What is Ecology?

What is Ecology
- The study of our house and the individuals within
Abiotic - Atmosphere
Biotic - Primary producers, Secondary producers, Decomposers
Open systems - Earth can be affected by outside objects
Closed systems - Universe
Disciplines of Ecology
- Individual
-Population
-Community
-Ecosystem
-Landscape
- Biosphere
-Universe

Biomes and State Factors

Climatograms - average temp season graph
Temp/precipitation and highlighted growing season
Nine Terrrestisl Biomes
1. Tundra
- coldest biome, permafrost and stunted
-mountains, harsh wind, very short growing season
2. Boreal Forest (Taiga)
- Densely populated by coniferous trees
- not below the Equator
-Harsh winter, short growing
3. Temperate Rainforest
-mild temperature
-lots of rain
-evergreen forest (Giants)
4. Temperate Seasonal Forest
- moderate temperature and precipitation
- deciduous trees (oak, maple etc.)
- low continentality
5. Woodland/ shrubland (chaparral)
-hot dry/mild wet
-grasses and shrubs

Biomes and State Factors (cont)

6. Temperate Grassland
- hot dry/very cold
- grasses, flowers and shrubs
7. Tropical Rainforests
- Warm very humid
- long growing
8.Tropical Seasonal Forest
- wet/dry seasons
-deciduous trees
9. Subtropical desert
-hot temp, scarce rain
-long growing season

Five State Factors

1. Climate
2. Topography
3. Parent Material
4. Potential Biota
5. Time
Climate
-atmospheric conditions AVERAGED over years
-NOT weather
Topography
- layout of the land -elevation proximity to lakes
Parent Material
-underlaying geology of a region
- helps determine foil formation + nutrient availability
Potential Biota
- ecosystems hostages to evolution
Time
-Deep time - continental drift, meteor impacts
-Short term - Time since disterbance (succession)

Hadley Cell

Hadley Cell (Tropical air mass)
1. Warm air rises, expands and cools
2. Releasing latent energy, warm air rises more
3. air moves poleward due to pressure gradient (subtropics)

Hadley Cell (cont)

4. cool air sinks and heads back toward tropics with moisture
Rain Shadows
-effect Mountains and oceans have on temperature and precipitation
Elevation has significant effect on temperature
Continentality - climatic effect that results from a continental interior being insulated from oceanic influences

Natural Regions of Alberta

1. Rocky Mountain
- coolest summers, shortest growing season
- Greatest elevational range
2. Foothills
- Mid elevation
-Bedrock ridges to hills
-lots of precipitation
- Forest-dominated
3. Boreal Forest
- Four months < -10 deg C
- 2 months of summer > 15C
- extensive coniferous and aspen trees
- wetlands and sand dunes
4. Canadian Shield
- exposed granite bedrock
-glacial deposits, small lakes, forests
5. Grassland
-rich topsoil
- flat-rolling prairie
-warmest and driest region
-trees along riverbanks, uncommon shallow saline lakes
6. Parkland
- a mix of grasses and trees
- Edmonton, Red Deer, Calgary

Adaptation

Adaptations
- Morphological, physiological or behavioural traits that provide a fit between the organism and the environment
Environment
- Biotic - biological components
- Abiotic - physical components
Fit
1. Match - adaptations make sense given the conditions experienced by the organism
2. FITNESS - organisms with adaptations have higher success
Fitness
- Measure of the lifetime success
-number of offspring
-# of offspring surviving to adulthood
-# of offspring having offspring
- Survival is not as crucial as # of offspring
Evolution - Changes to the frequencies of alleles within a population
Natural Selection
- Selective agent is the biotic or abiotic environment
traits are favoured that enhance fitness
1. Variation in phenotype
2. Fitness is non-random in respect to phenotype
3. Phenotype is heritable
Forms
1. Stabilizing
- Avg phenotype has max fitness
- removes extreme phenotypes
- maintains average
2. Directional
- Operates when one extreme has higher fitness
-shifts average in the direction of extreme
3. Disruptive
- both extreme have higher fitness
- removes average
-two phenotypic groups

Adaptation (cont)

Static adaptation
- unchangeable across environments and life stages
Ontogenetic adaptations
-adaptions specific to life stages
Plastic
-change as the environment

Physiological Ecology

Range of Tolerance
Tolerance - degree of performance or fitness
Zone of intolerance - death is inevitable
Range of tolerance - full range individual can survive
Zone of physiological stress - barely survive
Range of growth - individual can survive and grow
Optimum range - individual can grow and reproduce
Enzymes - range temperature curve
INTERNAL BODY HEAT
Hs= Hm+-Hcd+-Hcv+-Hr-He
Hs - total heat
Metabolic heat - chemical reactions
Conduction - heat moves warm-> cold
Convection - movements air or water
Radiation - sun or radiated off of something (fire/rock)
Evaporative cooling - water
Ectotherms - Hs regulate by external temp
Endotherms - Hs regulated by internal process
Poikilotherms - Internal temp varies
Homeotherms - Internal temp remains constant
Coping with Extremes
1. Escape - migration, dormancy
- Cyptobiosis - complete loss of metabolism
- Hibernation - reduced not shut down
- Torpor - brief periods of reduced activity
- Aestivation - adaptation for coping with extreme heat
2. Seasonally-appropriate phenotype
3. Compensate for the inability to thermoregulate

Physiological Ecology (cont)

- Make more enzymes, each enzyme is slow but do more work
- turn on appropriate gene under appropriate temperatures
4. Die - strong selection can lead to extinction or to adaptation
via evolution through natural selection

The Niche

Niche
- The set of enviromental factors that influence the growth survival and rep. of a species
- Niche axis - shows diversity
Fundamental Niche
- Abiotic and Food conditions in which a species might live, in the absence of interactions with other organisms
Realized Niche
- Abiotic and food conditions in which a species might live, given interactions with other organisms

Allocation of Energy

Principle of the allocation of energy
- since energy resources are limited using energy for one thing reduces the energy available for another (e.g growth and rep)
Fast and Slow life histories
(R-selected) and (K-selected)
Life histories
1. Age of sexual Maturity
2. Fecundity
3. Partiy - breeding event
4. Parental investment
5. Longevity
Plants
- Competitors (top)- fare poorly in stress/disturbed
- Stress tolerant - unique adaptations
- Ruderals - quick to arrive and grow easily out-competed

Behavioral Ecology I

Battle of the Sexes
Asexual reproduction - without the fusion of gametes
Autogamy - fusion of gametes - within the same individual (can swap gametes)
Allogamy - fusion of gametes - different individuals
Gynogenesis - sperm touches but not penetrates
hybridogenesis - Father's DNA excluded from next generation
Isogamy - Sperm and egg same size
Anisogamy - Sperm smaller than egg
Oogamy - Egg non-motile
Sexual Dimorphism - difference in size/a-ppearance apart from genitalia
Anisogamous Species - sperm smaller than egg
Males - want to mate - Max. Fit.
Females - want to wait - Max. Fit.
Fit Max?? - males have more offspring
Male Phenotypes: compete with other males, attract females etc.
Female Phenotypes: drawing males in, choosing males
Consequences of Anisogamy
1. Female Choice
- Sexual selection, Direct/indirect benefits, Brain development
2. Battle of the males
-Direct battles, Sperm Comp, Interference, Infanticide
3. Sexual conflict between males and females
Tramatic insemination + infanticide
Features for grip
Genitalia changes
Cryptic Female choice - stores/ chemically kills sperm
Sexual Cannibalizm - female eats male
Battle of the female

Behavioral Ecology I (cont)

1. Nonadaptive hypothesis- female aggression byproduct
2. Natural selection Hypothesis - compete for food and protection
3. Sexual selection - males are rare/good genes

Mating Systems

Mating Systems
- Social sexual structure of a pop
Monogamy
- Exclusive
Serial - partner for that season but different yearly
Social - care of offspring together, not bio
Genetic - care for bio offspring
Polygamy
- multiple partners
Polygyny - Male +females
Polyandry - Female +males
Polygynandry -+males +females exclusive
Promiscuity
- no mate choice (seaanneminies)
Sex with Benefits
- mate guarding
- female-enforced monogamy
- mate assistance
Direct benefits, Indirect benefits
Material benefits polyandry
- more resources
- Better protection
- infanticide resistance
- genetic benefits (better chance pregnancy)
Dispersion of resources and ability to defend
Uniform/Random/Clumped
Paternal Care
Altricial - born helpless
Precocial - born independent

Population Ecology

Species
- a group of potentially interbreeding organisms capable of producing fertile offspring
Population
- Organisms ACTUALLY reproduce contained in the same geographic area
Population Characteristics
Geographic Range, Abundance, Density, Dispersion, Dispersal, Structure
1. Spatial distribution - Niche requirements, time, ability to get there
2. Abundance
-Census size (Nc) mark release capture M/N=R/C
3. Density
# of individuals per unit area
4. Dispersion
5. Dispersal
-the movement of individuals

Population growth

Type 1, Type 2, Type 3 - Percentage of survivors (log(lx*100))/(Max life span)
lx = proportion of those born Nx/N0
bx = average number of female offspring an individual female has during x
lxbx = replaced % of the starting population
R0 = Net reproductive rate sum of lxbx
snakes/snake/gen
T= generation time sumof xlxbx/R0
r= per capita growth rate lnR0/T
snakes/snake/inst.time
BIDE
N=B+I-D-E
N/T=BIDE/change T
r= b-d
dN/dt=rNt
Nt=N0e^rt
r=rmax((K-Nt)/K)
dN/dt = rmaxNt((K-N)/K)

Intraspecific interactios

Intraspecific interactions
- Behaviours directed towards the recipient from an actor
Actor - doing the thing
Recipient - getting the thing
Cooperation - benefits both - forging, protection
Selfishness - benefits actor - self protection
Altruism - benefits recipient - kin selection
greenbeard, reciprocal, costly signaling
Spite - no benifit

Help

Help test