

OIMB GK12 CURRICULUM

6th Grade

60 minutes

ISLAND BIOGEOGRAPHY—COLONIZATION

Oregon State Content Standards:

6.2 Interaction and Change: The related parts within a system interact and change.

6.2L.2 Explain how individual organisms and populations in an ecosystem interact and how changes in populations are related to resources.

6.3 Scientific Inquiry: Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses, and developing procedures for questioning, collecting, analyzing, and interpreting accurate and relevant data to produce justifiable evidence-based explanations.

6.3S.2 Organize and display relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions.

Ocean Literacy Principles:

5. The ocean supports a great diversity of life and ecosystems.

Goals: After completing this unit, the student will be able to

- describe the process of colonization on islands,
- predict the types of islands (big vs. small, close to the mainland vs. far from mainland) that will have the greatest biodiversity,
- explain how colonization and local extinction contribute to an island's biodiversity, and
- explain why different species might be found on different islands.

Concepts:

1. An island's biodiversity is affected by colonization and extinction.
2. Larger islands close to the mainland are more likely to be colonized than small islands that are far from the mainland.
3. Extinction rates are likely to be higher on small islands than on large islands.
4. Colonization is when organisms settle in numbers in an area where they did not occur previously.
5. Extinction is the dying out or termination of a species.

Materials:

- A large room
- Masking tape to tape out sections of the floor as diagrammed
- Recycled paper to crumple into "snowballs"
- Colonization worksheet for each student
- Graph paper for each student
- Colored pencils for the bar graphs

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Background: (modified from Wikipedia: [Island Biogeography](#))

Island biogeography is a theory that attempts to explain the factors that affect the biodiversity of biological communities on islands. For an island, biodiversity is a measure of the number of different species that live on an island (called species richness), and the number of individuals of each of those species that are present on the island (called species abundance). While the theory was developed to explain species richness of actual islands, it can also explain species richness in many other isolated areas, such as mountains surrounded by deserts, and lakes surrounded by dry land.

The theory of island biogeography proposes that the number of species found on an undisturbed island is determined by immigration, emigration, and extinction. For this lesson, we will look at how immigration affects the number of species on an island; however, extensions could be made to discuss how emigration and especially extinction on small islands or large islands contribute to the biodiversity of an island.

Immigration to an island is affected by the distance of the island from a source of colonists. Usually this source is the mainland (and it will be for this lesson), but it can also be other islands. Islands that are more isolated are less likely to receive immigrants than islands that are less isolated. We would predict islands farther from the mainland to have lower biodiversity than those closer to the mainland (if all other factors are the same for both islands, including age, climate, general topography of the island, and size.) Larger islands may also have higher immigration than smaller islands (if all other factors are the same) because they are bigger “targets” for colonists to land on.

Once species colonize an island, the rate of extinction is affected by island size. Larger islands in general contain larger habitat areas and opportunities for more varieties of habitat. Larger habitat size reduces the probability of extinction due to chance events (such as loss of habitat from lightning induced fires, storms, etc.).

The factors that influence the biodiversity of an island (so should be taken into consideration):

- Degree of isolation (distance to nearest neighbor, and to mainland)
- Length of isolation (time)
- Size of island (larger area usually facilitates greater diversity)
- Climate (tropical versus arctic, humid versus arid, etc.)
- Location relative to ocean currents (influences nutrient, larval, fish, bird, and seed flow patterns)
- Initial plant and animal composition if previously attached to a larger land mass
- Human activity

Lesson Plan:

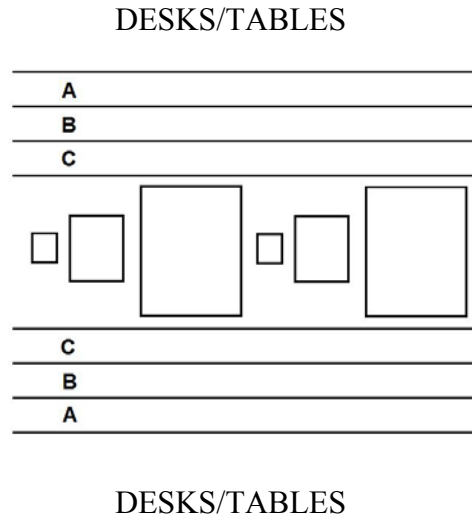
Preparation:

1. Prepare the materials that will be “launched” across the open area. (I used “snowballs” crumpled pieces of used paper), but you could also flick pennies or poker chips across the

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desks, or use any other short-distance projectile. This lesson is described using paper “snowballs”.)

2. Before the lesson, prepare the class in the following way: Clear a large open area in the middle of the room (desks/tables pushed against walls). On the floor, use masking tape to mark out the following sections in the middle of the floor:



Lesson:

3. Ask the students how plants and animals are able to “move onto” islands-- i.e. how Galapagos turtles and finches could be living on the Galapagos Islands, or how plants and animals could have moved onto the class’ island if they are participating in the “Our Island” activity. Write ideas on the board.
4. Explain the term colonization to the students, and relate it to their answers on the board. Have students write the definition of Colonization on their worksheet.
5. Review the background information with the students.
6. Explain to the students that we are now going to do an activity to model island colonization. We are going to have a “Snowball” fight. Lay out the ground rules for the snowball fight:
 - a. Students are divided into two groups, with one group standing behind each set of desks/tables (opposite side from the center of the room).
 - b. Students can only throw snowballs over their backs- they must be facing completely away from the other team. This is especially helpful in very small rooms to prevent direct hits.
 - c. Students may not leave the areas behind the desks/tables. They can collect snowballs from under the tables or on top of the tables, or from the areas where they are standing. They are NOT to move in front of the desks/tables at all. Any students entering the area between the desks/tables areas will disqualify their entire team. (As a side note, the more disruptive a class is, the more I limited

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their movement. Those classes that were very disruptive and hard to control were not allowed to go under the tables, and were not allowed to move out to the sides of the desks or tables.)

- d. Snowballs collected from under or on top of the desks/tables, or from the floor behind the desks/tables, can be used as further ammunition, but must also be thrown over the student's back.
- e. Students will be given 30 seconds to throw their snowballs. Any snowballs thrown after the 30 seconds are up will be counted against the team that threw them.
- f. There will be two rounds. In between rounds, students can collect snowballs from anywhere outside of the marked area and the teacher can distribute enough extra snowballs so that each student has one more to throw. Only 20 seconds are allowed for the second round.
- g. After both rounds, the snowballs are counted. A point is given for each snowball that lands on the other team's side of the room. Teams want to have more snowballs on the opposite side of the room than on their own side.)

Incidentally, I used snowballs as incentives in my classes. Students were given snowballs when they answered questions or participated in the discussion, and then all students were given 5 snowballs before beginning the fight (so some students had more than others).

7. Collect class data. Count separately the number of snowballs that landed in each of the "A", "B", and "C" sections, as well as the numbers of snowballs that landed in the small, medium, and large squares in the center of the room.
8. Explain to the students how this activity models island colonization. Tell the students that one team was "Southeast Asia", and the other team was "Australia". The area in between represents the water between SE Asia and Australia, with islands (Indonesia). The snowball fight was actually a typhoon, or winds and storms over a long time period, that "blew" or "carried" plants and animals from the mainland, across the water. The A, B, and C sections represent the likelihood that plants or animals would land close to the mainland, far from the mainland, or very far from the mainland. The snowballs that landed in the squares in the middle can be used to show the likelihood of small, medium, or large islands being colonized by plants or animals.
9. Graph data. Decide if it would be better to average the A's, B's and C's, or if it would be better to just use one A-B-C set of data from one side of the room. Lead the students in constructing a bar graph for "number of plants/animals that could colonize islands close to the mainland" (number of snowballs that landed in the A area), "number of plants/animals that could colonize islands far from the mainland" (number of snowballs that landed in the B area), and "number of plants/animals that could colonize islands very far from the mainland" (snowballs in the C area).

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10. Discuss results. Are plants and animals more likely to colonize islands close to the mainland, or far from the mainland? Why might that be?
11. Graph data. Average the number of snowballs that landed on the big islands, the small islands, and the medium islands. Lead the students in constructing a bar graph for “number of plants/animals that could colonize small islands” (number of snowballs that landed in the small squares), “number of plants/animals that could colonize medium-sized islands” (number of snowballs that landed in the medium-sized squares), and “number of plants/animals that could colonize large islands” (snowballs in the large squares).
12. Discuss results. Are plants and animals more likely to colonize large islands or small islands? Why might that be?
13. Ask a couple of students to define “extinction”. Have the students write the definition of extinction. Discuss how local extinction affects the biodiversity of an island.
14. Have students predict if extinction would be more likely to occur on large islands or small islands. Use their answers to emphasize that large islands are more likely to have greater biodiversity due to higher rates of colonization and lower rates of extinction.

Extension: Speciation on islands could also be discussed if students have an interest, and if there is time. See the “Our Island” lesson for a discussion of speciation.

Assessment:

Students’ learning is assessed from the graphs of the data collected in the activity, as well as with the discussion about the processes of colonization and extinction, and how colonization and extinction contribute to an island’s biodiversity.

Review and reiterate with students important aspects from the lesson, and then see, through discussion, if the students might be able to predict whether there would be higher diversity on real islands (i.e. using a map) close to the mainland or far away, or on islands that are large or small.

Tips:

1. The students are always excited about the prospect of a snowball fight, but if you specifically lay out the ground rules before-hand, things do not get out of control.
2. For the ABC sections, it works better the farther away the desks/tables are from the ABC sections. To get the right trend, however, it may be necessary to use just one side’s data, or to average data from both sides.
3. Graph pages may need to be projected to show the students how to construct bar graphs if they are unfamiliar with their construction.

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Name: _____

Colonization:

Extinction:

Speciation:

