can you calculate her BMR?

# Body size and metabolism

- Surface law states that the basal metabolic rate of animals is nearly proportional to their body surface
- Bigger animals live longer
- Bigger animals use more energy
- However, animals in different classes do not conform to expectations



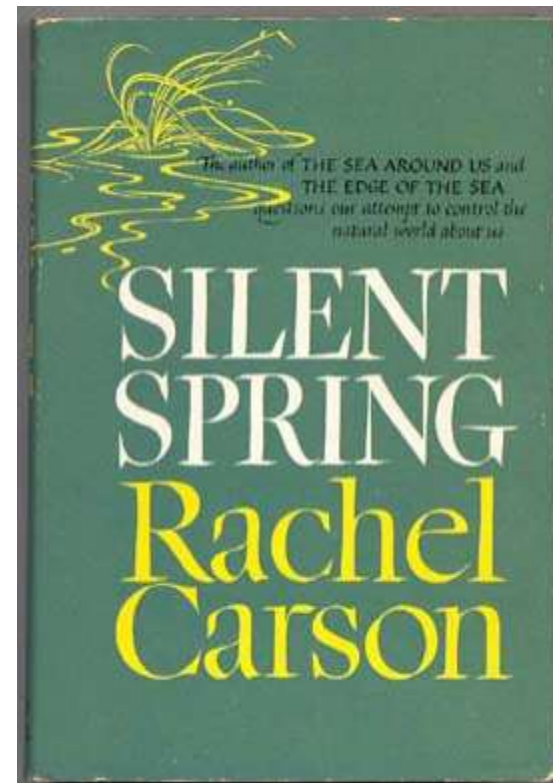
# Mass Specific Metabolic Rate



- Small animals have much higher metabolic rates compared to their mass.
- They also have much shorter life spans

# Ecology

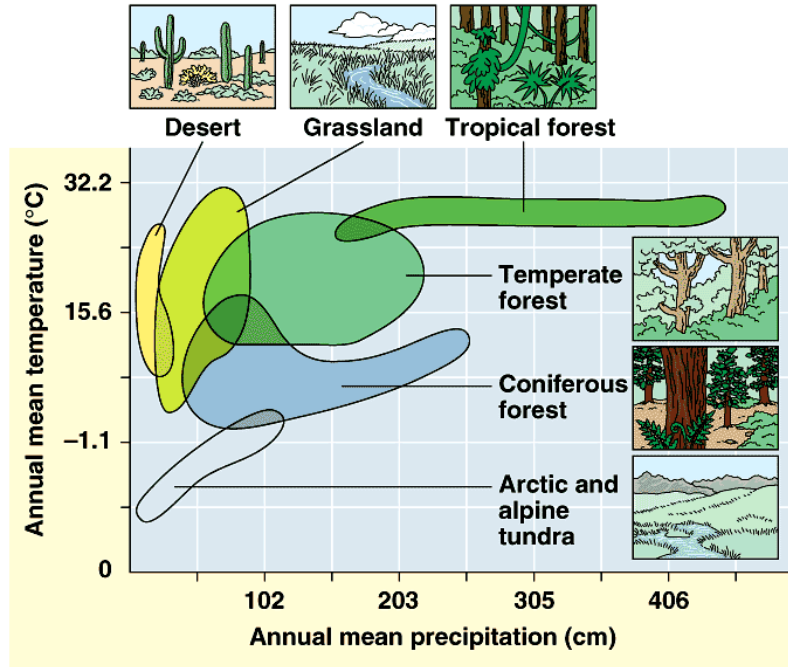
- Components:
  - **abiotic** ~ nonliving chemical & physical factors
  - **biotic** ~ living factors
- **Population** ~ group of individuals of the same species in a particular geographical area
- **Community** ~ assemblage of populations of different species
- **Ecosystem** ~ all abiotic factors and the community of species in an area
- Rachel Carson, 1962, *Silent Spring*





# Abiotic factors

- **Biosphere**~the sum of all the planet's ecosystems
- **Biome**~ areas of predominant flora and fauna
- **Temperature**
- **Water**
- **Sunlight**
- **Wind**
- **Rocks & Soil**
- **Periodic disturbances**

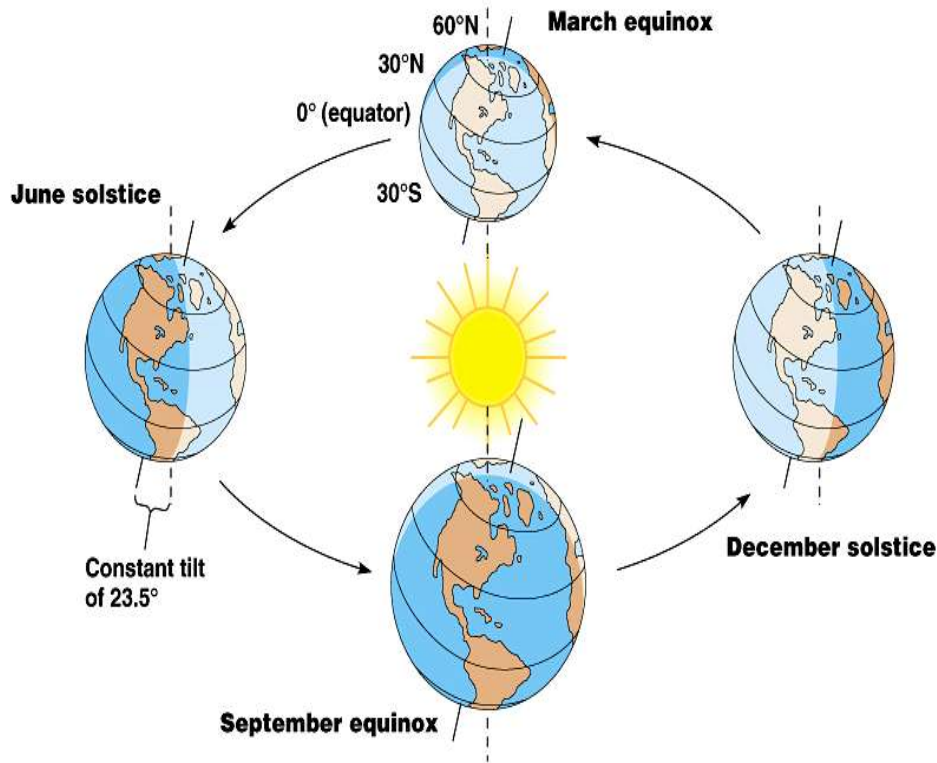


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Ecotone: biome grading areas

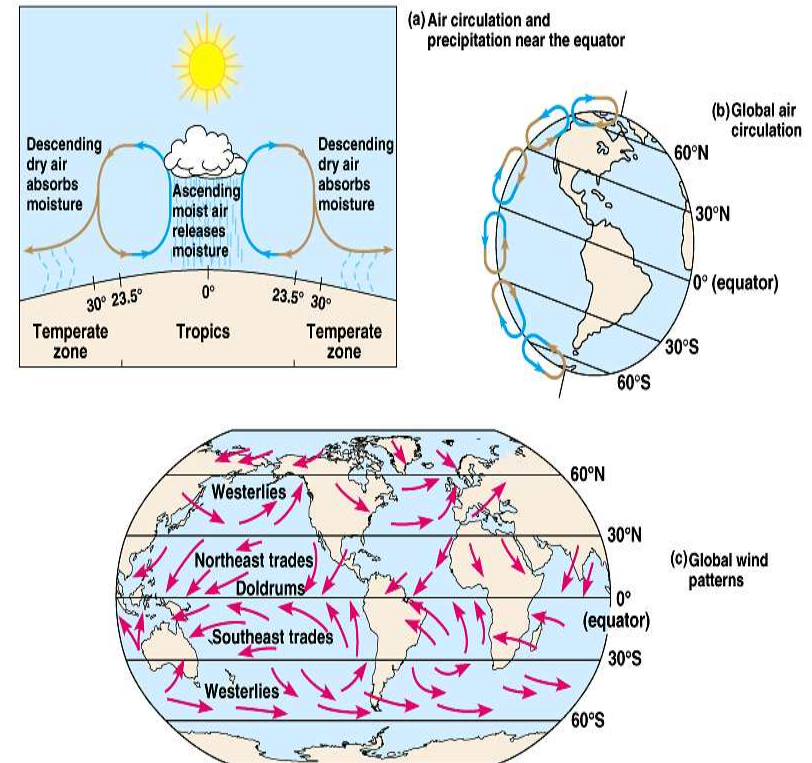
# Global climate

- Seasons



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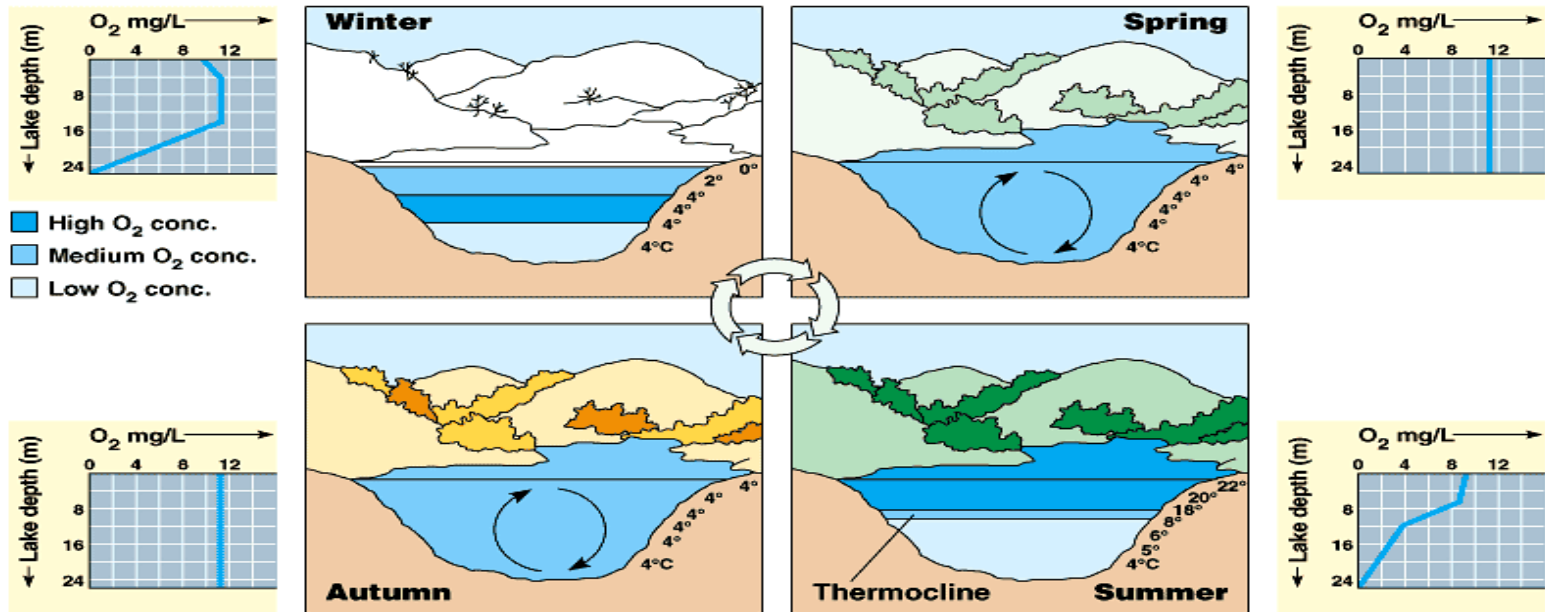
- Precipitation & Winds



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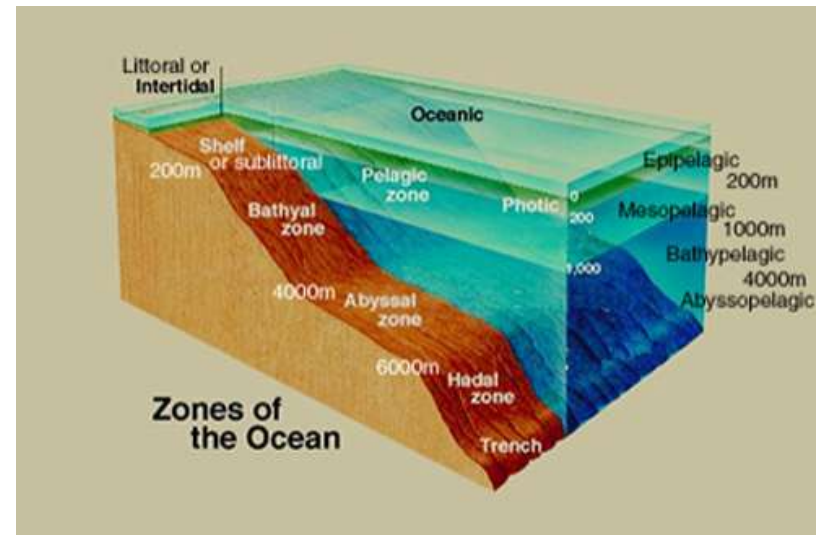
# Lake stratification & turnover

- Thermal stratification~ vertical temperature layering
- Biannual mixing~ spring and summer
- Turnover~ changing water temperature profiles; brings oxygenated water from the surface to the bottom and nutrient rich water from the bottom to the surface



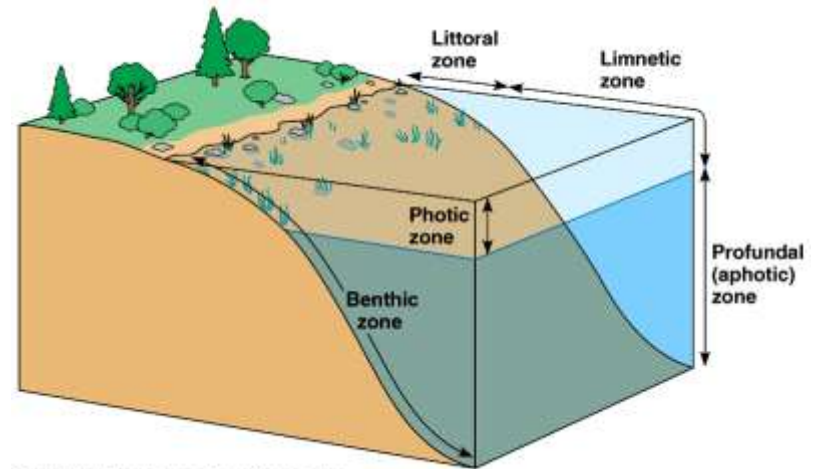
# Aquatic biomes

- **Vertical stratification:**
  - photic zone~ photosynthetic light
  - aphotic zone~ little light
  - thermocline~ narrow stratum of rapid temperature change
  - benthic zone~ bottom substrate
- **Benthos**~ community of organisms
- **Detritus**~ dead organic matter; food for benthic organisms



# Freshwater biomes

- **Littoral zone**~ shallow, well-lit waters close to shore
- **Limnetic zone**~ well-lit, open water farther from shore
- **Profundal zone**~ deep, aphotic waters
- **Lake classification:**
  - **oligotrophic**~ deep, nutrient poor
  - **eutrophic**~ shallow, high nutrient content
  - **mesotrophic**~ moderate productivity
- **Wetland**~ area covered with water
- **Estuary**~ area where freshwater merges with ocean



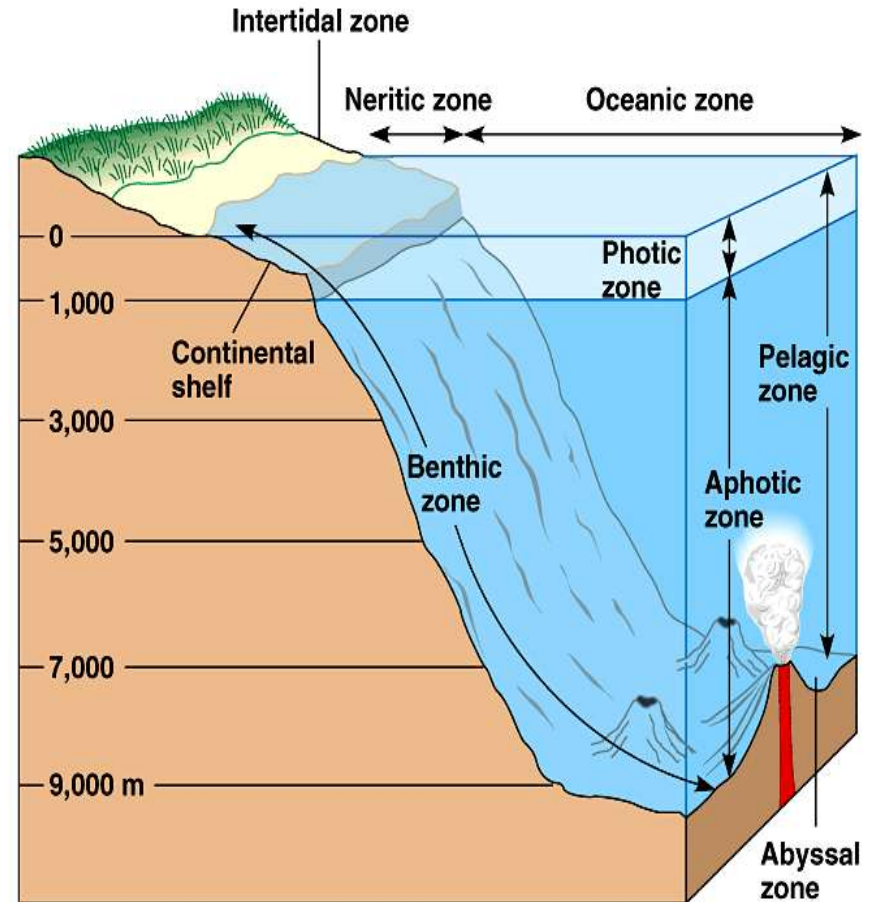
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# Marine biomes

- **Intertidal zone**~ area where land meets water
- **Neritic zone**~ shallow regions over continental shelves
- **Oceanic zone**~ very deep water past the continental shelves
- **Pelagic zone**~ open water of any depth
- **Benthic zone**~ seafloor bottom
- **Abyssal zone**~ benthic region in deep oceans



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# Terrestrial biomes

- Tropical forests~ equator; most complex; constant temperature and rainfall; canopy
- Savanna~ tropical grassland with scattered trees; occasional fire and drought; large herbivores
- Desert~ sparse rainfall (<30cm/yr)
- Chaparral~ spiny evergreens at midlatitudes along coasts
- Temperate grassland~ all grasses; seasonal drought, occasional fires; large mammals
- Temperate deciduous forest~ midlatitude regions; broad-leaf deciduous trees
- Coniferous forest~ cone-bearing trees
- Tundra~ permafrost; very little precipitation

