POPULATION AND DENSITY

Population, as we commonly know

In ecology, a *population* consists of all the organisms of a particular species living in a given area. For instance, we could say that a population of humans living in Delhi and that another population living in Mumbai. We can describe these populations by their size, i.e. area of the cities as well as by their density, i.e. how many people per unit area and also the distribution, i.e. how clumped or spread out the people are.

Demography: describing populations and how they change

In many cases, ecologists aren't studying people in towns and cities. Instead, they're studying various kinds of plant, animal, fungal, and even bacterial populations. The statistical study of any population, human or otherwise, is known as *demography*.

Why is demography important? Populations can change in their numbers and structure—for example age and sex distribution—for various reasons. These changes can affect how the population interacts with its physical environment and with other species.

By tracking populations over time, ecologists can see how these populations have changed and may be able to predict how they're likely to change in the future. Monitoring the size and structure of populations can also help ecologists manage populations—for example, by showing whether conservation efforts are helping an endangered species increase in numbers.

In this article, we'll begin our journey through demographics by looking at the concepts of population size, density, and distribution. We'll also explore some methods ecologists use to determine these values for populations in nature.

Population size and density

To study the demographics of a population, we'll want to start off with a few baseline measures. One is simply the number of individuals in the population, or *population size*—N*N*N. Another is the *population density*, the number of individuals per area or volume of habitat. Larger populations may be more stable than smaller populations because they’re likely to have greater genetic variability and thus more potential to adapt to changes in the environment through natural selection.

Size and density are both important in describing the current status of the population and, potentially, for making predictions about how it could change in the future. Plant density is a simple yet critically important variable that links the individuals to crops. Plant density is simply the number of individuals per unit ground area. In many circumstances, the identification of the individual is obvious. The unit of the population can clearly be identified as the individual plant.

Measuring population size

To find the size of a population, can’t we just count all the organisms in it? Ideally, yes! But in many real-life cases, this isn’t possible. For these reasons, scientists often estimate a population's size by taking one or more samples from the population and using these samples to make inferences about the population as a whole. A variety of methods can be used to sample populations to determine their size and density. Here, we will study the most important quadrat method

Quadrat method

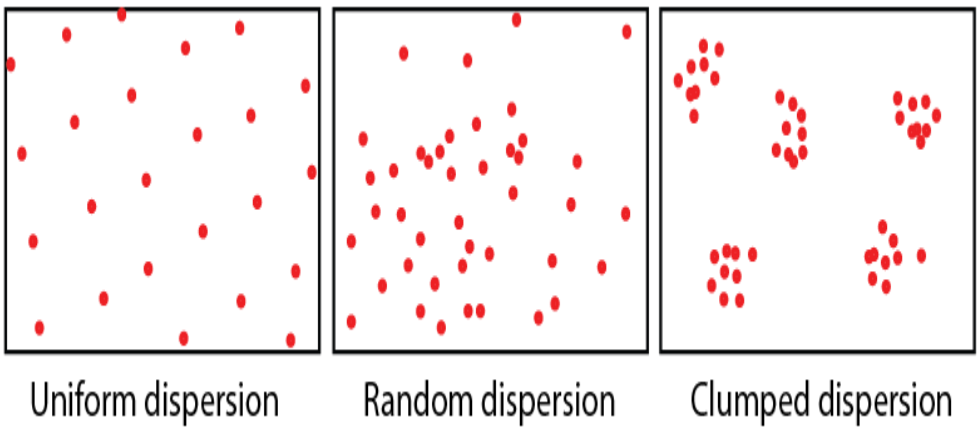
For immobile organisms such as plants—or for very small and slow-moving organisms—plots called *quadrats* may be used to determine population size and density. Each quadrat marks off an area of the same size—typically, a square area—within the habitat. A quadrat can be made by staking out an area with sticks and string or by using a wood, plastic, or metal square placed on the ground, as shown in the picture below.

After setting up quadrats, researchers count the number of individuals within the boundaries of each one. Multiple quadrat samples are performed throughout the habitat at several random locations, which ensures that the numbers recorded are representative for the habitat overall. In the end, the data can be used to estimate the population size and population density within the entire habitat.

Species distribution

Often, in addition to knowing the number and density of individuals in an area, ecologists will also want to know their distribution. Species dispersion patterns—or distribution patterns—refer to how the individuals in a population are distributed in space at a given time.

The individual organisms that make up a population can be more or less equally spaced, dispersed randomly with no predictable pattern, or clustered in groups. These are known as uniform, random, and clumped dispersion patterns, respectively.



Uniform dispersion

In uniform dispersion, individuals of a population are spaced more or less evenly. One example of uniform dispersion comes from plants that secrete toxins to inhibit growth of nearby individuals—a phenomenon called allelopathy. We can

also find uniform dispersion in animal species where individuals stake out and defend territories.

Random dispersion

In random dispersion, individuals are distributed randomly, without a predictable pattern. An example of random dispersion comes from dandelions and other plants that have wind-dispersed seeds. The seeds spread widely and sprout where they happen to fall, as long as the environment is favourable—has enough soil, water, nutrients, and light.

Clumped dispersion

In a clumped dispersion, individuals are clustered in groups. A clumped dispersion may be seen in plants that drop their seeds straight to the ground—such as oak trees—or animals that live in groups—schools of fish or herds of elephants. Clumped dispersions also happen in habitats that are patchy, with only some patches suitable to live in.

As you can see from these examples, dispersion of individuals in a population provides more information about how they interact with each other—and with their environment—than a simple density measurement.

Density as factor

The effect of plant density on growth, plant characters and yield could vary due to varietal characters and growing seasons in the same geographical areas. Thus the relationship of seed yield with different growth parameters and yield components under variable planting density is very important to understand the basic mechanism of yield-plant density relationship

Summary

In ecology, a *population* consists of all the organisms of a given species that live in a particular area. The statistical study of populations and how they change over time is called *demography*.

Two important measures of a population are *population size*, the number of individuals, and *population density*, the number of individuals per unit area or volume. Ecologists often estimate the size and density of populations using *quadrats.* A population can also be described in terms of the distribution, or dispersion, of the individuals that make it up. Individuals may be distributed in a *uniform*, *random*, or *clumped* pattern. Uniform means that the population is evenly spaced, random indicates random spacing, and clumped means that the population is distributed in clusters.