Module 4: Population Ecology
Lesson 1: Population Dynamics

All species occur in groups called populations and have these characteristics.
1. Population density
2. Spatial distribution
3. Growth rate

Population density: number of organisms per unit of living area
- Population density can be calculated by dividing the number of organisms in the population by the area the population occupies.

Dispersion: arrangement of a population in its environment
- The pattern of spacing of a population within an area
- One of the primary factors in the pattern of dispersion for all organisms is the availability of resources such as food.

Population ranges: No population occupies all habitats in the biosphere, not even humans
- Some species have a very limited population range, or distribution. Other species have a vast distribution.
- A species might not be able to expand its population range because it cannot survive the abiotic conditions found in the expanded region.
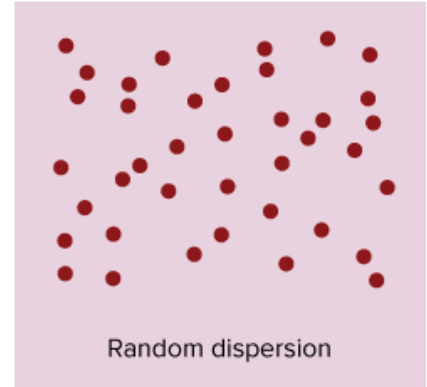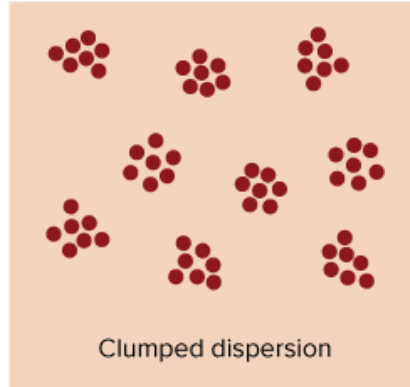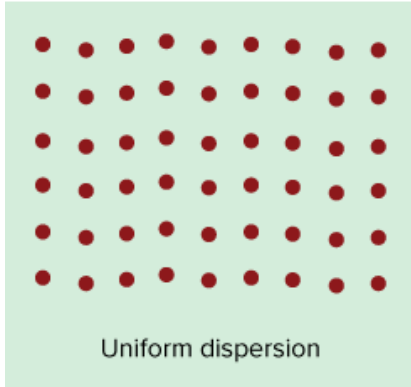
| Black Bear	American Bison	White-tailed Deer

Spatial distribution

The pattern of spacing of a population within an area; one of the primary factors in the pattern of dispersion for all organisms is the availability of resources such as food.

Uniform dispersion

Clumped dispersion

Random dispersion

Population density

The number of organisms per unit area; can be calculated by dividing the number of organisms in the population by the area the population occupies.

1/~200km²

4/km²

10/km²
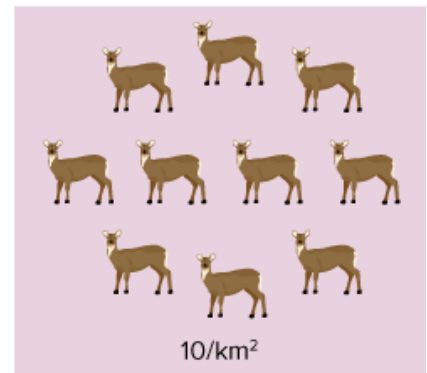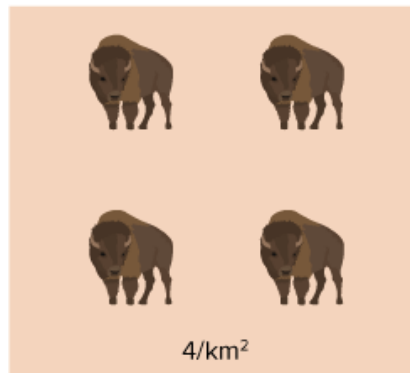
Population range

Some species have a very limited population range, or distribution. Other species have a vast distribution. A species might not be able to expand its population range because it cannot survive the abiotic conditions found in the expanded region.

Historic range prior to 1865

Limiting factors are biotic or abiotic factors that keep a population from continuing to increase indefinitely. Decreasing a limiting factor changes the number of individuals that are able to survive.

Density-independent factor: environmental factor, such as storms and extreme heat or cold, that affects populations regardless of their density
- Air, land, and water pollution can also limit populations by making some of the resources toxic.

Density-dependent factor: environmental factor that depends on the number of members in a population per unit area
- Often biotic factors, such as predation, disease, competition, and parasites

Population growth rate (PGR): how fast a specific population grows
- Ecologists must know (or estimate) the natality, or birthrate, of a population.
  - The natality is the number of individuals born in a given time period.
- Ecologists must know the mortality, or number of deaths that occur in a population during a given time period.
- **Emigration:** movement of individuals away from a population
- **Immigration:** movement of individuals into a population

Carrying capacity: largest number of individuals in a species that an environment can support long-term
- Limited by such factors as the availability of living and nonliving resources and from such challenges as predation, competition, and disease
- Environment with plentiful resources → more births than deaths → population reaches carrying capacity → resources become limited →

population exceeds carrying capacity → deaths outnumber births (not enough resources available) → population stabilizes
- Factors that are considered for real populations
  - o Number of births per reproductive cycle
  - o Age of reproduction begins
  - o Life span of the organism

	Human	Mouse
Sexual maturity	14-15 years old	5-7 weeks
# births/cycle	1-3 babies	5-6 mouse pups
Gestation period (pregnancy)	10 months	20 days
# pregnancies/year	1 pregnancy/year	5-10 litters/year
Life span	70-80 years	2 years

Reproductive strategy: 2 groups
1. r-strategists
   a. Generally small organisms
   b. Short life span
   c. Produce many offspring in a short period of time
   d. Typically expend little or no energy in raising their young to adulthood (high mortality rate at the beginning of life)
   e. Controlled by density-independent factors
   f. Fruit fly, mouse, grasshopper (locusts)
2. k-strategists
   a. Generally larger organisms
   b. Longer life span
   c. Produce few offspring
   d. Reach equilibrium at the carrying capacity
   e. Produce few offspring that have a better chance of living to reproductive age because of energy, resources, and time invested in the care of young
   f. Controlled by density-dependent factors
   g. Elephants, humans, gorillas