Lab: Island Biogeography

(modified from Conservation Biology, Stanford University)

Background:

Habitats, of various types, once covered thousands of acres of land in the United States and many other countries. These habitat areas are being reduced to small fractions of their original size as humans turn more wild lands into urban and suburban areas, farms and pastures, highways and other developed land. These small fractions, or habitat "patches", are like islands of safety for the animals and plants that live there. When a habitat is fragmented like this, it becomes a series of little habitat islands that are various sizes and distances from each other. There is often a larger habitat area that serves as a source of new individuals for smaller habitat islands; much like the mainland does to islands in the ocean. Examples of these biological islands might include forest fragments, mountaintops, isolated lakes or actual islands in the ocean.

Biological islands usually show differences in species richness. To explain these differences, Robert MacArthur and E.O. Wilson proposed the *theory of island biogeography*, or species equilibrium model. This model states that the number of species (richness) found on an island is determined by the interactions of two factors: the rate at which new species immigrate to the island and the rate at which species become extinct locally on the island. Two features of an island determine the immigration and extinction rates: island size and an island's distance from the mainland.

Your group has been appointed by the government to determine what kind of forest islands are the most desirable to save native fauna and flora, which may migrate between habitat islands. Your choices are:

a. islands that are near the source population and small in size
b. islands that are near the source population and large in size
c. islands that are far away from the source population and small in size
d. islands that are far away from the source population and large in size

Procedure:

1. Place the brown circle (25 cm in diameter) in the center of your table
2. Place the red circle (10 cm in diameter) 2.5 cm due north from the edge of the brown circle
3. Place the green circle (18 cm in diameter) 2.5 cm due west from the edge of the brown circle
4. Place the yellow circle (18 cm in diameter) 15 cm due south from the edge of the brown circle
5. Place the blue circle (10 cm in diameter) 15 cm due east from the edge of the brown circle
6. Make sure all the circles are as flat as possible on the table
7. Drop 100 beans from a height of 30 cm directly above the center of the brown circle

Note: The beans represent individuals of species that attempt migration from the source population to the biological islands. The chances of a bean landing on a paper island represent the chances of a migrating organism colonizing a habitat island. Beans that do not land on an island did not successfully colonize.

8. Record the number of beans on each island (not the brown mainland) in the data table.
9. Perform four additional trials and record the mean value of each island.
10. Create a class data table with each groups mean and calculate the class mean.

Data:

Trial #	Yellow large far	Green large near	Blue small far	Red small near
1				
2				
3				
4				
5				
Mean				

(continued on back)

Lab Group	**Yellow** large far	**Green** large near	**Blue** small far	**Red** small near
1				
2				
3				
4				
5				
6				
7				
8				
9				
Mean				

Analysis:

1. Using the class data, rank the islands in order of successful immigration from least to greatest.

2. Why is it more accurate to use the class data than individual group data?

3. How does successful immigration rate relate to the anticipated biodiversity of each island?

4. Explain the difference between local extinction and species extinction.

5. How does successful immigration rate relate to the local extinction rate of each island?

6. How does biodiversity on each island relate to anticipated speciation rates on each island?

7. Based on your data, which island do you think is most important to protect and why?

8. List three habitat types ("biological islands") that are influenced by the theory of island biogeography.

9. Choose one of the habitats you listed in question #8 and provide an example of one species that could migrate to a habitat island of that type.

10. Describe challenges to migration that your species in question #9 might face.