Biodiversity, Species Interactions, and Population Control

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1. Populations change in response to environmental conditions
    - Size — Number of individuals
    - Density – Number of individuals in a certain space
    - Age Distribution Structure — Percentage of individuals in each age group
    - Other Types of Distributions — Spatial pattern (*i.e. clumping*), uniform dispersion, random dispersion
2. Limits of Population Growth
    - Birth
    - Death
    - Emigration/Immigration
3. Population Growth (n)
    - n = (birth + immigration) - (death + emigration)
    - Dependent on resource availability
4. Interspecific Competition — 2 or more species interact to gain access to limited resources
5. Intraspecific Competition — Competition within a species
6. Predation — Prey/predator
7. Symbiosis — Relationships between organisms
    - Parasitism — Parasite/host

- Mutualism — Benefits both species
- Commensalism — Benefits on species, no effect on the other

8. Cyclic Changes — Sharp increases in number followed by seemingly periodic crashes
9. Resource Partitioning — Specialized traits allow species to use shared resources at different times
10. Competitive Exclusion — Intense competition between 2 equal species, where both suffer (one more than the other) by having reduced access to resources
11. The Intrinsic Rate of Increase – r

    - Rate at which a population could grow if it had unlimited resources (this will never happen)
    - Always limits — Light, water, space, nutrients
    - "High r" — Reproduce early in life, short generations (*i.e. reproduce many times and many offspring like flies*)

12. Carrying Capacity — The capacity for growth (K)

    - Number of individuals of a given species that can be sustained indefinitely in a given area
    - Determined by interaction between biotic potential and environmental resistance (factors that act jointly)

13. Bioitic Poential

    - Reproductive rate
    - Ability to migrate (animals) or disperse (seeds)
    - Ability to invade new habitats
    - Defense mechanisms
    - Ability to cope with adverse conditions

14. Environmental Resistance

    - Lack of food or nutrients
    - Lack of water
    - Lack of suitable habitat
    - Adverse weather conditions
    - Predators
    - Disease

- Parasites
- Competitors

15. Population Density (or ecological population density) — Is the amount of individuals in a population per unit habitat area

    - High density: Mice
    - Low density: Mountain lions

16. Density depends upon:

    - Social/population structure
    - Mating relationships
    - Time of year

17. Population Growth:

    - J-shaped — Exponential growth curve, starts slowly then speeds up
    - S-shaped — Logistic growth curve - slow start, rapid exponential growth, then levels off when K is reached

18. Goal of every species is to produce as many offspring as possible

19. Each individual has a limited amount of energy to put towards life and reproduction

20. This leads to a trade-off of long life or high reproductive rate

21. Natural Selection has led to two strategies for species: r-strategists and K-strategists

22. r-Startegists

    - Many small offspring
    - Little or no parental care and protection of offspring
    - Early reproductive age
    - Usually generalist species

23. K-Strategists

    - Fewer, larger offspring
    - High parental care and protection of offspring
    - Later reproductive age
    - Usually specialist species

24. Survivorship Curves

- Late Loss: K-strategists that produce few yound and care for them until they reach reproductive age, thus reducing juvenile mortality
  - Type I — Elephant
- Constant Loss: Typically intermediate reproductive strategies with fairly constant mortality throughout all age classes, K-strategists
  - Type II — Songbirds
- Early Loss: r-strategists with many offspring, high infant mortality and high survivorship once a certain size and age
  - Type III — Sea stars

25. Population cycles:
    - Relatively Stable — Slight fluctuation above and below carrying capacity, tropical rain forest
    - Irruptive — High peak, crash (raccoons)
    - Cyclic — "boom" and "bust"
26. Density Independent Factors — Floods, drought, hurricane, habitat destruction, pesticide spraying
27. Density Dependent Factors — Competition for resources, predation, disease (infectious)
28. Primary Succession — Gradual establishment of biotic communities in lifeless areas where there is no soil in a terrestrial ecosyste or no bottom sediment in an aquatic ecosystem
    - Bare rock subject weathering crumbles into particles, releasing nutrients
    - Pioneer or early successional species (lichens or mosses) attach to rock and start the process of rock formation by secreting mild acids
    - Mid successional plants — Grasses, herbs, small plants
    - Late successional spcies — Trees that can tolerate shade
29. Secondary Succession — Series of communities or ecosystems with different species development in places containing soil or bottom sediment
    - Ecosystem has been disturbed, removed or destroyed, some soil or bottom sediment remains
    - Abandoned farmland, burned or cut forests, heavily polluted streams, flooded lands