

# Population Ecology

## The Population Defined

A group of individuals of the same species occupying a given area

As a reproductive unit – a group of interbreeding organisms

As an ecological unit – a group of organisms occupying a definite habitat and niche

As a genetic unit – a group of organisms that share a common gene pool

## Population Characteristics

Size, density, and dispersion

Size – number of individuals making up its gene pool

Density – number of individuals per unit area or volume

Dispersion – general pattern in which its members are spaced throughout the habitat

Clumped

Uniform

Random

Age structure – relative proportion of individuals of each age

Birth rate (fecundity) – number of offspring produced during a certain amount of time

Death rate – number of deaths during a certain amount of time

Generation time – average span between birth of individuals and birth of their offspring

## Population Growth Models

Birth and death rates can be used to predict how populations will change in size over time

Exponential model – population growth in an idealized population in an unlimited environment

Change in population size during a particular time interval is equal to births during that time minus deaths during that time

Birth rate of a population during a particular time interval is the number of births during that time divided by the number of individuals in the population at the beginning of that time

Death rate of a population during a particular time interval is the number of deaths during that time divided by the number of individuals in the population at the beginning of that time

Growth rate of a population during a particular time interval is birth rate minus death rate

If the growth rate is positive, the population is increasing

If the growth rate is negative, the population is declining

If the growth rate is zero, the population is at zero population growth

The maximum rate at which a population can grow under ideal conditions is the intrinsic rate of increase

Exponential population growth is maximum growth under unlimited environmental conditions, which leads to population doubling in successively shorter time intervals

Populations of organisms with lower intrinsic rates of increase simply take longer to get to extremely large sizes

Logistic model – incorporates the concept of carrying capacity

Exponential growth requires unlimited resources, which is never the case in nature

Carrying capacity is the maximum population size that a particular environment can support with no net increase or decrease over a long period

Logistic population growth incorporates the effect of population density on growth rate

When population size is below the carrying capacity, the growth rate is high

As the carrying capacity is approached, the growth rate slows

The growth rate reaches zero when the carrying capacity is reached

The growth rate can decrease because of a lower birth rate, a higher death rate, or a combination of the two

## Human Population Growth

The human population has been growing almost exponentially for centuries

World population – 6+ billion

Yearly increase – about 100 million

### Sidestepping controls

New habitats and climate zones

Increased carrying capacity

Removal of limiting factors (any factors that limit population size)

### Present and future growth

First billion people – 2 million years

Second billion people – 130 years

Third billion people – 30 years

Fourth billion people – 15 years

Fifth billion people – 12 years

Sixth billion people – 10 years

### Control of population growth

Control through economics

Control through family planning

Competition for resources

Disease

Natural phenomena

This lecture outline was prepared partly from *Biology*, by Campbell and Reece, 2002 (6<sup>th</sup> edition), and from *Botany – An Introduction to Plant Biology*, by Mauseth, 1998 (2<sup>nd</sup> edition), and may contain phrases or entire sentences taken verbatim from those sources.