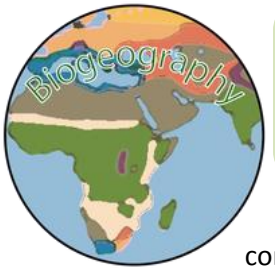



# Biogeography

**Species Energy Theory**

Name:

Section:

Score: _____/ 5

Directions: Work through the series of questions below regarding genetic diversity and its connection to physical location. The activity is a combination of a field-lab, map-lab, and article so it may need to be completed in pieces.

1. Come up with a general theory of how species diversity is connected to location in relation to the equator based on you field observation to the aquarium - Theorize why that might be the case.

## Species Richness Geoinquiry

Open up the Species Richness Webmap (https://bit.ly/2pxrCQ4) and answer the following series of questions related to the connection of species diversity to the physical location. Take a moment to familiarize yourself with the controls in the top right of the map by turning different layers on and off. You can change the opacity (how see-through they are) by clicking the down arrow next to the individual layer and then selecting opacity and then moving the slider back and forth.

2. Generally does your theory from question 1 hold true when it comes to mammalian diversity? Explain how closely they are connected. (For this question keep on the prominent world longitudes and latitudes and Global Mammal Species Richness layers)

3. Between which parallels (horizontal markers) does most of the mammalian diversity exist?

4. Turn on the Climate Zones features and manipulate the opacity to see which climate zones (top 3) contain the most mammalian diversity. what about the bottom 3?

## Major Spatial Patterns in Biodiversity

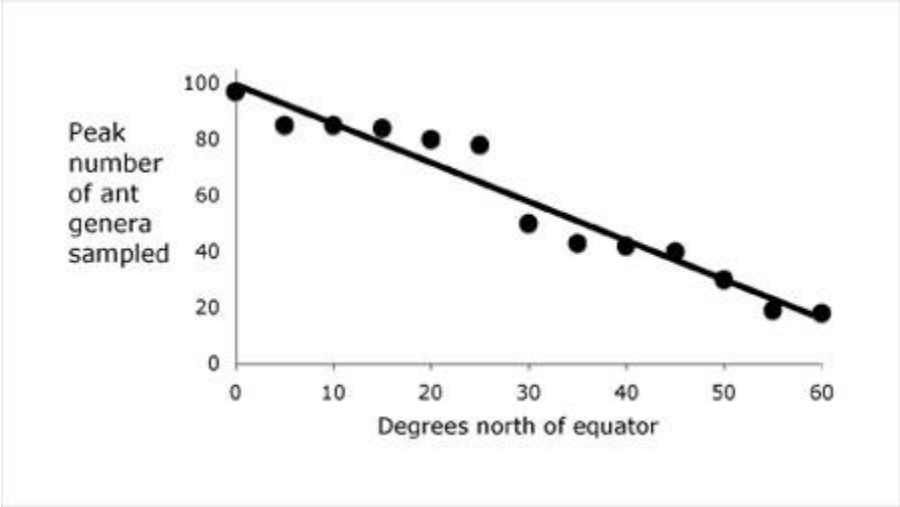
Directions: Read the following excerpt from the Nature.com article titled "Effects of Biogeography on Community Diversity" (https://www.nature.com/scitable/knowledge/library/effects-of-biogeography-on-community-diversity-13260138) and answer the questions that follow.

One major geographic pattern in biodiversity is the latitudinal gradient in species richness. As one travels further away from the equator, for most taxa, the number of species declines. For example, Figure 3 demonstrates the latitudinal richness gradient for richness in ants of the Northern Hemisphere. This general pattern holds true for most taxa and ecosystem types in both marine and terrestrial environments. There is broad agreement that this pattern is caused by differences in the abiotic, climatic environment, but the specific mechanism or mechanisms causing this pattern are a continued topic of discussion and investigation. One set of theories, broadly grouped together as “species-energy theory” is based on the fact that the amount of radiant energy from the sun captured by ecosystems is negatively associated with latitude. As energy is distributed throughout ecosystems through trophic processes, it is thought that species richness will track the energy following one or more mechanisms. Models of species-energy theory incorporate variables such as temperature, net primary

productivity, speciation, and extinction. Other ideas that have been proposed to account for the latitudinal gradient are related to the physiological responses of animals to climatic conditions and the effects of the abiotic environment on historical processes. Most of these theories are not mutually exclusive.

Another recurring pattern in biogeographic theory is the elevational gradient in species richness. As one travels to higher elevations, the number of species declines, or, in many cases, peaks at mid-elevations. Aside from the environmental mechanisms driving this diversity gradient, there is a phenomenon that is based on the geography of species range distributions called the mid-domain effect. The mid-domain effect predicts a peak of diversity at the midpoint along any domain simply by the fact that the ranges of more species overlap in the middle of a domain (like a mountain or an island) than on the edges, and this effect works together with environmental determinants to affect the net distribution of species along many elevational gradients.
A third recurring pattern in the distribution of species is the area effect on species richness. The larger an place is, the more species it can support. This applies to actual islands in bodies of water, as well as habitat islands such as those surrounded by human development. The species-area relationship is presented in more detail in an article about the theory of island biogeography.

Figure 3: The latitudinal gradient in richness in ants. The maximum number of genera sampled decreases as one moves north from the equator.




5. Summarize the first species diversity pattern.

6. Summarize the second species diversity pattern.

7. Summarize the third species diversity pattern.