Habitat utilization

- The habitat of an organism is the place where it lives.
- It is the sum of the specific resources that are needed by organisms.
- These resources include food, cover, water, rest and special factors needed by a species for survival and reproductive success.
- Thus, migration and dispersal corridors and the land that animals occupy during breeding and nonbreeding seasons are habitat.
- So, it is an active behavioural process.
- Collectively, these needs dictate how animals use their surroundings (i.e., dictate **habitat use**)

Habitat Use

- Habitat use is the way an animal uses the physical and biological resources in a habitat.
- Habitat may be used for
  - foraging,
  - cover, nesting,
  - escape,
  - denning, or
  - other life history traits.
- These categories (e.g., foraging, escape) divide habitat but overlap occurs in some areas.
- One or more categories/habitats may exist within the same area, but not necessarily.
- An area used for foraging may be comprised of the same physical characteristics used for cover, denning, or both.
- The various activities of an animal require specific environmental components that may vary on a seasonal or yearly basis.
- A species may use one habitat in summer and another in winter. This same habitat may be used by another species in reverse order.

Habitat selection

- Habitat selection is a hierarchical process involving a series of innate and learned behavioral decisions made by an animal about what habitat it would use at different scales of the environment.
- Factor affecting habitat selection:
  - Heredity and experience
  - Foraging selection
  - Cover availability
  - Forage quality
  - Forage quantity
  - Resting and denning site
- Each of these may vary seasonally or yearly.
- Reproductive success and survival of the species are the ultimate reasons that influence a species to select a habitat
- Habitat selection will be species-specific (tied to needs of species wildlife species)

- Other interacting factor affecting habitat selection:
  - Competition (interspecific and intra-specific)
  - Predation

- Habitat preference:
  - Habitat preference is the consequence of habitat selection, resulting in the disproportional use of some resources over others.
  - Habitat preferences are most strikingly observed when animals spend a high proportion of time in habitats that are not very abundant on the landscape.
- Habitat availability:
  - Theoretically, one should be able to measure the amounts and kinds of resources available to animals but in practice it is not always possible to assess resources availability from an animal's point of

- Habitat quality:
  - Habitat quality refers to the ability of the environment to provide conditions appropriate for individual and population persistence.
  - Hall et al. (1997) suggest that habitat quality is a continuous variable, ranging from
    - Low (i.e., based on resources only available for survival), to
    - median (i.e., based on resources available for reproduction) to
    - high (i.e., based on resources available for population persistence).

- Critical habitat:
  - Critical habitat is primarily used as a legal term describing the physical or biological features essential to the conservation of a species, which may require special management consideration or protection
  - This definition would make it an operational and ecological term and not political.

Habitat is scale dependent

- Macrohabitat and microhabitat are common terms but actually relate more to the landscape level.
- Macrohabitat refers to landscape-scale features such as seral stages or zones of specific vegetation associations (Block and Brennan 1993).
- Microhabitat usually refers to finer scaled habitat features.
- Johnson (1980) summarized 4 natural ordering habitat selection process:
  - First-order selection (area): This is essentially the selection of the physical or geographical range of a species.
  - second-order selection. The second-order selection is the home range of an individual or social group within their geographical range.
  - Third-order selection (relation): This relates to how the habitat components within the home range are used (i.e., areas used for foraging).
  - Fourth-order selection (Quantity). This order of habitat selection relates to how components of a habitat are used.
- Understanding these levels can have profound influences on the management of a species.

Habitat Use measurement

- The way an animal *uses* the collection of physical features and resources in a habitat.
- We can measure habitat use for
  - Individuals (or social groups)
  - Populations (averaged across constituent individuals)
  - Species (overall tendencies)
- We can quantify habitat use for
  - all activities combined
  - particular behaviors
    - e.g., foraging habitat use

Research methodology

- Habitat use studies employ a variety of approaches
  - direct observation
  - tracking (or by noting other animal signs such as calls and feces)
  - VHF (very high frequency) telemetry
  - Satellite telemetry
- An emerging technique
  - **animal-borne video cameras**

Population dispersion

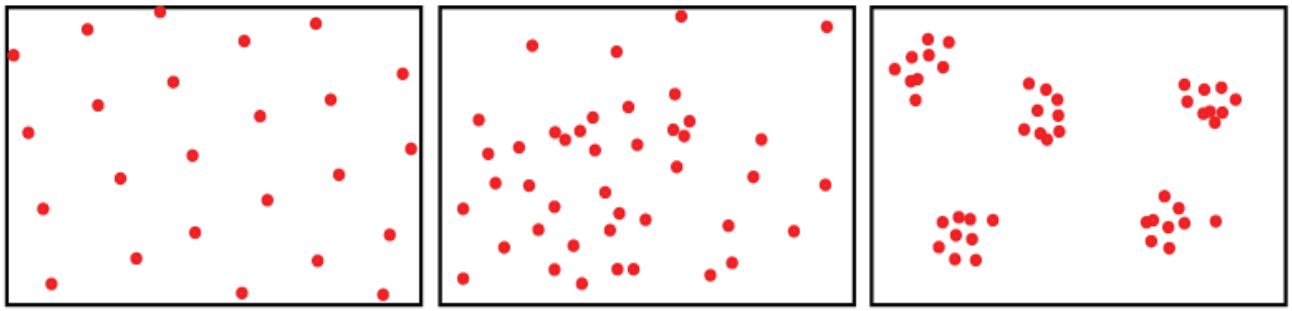
- Dispersal is defined as any movement that has the potential to lead to gene flow.
- Biological dispersal refers as both movement:
  - Natal dispersal: movement of individuals (animals, plants, fungi, bacteria, etc.)
  - Breeding dispersal: the movement from on breeding site to another.
- The act of dispersal involves 3 phases:
  - Departure,
  - Transfer,
  - Settlement
- There are different fitness costs and benefits associated with each of these phases

Types of dispersal

- Density-independent dispersal (passive dispersal): They take advantages of various kinetic energy of environment such as animal vactors, wind, gravity or current. Ex. Some invertebrates, fish, insects and sessile organisms.
- Density-dependent dispersal (active dispersal): Many animals depends upon some other factors such as population size, resource competition, habitat quality and habitat size.
- Other classification:
  - Natal dispersal
  - Breeding dispersal

Species dispersion

- *Uniform dispersion.* In uniform dispersion, individuals of a population are spaced more or less evenly.
- *Random dispersion.* In random dispersion, individuals are distributed randomly, without a predictable pattern.
- *Clumped dispersion.* In a clumped dispersion, individuals are clustered in groups.



- Benefits:
  - Locating new resources
  - Escaping unfavorable conditions
  - Avoiding competing with siblings
  - Avoiding breeding with closely related individual which could lead inbreeding depression.
- Costs:
  - Energy cost (extra energy)
  - Risk (injury and mortality)
  - Time
  - Dispersal individual loss their social rank in their population
  - Sometimes outbreeding depression

Dispersal mechanism

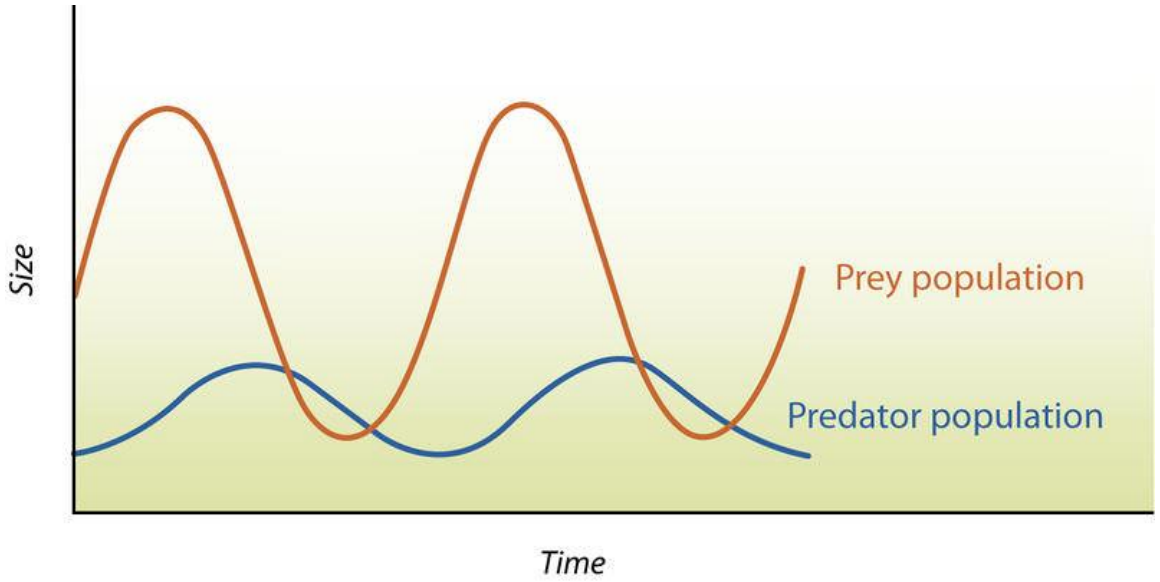
- Plant dispersal mechanisms
  - Seed dispersal by dispersal vectors (abiotic and biotic)
  - Other modes: gravity, wind, ballistic, water and by animals.
- Animal dispersal mechanisms
  - Non-motile animals: Examples: sponges, bryozoans, tunicates, sea anemones etc.
    - Their dispersal units are “buds” or motile sexual reproductive products (ova and sperm).
  - Motile animals: Majority of animals are motile.
  - Dispersal by dormant stages: In some animals dormant eggs, dormant embryos, even dormant adult stages are disperse by wind and water.

- Consequences of dispersal:
  - Individual fitness
  - Population dynamics
  - Population genetics
  - Species distribution
  - Lower the risk of extinction
  - Increase the connectivity between metapopulation
  - Maintain gene flow
  - Sometime goes extinct
  - Sometime gives rise to new population

Predator and prey relation

- Predator - An animal that naturally preys on and eats other animals for food.
- Prey - An animal that is hunted by another for food.
- Population of the Prey go up, the Population of the Predator(s) will soon go up as well.
  - Why - because there is more food available for the Predator to eat, therefore reproduce and have more offspring survive.
- BUT, as the Predator Population rises, there will reach a point where the Prey Population will begin to fall or decrease.
  - As the Prey Population decreases, soon thereafter the Predator Population will also begin to decrease - because there is now less food for the Predator to eat and therefore less offspring survive.

- A predator-prey relationship tends to keep the populations of both species in balance.
- As the prey population increases, there is more food for predators.
- So, after a slight lag, the predator population increases as well.
- As the number of predators increases, more prey are captured. As a result, the prey population starts to decrease.



Effects of predation on population size

- Too many predators: decrease in the number of prey
- Not enough prey: predator population decrease

- Predator and prey evolve together. The prey is part of the predator's environment.
- Predator always found on the top in food chain.
- Predator evolves whatever is necessary in order to eat the prey: dies if it does not get food:
  - Speed
  - Stealth
  - Camouflage
  - A good sense of smell
  - Sight or hearing (to find prey)
  - Immunity to the prey’s poison
  - Poison (to kill prey)
  - Right type of mouth parts and digestive system

- Likewise, the predator is part of the prey's environment, and the prey dies if it is eaten by the predator, so it evolves whatever is necessary to avoid being eaten:
  - speed,
  - camouflage (to hide from the predator),
  - a good sense of smell,
  - sight, or hearing (to detect the predator),
  - thorns,
  - Shield (armor) (ex. Tortoise, porcupine)
  - poison (to spray when approached or bitten),
  - Live in group
  - etc.

Type of relationship

- Mutualism - a relationship between two species in which both species benefit.
- Here are three other examples of mutualistic relationships:
  1. The bee and the flower. Bees fly from flower to flower gathering nectar. When they land in a flower, the bees get some pollen on their hairy bodies, and when they land in the next flower, some of the pollen from the first one rubs off, pollinating* the plant.
  2. The spider crab and the algae. Spider crabs live in shallow areas of the ocean floor, and greenish-brown algae lives on the crabs' backs, making the crabs blend in with their environment, and unnoticeable to predators. The algae gets a good place to live, and the crab gets camouflage.**
  3. The bacteria and the human. A certain kind of bacteria lives in the intestines of humans and many other animals. The human cannot digest all of the food that it eats. The bacteria eat the food that the human cannot digest and partially digest it, allowing the human to finish the job.

- Commensalism - a relationship in which only one species benefits and the other is neither helped or harmed;
- Parasitism - a relationship in which one species is benefits and the other is harmed, often killed.

- Thanks