

TwoOldGuys™ Study Guides

BI114 Biological Concepts for Teachers

Chapter 5. Ecology, Basics

5.2. Species Distribution

Based on Indiana's Academic Standards, Science, as adopted by the Indiana State Board of Education, Nov 2000.

Numbers refer to the age-appropriate grade-level for the content.

Review

We have begun our examination of the concepts of Ecology by looking at the ability of populations to increase. We defined the population to be geographically bounded groups of organisms of the same species (or type). We demonstrated that, at least mathematically, populations are capable to rapidly increasing to ridiculous numbers; yet in the real world tend not to do so. It was suggested that the relatively stable population size of any species is not a characteristic of the species, but of the environment in which the population lives.

Species distribution

grades 2: to 4:

Different animals and plants are found in different regions

Anyone who has watched nature shows on television is certainly aware that there are different animals in different parts of the world. In the Arctic, as represented by Alaska, there are large white bears called Polar Bears. In Yellowstone National Park, Wyoming, the famous bears are a slightly smaller large brown bears called Grizzly Bears; and in the

Great Smoky Mountains, the resident bears are small [for a bear] black or brown bears called Black Bears. Similarly, the large cats of North America are Mountain Lions; of northern Africa are African Lions; and of South America are black Panthers. Large grazing [feed on grasses and non-woody weeds] or browsing [feed on woody plants] mammals include White Tail Deer in eastern North American woods, Mule Deer in the Rocky Mountains of western North America, Bison [buffalo] on the North American steppes and prairies, miscellaneous Antelopes on the African savannahs. And, of course, Australia is populated by many strange creatures, such as Kangaroos and Wallabies [comparable to Rabbits and Jack Rabbits of North America, and Bunnies of Europe].

Plants exhibit similar regional patterns: Arctic tundra of Alaska, Yukon and Northwest Territories with Willow “trees” less than 12 inches [0.3 meters] tall and sedges [which resemble grasses]; Spruce-Fir forests across most of Canada; eastern Deciduous (Maple-Beech) Forests and midwestern tall grass Prairies of the United States; [White] Pine Barrens along the Atlantic coastal plain of the southeastern United States; the (Organ pipe) cactus deserts of Arizona, USA, and Sonora, Mexico; scrub land of southern California; and subtropical forests of Florida [and the Caribbean Islands and parts of Central America]. Even within the deciduous forests, there are the Maple forests of Vermont; Oak Forests of the Missouri Ozarks; and the swamp forests of the Louisiana bayous.

grades 5: to 6:

**Each species thrives in a particular environment,
does not survive as well in other environments,
and does not survive at all in other environments**

Any kind (species) of animal or plant requires resources from its environment. These resources include physical factors such as climate,

and living factors such as food sources. For each kind of animal or plant, there is one set of environmental factors where that kind of animal or plant thrives. At any other set of environmental factors, that kind of animal or plant will not survive as well, if it survives at all. All geographic locations at which the kind of animal or plant can survive defines the range of that kind of animal or plant. For example, Sugar Maple trees are limited on the west by requiring a minimum of about 30 inches of rainfall per year [Illinois is typically too dry], on the east by requiring land [the Atlantic Ocean is too wet], on the north by length of growing season [Canada has too short a growing season].

Some species, such as Kirtland's Warbler have very narrow requirements. This song bird lives only in the northern half of Michigan's Lower Peninsula, in pine forests less than five years old. Similarly, Saguaro cactus is limited to the region around Tucson, Arizona, and southward to Nogales, Sonora, Mexico. Other species have very broad requirements. The cougar, or mountain lion, was found throughout North America (south of the Arctic Circle) and Central America, although it shared parts of Central America with the panther. The most familiar of the wide spread species are the dandelion and the cockroach, either of which is now found anywhere that humans have been (including the high Himalayas and Antarctica, but excluding the Moon).

The distribution of species is summarized as the following:

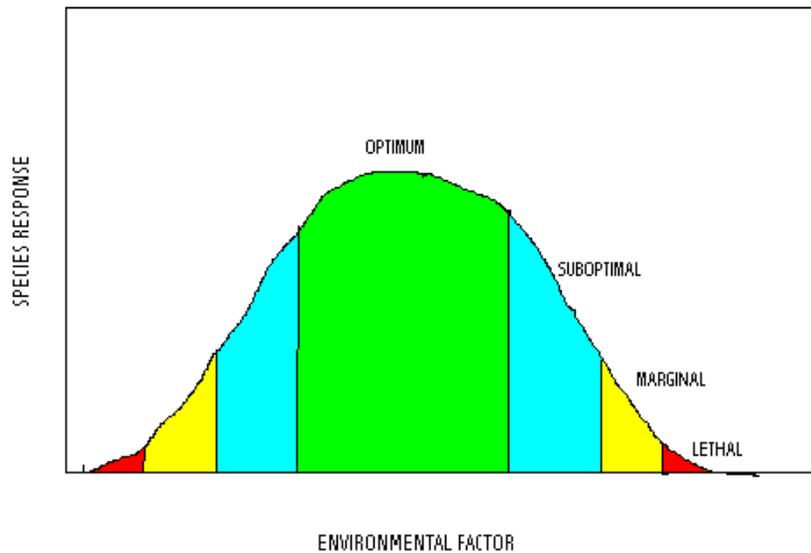
- "optimum" environment, where the species thrives
- suboptimum environments, where the species does well
- marginal environments, where the species is only present
- "lethal" environments, where the species is absent.

grades 7: to 8:

The ability to survive forms a bell-shaped curve, similar to a grading curve.

distribution in environment	
resource	survival
not enough	lethal
barely enough	marginal
almost enough	suboptimal
just right	OPTIMAL
a bit too much	suboptimal
too much	marginal
way too much	lethal

LAW OF TOLERANCE



grades secondary: to college:

Each species is distributed relative to needed resources independently

We normally expect that if we were to examine two different species, we would find that their distributions are different. Plant ecologists have reported that some species tend to be associated with each other, or are normally found together. One example of this tendency for association is oak trees and hickory trees. Other associations involve wildflowers and trees, for example Western Wallflowers tend to associate with Engleman Spruce trees. There are two opposing hypothesis to account for this tendency for association. One group believes that the associations are relatively strong, so groups of species have largely similar distributions; the other group believes the associations arise largely by chance due to overlap in the distributions of species. The former group defines the associations as being Communities. The latter group describes the independent distributions as producing a Continuum. My own research supports the continuum interpretation, but I cannot *conclude* that the continuum is real because most of the analyses I have conducted begin with the assumption that species are distributed as a continuum. As a reminder, there is no logical method to conclude that one's assumptions are correct because the entire logical argument in support of the conclusion(s) is predicated on the assumption that the assumptions are reasonable approximations of reality. Had I stated the continuum interpretation as a hypothesis (based on other assumptions) rather than as an assumption, then I could conclude that the continuum is (or is not) real.

Another pair of opposing hypotheses suggest (a) that the more closely related the two species the less overlap there ought to be in their distributions, or (b) that the greater the overlap in their distributions the

shorter the interval of time since the two populations diverged from a common ancestral species.

In a later section we will examine the relationship between the theoretical distribution of species based on resource requirements, and the theoretical distributions of populations as predicted by the Theory of Island Biogeography.