Name:__Ivan Wang____ Class:__Pd3____
Date:___12/6/19_______________________

LAB: Island Biogeography

Background:

Island biogeography is the study of community diversity on islands. One of the variables studied is the rate of colonization by additional species – called recruitment. The farther an island is from the mainland (or the source of colonists), the less frequently new colonists will arrive and become established. Also, the larger an island, the more likely it is more colonists to "find" that space and establish themselves on the island.

Another variable is the carrying capacity of the island. Small islands contain fewer resources and support populations of fewer individuals. Small populations are more susceptible to local extinction; so small islands have fewer species than equivalent large islands. Small islands also have a higher ratio of perimeter to area than larger islands. This is important because at the borders of habitats, the physical conditions are often a combination of the conditions of either habitat. An example on oceanic islands is the perimeter of the forest, which will be buffeted by salt spray, while the forest's center will not be. This creates an "edge effect."

The principles from island biogeography can easily be applied to terrestrial situations. For example, alpine habitats are usually separated by lowland habitats, and lake habitats are separated by terrestrial and stream habitats. Fragmented habitats, such as rainforest parcels separated by farmlands, can be considered "islands." Many wildlife managers have taken the effects of "island" size into account and have begun to link smaller fragments of habitat together using small corridors to effectively increase the island size. (Costa Rica is an example.) There has also been increasing concern that if a catastrophe damages a nature preserve that is essentially an island, the preserve may not recover quickly unless there is a source of colonists (equivalent to the mainland) fairly close by.

Procedure:

http://virtualbiologylab.org/ModelsHTML5/IslandBiogeography/IslandBiogeography.html
(I have also linked it into Google Classroom so you can just click)

1) Read the ***Background Information*** then click the home button
2) Watch the ***Tutorial*** then click the home button.
3) Click ***Run Experiments***

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Run 1

1) Set Island 1 to 130 Km distance.
2) Set Island 2 to 410 Km distance.
3) Set Taxon to Birds
4) Click the arrow to the data section and allow it to run for 500s.
5) Record the number of individuals (**n_i**) of each species in the data table.
6) Sum the n_i for each island, for each species - show your work
7) Calculate the relative abundance for each species **p_i= (n_i/N) show your work**

Count	**Island 1 n_i**	**Island 1 p_i**	**Island 2 n_i**	**Island 2 p_i**
Species 1	2	0.062	0	0
Species 2	2	0.062	1	1
Species 3	3	0.093	0	0
Species 4	2	0.062	0	0
Species 5	2	0.062	0	0
Species 6	7	0.2	0	0
Species 7	7	0.2	0	0
Species 8	2	0.062	0	0
Species 9	2	0.062	0	0
Species 10	3	0.093	0	0
Island Total (N)	32	0.962	1	1

Compare and contrast the **species richness** for each island .USE DATA

The species richness is greater in island 1 then island 2. In island 1, there is a total of 32 species in total. In island 2, there is a total of 1 species in total.

Compare and contrast the **relative abundance** 'profiles' for each island. USE DATA

Island 1 has more relative abundance then island 2. Island 1, has a lot of abundance of species, while island 2 had 1.

How does the Theory of Island Biogeography predict the data found? Detailed answer – USE DATA

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There's more species richness and relative abundance in island 1 due to it being closer to the mainland. There's less species richness and relative abundance in island 2 due to it being further to the mainland.

Run 2

1) Set Island 1 to 130 Km distance.
2) Set Island 2 to 410 Km distance.
3) Set Taxon to Mammals.
4) Click the arrow to the data section and allow it to run for 500s.
5) Record the number of individuals (**n_i**) of each species in the data table.
6) Sum the n_i for each island, for each species - show your work
7) Calculate the relative abundance for each species **p_i= (n_i/N) show your work**

Count	**Island 1 n_i**	**Island 1 p_i**	**Island 2 n_i**	**Island 2 p_i**
Species 1	4	0.133	0	0
Species 2	4	0.133	0	0
Species 3	2	0.066	0	0
Species 4	1	0.033	0	0
Species 5	1	0.033	0	0
Species 6	3	0.1	0	0
Species 7	4	0.133	0	0
Species 8	5	0.166	0	0
Species 9	3	0.1	0	0
Species 10	3	0.1	2	1
Island Total (N)	30	0.997	2	1

Compare and contrast the species richness for each island .USE DATA

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Island 1 has more species richness then island 2. In island 1, there are 30 species in total while in island 2 has 1 species in total.

Compare and contrast the relative abundance 'profiles' for each island. USE DATA

Island 1 has more relative abundance then island 2. Island 1, has a lot of abundance of species, while island 2 had 1.

Calculate Simpson's Diversity Index for each Island **$D= \Sigma[n_i(n_i - 1)]/N(N-1)$** show your work

D = 76/30(30-1) = 73.466 island 1 D = 2/1(1-1) = 0 island 2

How does the Theory of Island Biogeography predict this? Detailed answer – USE DATA

Island 1 is closer to the mainland while island 2 is further away from the mainland. There's more species richness and species diversity in island 1 and less species richness and species diversity in island 2.

Can you give a real world example that seems to reflect your data?

When a species habitat is destroyed, the species will move to the next closest habitat.

Run 3

1) Set both islands to 190 Km distance.
2) Set Island 1 to 128 Km diameter.
3) Set Island 2 to 256 Km diameter.
4) Set Taxon to Birds.
5) Click the arrow to the data section and allow it to run for 500s.
6) Record the number of individuals (**n_i**) of each species in the data table.
7) Sum the n_i for each island, for each species - show your work
8) Calculate the relative abundance for each species **$p_i= (n_i/N)$ show your work**

Count	**Island 1 n_i**	**Island 1 p_i**	**Island 2 n_i**	**Island 2 p_i**
Species 1	1	0.142	2	0.054
Species 2	1	0.142	2	0.054
Species 3	1	0.142	3	0.081
Species 4	2	0.285	4	0.108

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Species 5	2	0.285	6	0.162
Species 6	0	0	4	0.108
Species 7	0	0	3	0.081
Species 8	0	0	5	0.135
Species 9	0	0	4	0.108
Species 10	0	0	4	0.108
Island Total (N)	7	0.996	37	0.999

Compare and contrast the species richness for each island .USE DATA

Island 2 has more species richness then island 1. In island 2, there are 37 species in total while in island 1 has 7 species in total.

Compare and contrast the relative abundance 'profiles' for each island. USE DATA

Island 2 has more relative abundance then island 1. Island 2, has a lot of abundance of species, while island 1 less abundance of species.

Calculate Simpson's Diversity Index for each Island **$D= \Sigma[n_i(n_i - 1)]/N(N-1)$** show your work

D = 4/7(7-1) = .0952 island 1 D =114/37(37-1) = 110.9189 island 2

How does the Theory of Island Biogeography predict this? Detailed answer – USE OBSERVATIONS AND DATA. Island 2 is bigger than island 1 which cause more variety of species to inhabit island 2.

Run 4

1) Set both islands to 190 Km distance.
2) Set Island 1 to 128 Km diameter.
3) Set Island 2 to 256 Km diameter.
4) Set Taxon to Mammals.
5) Click the arrow to the data section and allow it to run for 500s.
6) Record the number of individuals (**n_i**) of each species in the data table.
7) Sum the n_i for each island, for each species - show your work
8) Calculate the relative abundance for each species **$p_i= (n_i/N)$ show your work**

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Count	**Island 1 n_i**	**Island 1 p_i**	**Island 2 n_i**	**Island 2 p_i**
Species 1	0	0	2	0.095
Species 2	1	0.111	1	0.047
Species 3	2	0.222	0	0
Species 4	0	0	1	0.047
Species 5	2	0.222	5	0.238
Species 6	0	0	1	0.047
Species 7	1	0.111	2	0.095
Species 8	1	0.111	3	0.142
Species 9	0	0	3	0.142
Species 10	2	0.222	3	0.142
Island Total (N)	9	.999	21	0.995

Compare and contrast the species richness for each island .USE DATA

Island 2 has more species richness then island 1. In island 2, there are 21 species in total while in island 1 has 9 species in total.

Compare and contrast the relative abundance 'profiles' for each island. USE DATA

Island 1 has more relative abundance then island 2. Island 1, has a lot of abundance of species, while island 2 less abundance of species.

Calculate Simpson's Diversity Index for each Island **$D= \Sigma[n_i(n_i – 1)]/N(N-1)$** show your work

D = 6/9(9-1) = 5.333 island 1 D =42/21(21-1) = 40 island 2

How does the Theory of Island Biogeography predict this? Detailed answer – USE OBSERVATIONS AND DATA. More Species on island 1 are going extinct. More species are colonizing island 2.

Can you give a real world example that seems to reflect your data?

When the Europeans discovered America. The native American tribes population decline while the different European nation grew.

Analysis Questions:

1) Which island had the highest diversity according to your calculations? Explain why this might be. Island 2 in run4, island 2 of run3and island 1 of run 2 b/c Simpson's Diversity Index was higher than the Simpson's Diversity Index for the other island.

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2) Did fragmentation of the mainland habitat affect the diversity of the species found? Explain.
Yes b/c this will separate some species from each other will cause offspring of new and diverse species.
3) Would a habitat of 10 species (2 individuals of each) be more or less diverse than a habitat containing 1 species with 85 individuals and 9 other species with 1 representative of each? Explain.
The habitat of 10 species will be more diverse b/c there's more variety of species.
4) If you were designing a biological reserve on the basis of your data, what size island would be your ideal? Why? What would be your goal? 256Km b/c more species will come to bigger islands. My goal will be to test the different amount of species come to the island.
5) In designing your reserve, take into account the high cost of land and a limited budget, what size reserve would you design? What trade-offs might be associated with your decision? 96KM, this will cause less species to come to the island.
6) You are working on designing a reserve, but the final size has been decided, you must now choose between two sites. Site 1 has a very low community diversity value because it is largely dominated by a single species; however one of the rare species is so rare that it is only found in one other park. Site 2 lacks this particular species, but has a much higher diversity values because it contains more species than Site 1 and none of the species is particularly dominant. Which site would you choose for the reserve and why?
I would choose site 1 for the reserve b/c I would like to study the rare species before it goes extinct.

7) Habitats-which once covered thousands of acres of island-, are being reduced to tiny fractions of their original size as humans turn more and more wild lands into farms, pastures, cities, and highways. These patches are like islands of safety for the animals and plants that need that habitat to survive; they are surrounded by a “sea” of unsuitable habitat. When a habitat is fragmented like this, it becomes a series of little habitat islands that are various sizes and various distances from each other. Often there is a larger habitat area (like a mainland for islands in the ocean); this serves as a source of new individuals for the smaller habitat islands (see diagram below). For example, a protected national forest might have a source population of squirrels that migrate through the farmland to get to the forest habitat islands.

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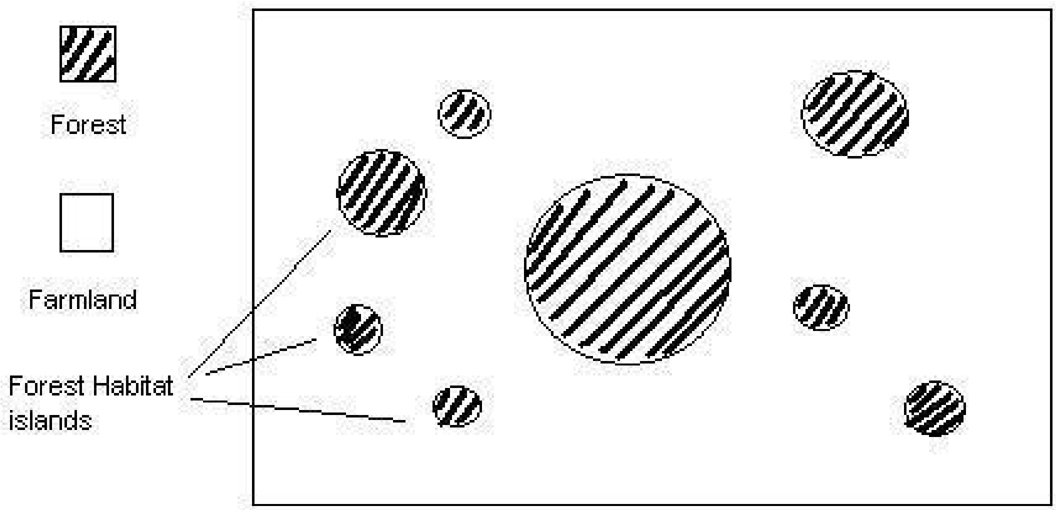

For Example:

8) Assume that a 10,000 acre part of a national forest has been leased to a lumber company. As part of the leasing agreement, the lumber company agrees to leave a 1,000 acre island in the middle of the forest uncut. They will also leave uncut several patches of forest totaling about 1,000 acres. How well will the smaller habitat fragments fare?
The smaller habitats will not do so well. Since there'll be less species diversity. There will be large or small amounts of 1 or 2 types of species.