

# **TwoOldGuys™ Study Guides**

## **BI114 Biological Concepts for Teachers**

### **Chapter 6. Ecology, Advanced**

#### **6.2. Diversity**

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**

In the previous sub-section, we reviewed the process of succession, which allows the community to change over time. It is this change that allows the community to “heal” from the “injuries” of the loss of all or part of a species.

### **Diversity**

*grades secondary: to college:*

**Diversity is number of species and relative number of individuals in each species**

From earlier grades, we may remember that there are usually more than one kind (species) of plants and of animals in any given geographic area. Normally, we would not deliberately introduce the term “diversity” to describe this unless the students are aware of the use of this term from, for example, articles in magazines or from programs on PBS or the Discovery channels. By middle school/junior high school, we do want to introduce the jargon “diversity.” You should remember from L. Carroll’s Humpty Dumpty that we can use words to mean just what we want them to mean *provided* we ‘publish’ our definition to the listener/reader.

I, having introduced the term to you – my reader, am no obligated to explain what I think the term ought to mean. This is a bit difficult because my colleagues and I have not determined precisely what we intend the term to include. Somehow we hope to describe how the resources of any given community are divided among the species of the community.

The oldest definition is that diversity equals simply the number of different species in the community. The problem with this definition was that it led to some unacceptable conclusions. Consider the following two theoretical communities:

number of individuals by species		
	community	
	A	B
species 1	993	130
species 2	1	128
species 3	1	126
species 4	1	125
species 5	1	125
species 6	1	124
species 7	1	122
species 8	1	120
average	125.0	125.0
s.d.	328.07	2.96

Community A is clearly dominated by species 1, while community B is not dominated by any of the eight species. It seems to my colleagues and I that community B ought to be more diverse than community A, so we have tried to add some measure of the relative contributions of each species to the total number of individuals in the community. Several different mathematic models have been tried so far, but we are not yet in agreement as to which gives the “best” results. I have argued for some

estimate of the probability that, having located an individual, the nearest individual is of the same or of a different species. A colleague has argued that this is too complicated, and that the percent of individuals from each species in the community would work better. Most of my colleagues have suggested that we need a single number (maybe two numbers) to summarize the diversity of the community, for example mean and standard deviation [s.d.] of the population numbers for all species of the community. You may recall, from section 5.3 of this text, that I have observed approximately 200 plant species in a number of communities, and that there may be as many as 1,700 species available to be in plant communities of Indiana, which are considered to be less diverse than the tropical rain forests of South America. It takes very little imagination to picture how complicated any estimate that includes one number for each species would be, and therefore how much more desirable would be an estimate of one or two numbers.

## Theory of Island Biogeography

- There is an annual emmigration of individuals from occupied habitats
- immigrants arrive by chance; first come – first 'served' for each niche
- Once a species arrives at the site, it tries to 'take over the world.'
- Later arriving immigrants meet competition, but they still try to take over the world. If local extinction has occurred,...
- Diversity (composition) of community is dynamic

If we were to imagine a 'new' site, on which primary [plant] succession is going to occur, when the first individual immigrates, the total population of the site will be 1 species with 1 individual each (average = 1.0; s.d. = 0.0). If the individual is of an annual species and it produces 40 surviving offspring, the following year we can expect 1 species with 40 individuals each, but a new species may immigrate, giving us 2 species:

one with 40 of individuals and one with 1 individual (average = 20.5; s.d. = 19.5). If each individual is an annual and has 40 surviving offspring, and one new species immigrates every year, in the third year there will be 3 species: 1,600 individuals, 40 individuals, 1 individual (average = 547.0; s.d. = 744.75). Until the entire site is covered with plants, new species will continue to immigrate [and have fewer individuals than the previously established species].