1

Ecology

Classical Population Biology

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2

Terms of Ecological Endearment

- *habitat
  - place where you live; the physical location
  - has distinguishing physical and chemical features
  - is where individuals of a species normally live
  - is occupied by various species
- community – all organisms that live in the same habitat

3

Five factors that determine community structure

- the habitat's temperature, rainfall and soil conditions
- available food supply – both the quantity and quality
- adaptive traits that allow each species in the community to survive and use the resources in the habitat
- species interactions: predation, parasitism, competition, beneficial interactions
- changes in the habitat and changes in the population

4

* Certain regions favor and support a greater quantity of species

arctic vs tropics

5

Niche

- * Definition: the sum of all activities and relationships in which a species performs in order to allow survival and reproduction
  - Job
  - The functions it performs in the population of community
  - Sometimes it is which other organism it eats

6

Interactions – symbioses

(the word means to live together)

- Neutral interaction – Canadian Lynx and grasses (0/0) – only indirect relationship

7

Interactions – symbioses

- * Commensalism – one benefits/ one neutral - neither harmed or helped (bird+ / tree-o)

8

Interactions – symbioses

- * Predation - one benefits/ one is harmed (killed) (hawk+/mouse-)
  - Animals that feed on other animals
  - The one that eats is the predator
  - The one eaten is the prey
  - They do not live on or in their prey
  - The prey may die or may live if only part or the whole prey is damaged

9

Interactions – symbioses

- Predation
  - * Cyclic in nature – increase in prey leads to increase in predators and vice versa
  - More food supports more prey (good rainfall year) and vice versa
  - The more prey eaten leads to more predators until prey is insufficient for predator population
  - Predator numbers decline until past what prey will support
  - The cycle begins again after a **short lag period**

10 Interactions – symbioses

- Parasitism* – symbiosis where one benefits/one harmed, but usually not killed

(flea+/dog- ; intestinal worms+/man- ; lice+/children-)

11 Interactions – symbioses

- Parasitism
  - * parasites live on or in the host organism
  - most hosts survive or parasite is out of food
  - careful balance between needs of parasite and those of the host
  - parasites usually weaken the host
  - parasites make predation of the host more likely
  - parasites reduce host's ability to mate & produce offspring

12 Interactions – symbioses

- Parasitism
- Kinds of parasites
  - **microparasites** – bacteria, protozoans, viruses, fungi
  - **macroparasites** – worms (round and flat), arthropods like: fleas, ticks, mites, lice
  - **social parasites** – cuckoo – lays egg in another species nest
    - cuckoo hatches first and throws out other eggs
    - the other species feeds and cares for cuckoo only!

13 Interactions – symbioses

- Parasitism
  - It is less advantageous for a parasite to kill the host – it is an evolutionary adaptation to keep the host healthy enough to allow parasite reproduction and the life cycle of the parasite to complete
  - Sometimes we employ parasitic wasps for biological control of certain insects (sometimes results not exactly as planned)

14 Interactions – symbioses

- Mutualism – both benefit (insects+/flowers+)
  - flowers/insects (flowers get assistance in pollination – insects get food)
  - yucca plant and yucca moth
    (yucca-pollination – moth gets housing and food

15 Interactions – symbioses

- Competition
  - * interspecific competition – two different species occupy the same niche and use same food source (small shark and tuna both want mackerel for food). It is not usually as intense as intraspecific competition because they have similar, but not identical requirements
  - intraspecific competition – competition within the same species – very intense because they have identical requirements

16 Interactions – symbioses

- Competition
  - Competitive exclusion – one species is better able to compete for food the other species dies out or moves or switches to an alternate food source
  - Where two species coexist in nature competitive interactions suppress population growth

in both species

17 Interactions – coevolution

- * Mimicry -physical or behavioral resemblance of one species to another to benefit itself or sometimes benefit both species.
  - example – a certain moth tastes bad and has bright colors
  - natural selection of a second moth species favors moths who look like the bad tasting species (bright colors)
  - color patterns may be similar
  - examples in nature: moths, wasps, wing patterning

18 Interactions – coevolution

- * Warning coloration - is intended not to camouflage an organism but to make it more noticeable. Such bright coloration is found among animals that have natural defenses that they use to deter or fend off predators.
  - These defenses can take many forms
  - An animal may simply cause a disagreeable smell (such as a skunk's odor)
  - An animal may actually cause pain (as from bee's sting) or even death (as from snake's venom).
  - Many of these animals are brightly colored, presumably as a warning to potential aggressors.

19 Interactions – coevolution

- Camouflage – aka ***Cryptic coloration*** helps disguise an animal so that it is less visible to predators or prey.
- One of the most common types of cryptic coloration is background matching
- Octopus camouflage video clip

20 Interactions – coevolution

- Camouflage
  - Many helpless animals have developed colors and markings that match their surroundings in order to hide from predators.
  - Fish eggs and microscopic zooplankton, for example, are transparent and nearly invisible as they drift in the upper layers of oceans and freshwater lakes

21 Interactions – coevolution

- Camouflage
  - A fawn's spotted coat camouflages the animal against the speckled forest floor
  - Some animals attempt to camouflage themselves physically
  - A decorator crab cements bits of algae, seaweed, and other ocean debris onto its shell so that it resembles the ocean floor.

22 Interactions – coevolution

- Alluring coloration -animals are colored so that a predator's attention is drawn to a non-vital part of the animal's body
  - lizard known as the blue-tailed skink has a bright blue tail that the animal can shed at will with no harm to itself
  - Potential predators are attracted to the tail; if they attack the tail, the skink sheds it and darts away unharmed.

23 Interactions – coevolution

- Alluring coloration - animals are colored so that a predator's attention is drawn to a non-vital part of the animal's body
  - In butterflies the spot looks like an eye for confusion
  - In fish, it draws attention from the vital head to the tail with the larger "eye" at the opposite end

24 Interactions – coevolution

- * Moment of truth defenses – action by prey just before death that is unexpected by predator
  - if you hit a shark on the nose it MAY leave you alone
  - rapid turn by monkeys just before capture – with aggressive stance
  - stink bug turns and sprays odorous liquid just before capture

25 Succession

- * Definition - Succession is the gradual replacement of one community with another
- Ecosystems change over time, due to *sediment buildup, introduction of new species, extinction of old species, and other factors.

26 Succession

- * Primary succession occurs when land is first formed.
- Microbes, lichens and mosses must create soil before other plants can grow.

27 Succession

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28 Succession

29 Succession

Mount St. Helens

Before After

30 Succession

- * Secondary succession occurs when succession must start over after the destruction of a climax community.
- This is Mount St. Helens in the process of secondary succession

31 Succession

- Secondary succession

32 Succession

33 Succession

- A climax community is the ultimate goal of succession. It is marked by the domination of long-lived species and great diversity.
- A climax community is a stable group of plants and animals that is the end result of the *successional* process.
- The redwood forest of California is a climax community.

34 Keystone Species

- A * keystone species is the most dominant species in the community
  - They can dictate community structure
  - This species can be demonstrated by removal of keystone species from community
  - Robert Paine performed experiments using a starfish
  - Starfish controlled entire community population levels of mussles, chitons, limpets and barnacles (all are starfish prey)
  - When the starfish were removed: mussles took over

35 The Importance of Diversity

- Diversity in an ecosystem helps prevent mass extinctions and genetic problems.
  - A monoculture is a one-species ecosystem. A corn field is an example.
  - Complexity provides stability in that if a new species is introduced or an old one becomes extinct, it is much less likely for the whole system to stop.
  - Monocultures are massively disrupted when a new species is introduced.

36 Ecological Limiting Factors

- Limiting factors in an ecosystem control population and, to some extent, diversity.
- Examples of limiting factors:
  - Water
  - Phosphorus
  - Sunlight
  - nitrogen
- The Law of Limiting Factors: "The factor that is most deficient determines the presence or absence of any given organism."