

TAKING A COUNT OF BIODIVERSITY

Compare species diversity of a desert habitat with a school field and describe the impact human development has on wildlife habitat and species diversity.

ARIZONA SCIENCE STANDARDS

SC04-S4C1-02,
SC03-S4C3-01,
SC05-S1C4-02,
SC07-S1C3-06&07

OBJECTIVES

Students should:

- Use a basic transect technique to collect data on species diversity.
- Compare data from two different sites to determine which one has more biodiversity.
- Describe the most effective method for protecting biodiversity.

BACKGROUND

Your students will now be familiar with why species become endangered or threatened and why loss of biodiversity is a problem. This activity provides a forum for students to compare a natural desert area to a school field to see how habitat destruction affects species diversity. By setting up transects, lines which serve as guides, and taking samples at regular intervals, students can systematically compare the two habitats and quantify their diversity.

GETTING READY

Assemble the materials listed in the left margin of the next page. On a large piece of butcher paper, poster board, or other paper (about 2x3') make a class data sheet for the sample transect results (see "Class Data Sheet", figure 3.)

DOING THE ACTIVITY: TRANSECT STUDIES

SETTING THE STAGE

- 1) Refer to the information in the reading from the previous activity and ask, "What is the biggest single cause of species becoming endangered or threatened in our area?" (habitat loss)
- 2) Review the meaning of the term biodiversity. Ask the students, "Which do you think would have more species diversity, a desert lot or a school playing field or schoolyard lot?" They would likely assume that the desert lot would be more diverse. Tell them they need to prove it!
- 3) Explain that to do so, they need to work in groups as field scientists to count the number of different species of plants (and record any animals seen, including insects and other arthropods) they find in both areas

and compare them. The method they will use is called taking *transects*. Transects are lines that serve as guides. By counting the number of species along a transect at regularly spaced stops, they will be able to determine the number of species of plants (and any animals) in two plots and compare them to see which one has more biodiversity. They do not need to know the name of each species but will simply need to tell them apart from other species and keep track of how many they see. Explain that they will do a practice run to see how transect studies work. (You will do the sample transect study with a measuring tape, but the actual transects will require a transect line. You may want to have the students make the transect line. See "Making Transect Lines" on the next page for instructions. To have sufficient time for the activity, we suggest that you do the sample transect study and have students make the group transect line on one day, then do the transects of the desert lot and schoolyard another day or days.)

PART 1: SAMPLE TRANSECT STUDY

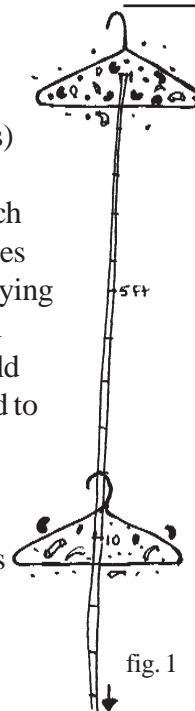


fig. 1

- 1) In a hallway or along a sidewalk, lay out the measuring tape. Starting at the end of the tape, drop a few handfuls of the seed/macaroni/bean mix every ten feet (3 meters). Place a coat hanger on top of each pile so that it encircles some of the mix within its perimeter (figure 1.) Have the students gather around the pile and hanger at the first marked interval. Explain that the line is a transect, and at regular, marked spots along it, there are species to sample. The coat hangers are standardized measuring devices to define the size of the sample at each plot. Each type of seed or bean or

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MATERIALS

- coat hangers (five)
- two cups of a mix of macaroni, beans, seeds, rice, etc. (anything you have around the house...a variety of up to six different kinds of items)
- 50 foot (15 meter) measuring tape
- 3x5" notecards
- clear tape
- pencils or markers
- calculator
- butcher paper, poster board, or other large paper for class data sheets
- waterproof markers
- flagging or marking tape
- clothesline (100 feet or 33 meters)
- scissors
- hula hoops or wire rings of same diameter (about a meter) (one per group of four students)
- ziplock sandwich bags
- a desert lot
- a school field
- a quarter
- plastic or paper bags for each group's field equipment

VOCABULARY

- Biodiversity**
- Endangered species**
- Habitat**
- Threatened species**

noodle represents a species. Ask the group, "If each one of these represents a species, how many 'species' are there within the coat hanger's area?" (up to six, depending on how many types of items you used in your mix) "How do we know?" (because we can count the number of 'species' we see)

- 2) Have some volunteers take a sample of each type of item and tape it to a 3x5" card with clear tape. Ask, "Do we need to know the names of these 'species' to be able to tell them apart and label them?" (no) Explain that even if we had never seen these 'species' before, we could take a sample of each type and give it a label or make up a descriptive name that distinguishes it from the other types. For example, the group may choose to call sunflower seeds "A," elbow macaroni "B," pinto beans "C," and so on. Have the volunteers label the cards however the group agrees to name each "species."
- 3) Explain that now that we have identified each "species" and can tell them apart from each other, we can count the total number of each one. Ask for volunteers to count how many individuals there are of each "species." Have them record the total number of each species counted on that species' identification card. Then have them choose a group name and record it on each card so the source of the data is known (figure 2.) Explain that

they are going to count the number of each species found in the remaining four plots along the sample transect line.

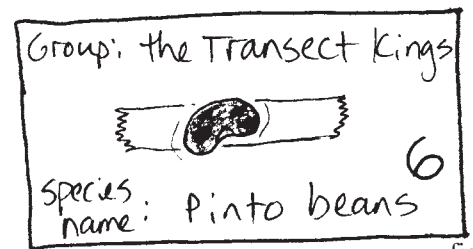
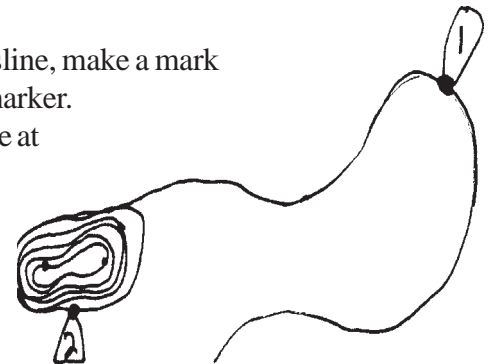


fig. 2

- 4) Have the students break into four groups and choose a group name to record on their cards. Pass out 3x5" cards, tape, markers, and pencils to each group. Send each group to one of the remaining coat hanger-defined plots along the sample transect line. Each group should make a set of species identification label cards for their plot, then record how many individuals of each species they found on the cards, plus their group name. It does not matter if one group has a different name for each "species" than another. They will use the species identification cards from their plots to compare their species counts with those of the other groups.
- 5) When the students are done at their respective plots, have them gather up the materials and come back to the classroom. They will need to compile their data on the class data chart you prepared for them (figure 3.) Have them record the data as follows:

MAKING TRANSECT LINES

- 1) On the 100 foot (33 meter) length of clothesline, make a mark every 10 feet (3 meters) with the waterproof marker.
- 2) Tightly tie a piece of flagging or marking tape at each of these marks with about 3 inches (8cm) of tape "tails" extending from the knot. The tails will be the tags.
- 3) Beginning with the 10 foot (3 meter) mark, label the tags #1, #2, #3, etc.



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Class Data Sheet

Transect location: _____
Date: _____ Time: _____

Species	1	2	3	4	5	6	7 etc →
Species ID cards							
Group A name							
Group B name							
Group C name							
Group D name							
Group E name							
etc ↓							
Total							

fig. 3

Class Data Sheet

Transect location: school sidewalk
Date: 8-24-00 Time: 10:15

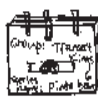

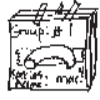
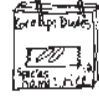

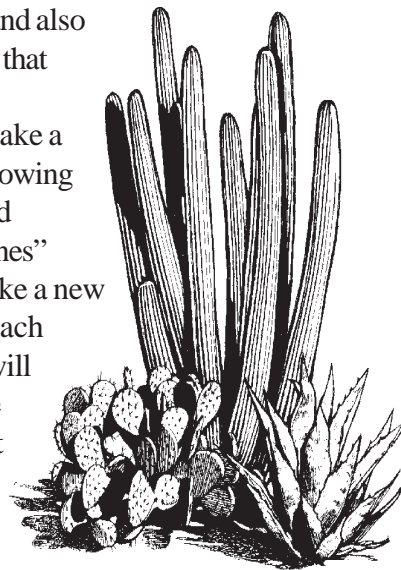
Species	1	2	3	4	5	6
Species ID cards						
Group A name Transect Rings	6	2	0	6	4	
Group B name Dudes	2	7	3	12	1	
Group C name #1	1	2	4	3	9	
Group D name Ace	3	5	4	14	6	
Group E name Cool Cats	5	0	2	7	8	
etc ↓						
Total	17	16	13	42	28	

fig. 4

- A) Each group needs to tape its species identification cards to the chart in the place marked “species.” Tape them layered one on top of the other, only on the top edge, so that the cards can be lifted and the ones beneath seen. For example, all five cards representing the “elbow macaroni” species will be taped in square 1, “pinto beans” in square 2, and so on.
- B) Have the groups list their name in one of the group slots, then record their species count data in that row beneath each species card. When all species are counted, have the students tally all group counts from each species column and record the total in the row marked “total” (figure 4.)
- 6) Ask the students to report on the species diversity of their plots. Were there plots that lacked any of the six species? Were the populations of each species evenly distributed or were there more of one kind than another?

- 7) Explain that they will be using these techniques to compare species diversity of a desert lot to that of the schoolyard. Instead of counting beans and macaroni, they will be taking samples of plants growing in the area and also counting any animals that they see.

- 8) Have the students make a class transect line following the directions labeled “Making Transect Lines” (previous page.) Make a new class data sheet for each transect your group will study, using the same format as before. Put enough group rows on for all groups to record their data.



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PART 2: TRANSECT STUDIES IN A DESERT LOT AND IN THE SCHOOLYARD

- 1) Count species diversity in the desert site first. Find a desert lot near the school or elsewhere that is at least 100 feet square (33 square meters.) The plot should be as “natural” as possible - a relatively undisturbed or uncut plot of desert. If the land is privately owned, be sure you get the owner’s permission to do the study there.
- 2) Divide the students into study groups of four. Ask them to choose a group name. Assemble 3x5” cards, pencils, hula hoops, ziplock sandwich bags, scissors, and clear tape for each group, (preferably in their own bag) as well as the transect line, a blank class data sheet, markers, and a quarter.
- 3) Bring the groups to the field site. Walk to approximately the center of the site. Explain that for the transect to be a fair representation of species diversity in the lot, the direction in which the transect is laid must be chosen randomly. Flip the coin twice, asking students to call heads (H) or tails (T), to determine in which direction to lay the transect line. (For example, if the coins fall TT, go north; TH - east; HH - south; or HT - west.)
- 4) With the students’ help, lay the line out straight in the chosen direction. Do not drape the rope in trees, bushes or cacti, but lay it at their bases. Take care to not entangle the rope in branches or cactus spines. Watch where you

are walking to avoid stepping on vegetation, live animals, or animal homes.

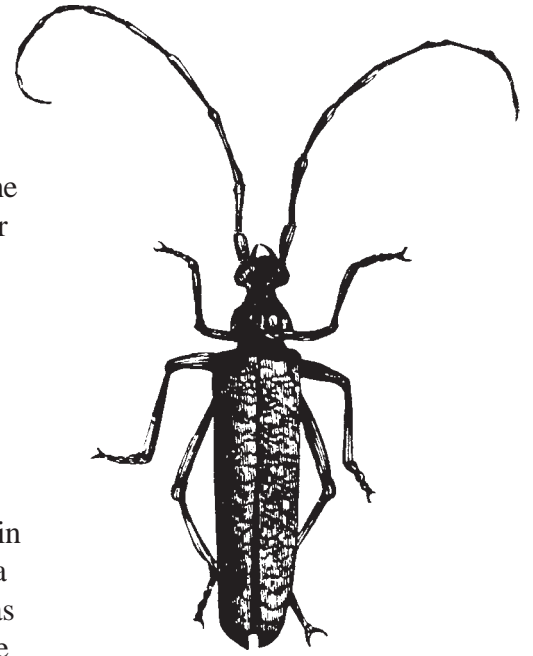
- 5) Explain that each group will count species at a numbered plot along the transect line. Before they go to their respective plots, review field techniques used in the sample transect and give the following instructions, demonstrating plant (and animal) sampling techniques:

A) Place the hula hoop over the tag on the transect line with the tag in the center of the hoop. (The hula hoop serves the same purpose as the coat hanger did in the sample transect.)

B) Make species identification cards for each species of plant. If the plant’s base is within the hoop or it’s leaves dangle over the circle, then it is part of the plot. Use scissors to cut a bit of branch and leaves, and flowers if there are some, and tape them to a 3x5” card. Only remove a portion of the plant for identification purposes. For cacti, draw a picture instead of trying to take a sample. Decide on a name or label for each plant species. Record the group’s name on the card.

C) Once each plant species has been named by the group, each group member should choose a species and count the total number found within the plot. Record the total on the species card. Count all members of each species.

D) Survey the plot for any insects or other animal life. Look along branches, under leaves, and on the surface of the ground. Care-



fully turn over rocks and pebbles to look under them, but be sure to return them to their original position after looking. If there are insects or arthropods in the plot, gently catch one of each kind and put it into a ziplock bag. (If the animal is a wasp, bee, scorpion, or spider, simply draw a picture and name it but do not collect it.) You can record sightings of other animals, too, such as birds or lizards. On a 3x5” card, make a sketch of the animal, give it a label or name, and put the plot number on the label. Count and record total numbers seen.

E) Record totals of species counts on the class data sheet (Tell them where the sheet will be at the field site.) Be sure to list the field site on the line marked “Location.” Tape species cards in the top columns, including any animal species cards. Compare any live animal

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specimens found. Record group data in the rows beneath.

F) Return any live insects or arthropods to the plot where they were found, taking care to gently return them to the specific place they were collected.

6) If time or enthusiasm allow, repeat the process in a different direction.

7) Return to the schoolyard and repeat the procedure for a schoolyard count. The schoolyard plot should be uninterrupted or contiguous schoolyard "habitat" whether a soccer field, dirt lot, or landscaped lawn or garden. Ideally, like the desert plot, it should be 100 square feet (33 square meters) so the same procedure used in the desert plot can be followed in the schoolyard plot. If the school setting does not allow for this, set the transect line where you can find contiguous, unpaved space. If this is still not possible, find a vacant lot near the school or desert field site that has been cleared of original desert vegetation but may harbor weeds and other secondary growth.

4) Ask students to extrapolate on what the data have shown them with questions such as:

- How does habitat loss affect biodiversity or the variety of species found in an area? (It reduces biodiversity by converting diverse systems into simpler ones.)
- Is a schoolyard a good substitute for a desert habitat? (It depends on the schoolyard. Perhaps some schools have desert landscaping or pollination gardens which closely replicate the natural desert environment. These provide habitat for many desert animals and plants that would otherwise be displaced by development. But, if they are isolated from intact desert habitat or are small, they are not able to provide all the habitat needs of a large population of plants or animals. This reduces total biodiversity.)
- What can we do to protect species best? (protect habitat)

5) Ask the students if they think this type of study could give information about populations of endangered species. Explain that transects are one technique used by wildlife biologists to get an idea of species frequency in an area. Transect data could be compared year after year to see if numbers have dropped. But if a species is severely endangered, biologists are more likely to count every individual of the species of concern instead of doing a transect. Remind the students that wildlife biologists use this type of study, as well as many others, to gather data about species' numbers.

DISCUSSION

- 1) Hang the class data sheets from the two sites on the wall or chalkboard so students can see the data for both.
- 2) Ask the following kinds of questions to get students thinking about biodiversity in the two sites:
 - Which setting had more kinds of plants?
 - Which setting had more kinds of animals?
 - Did you see the same kinds of plants or animals in both sites?

3) To observe patterns in species' frequency in a particular site, you may want the students to graph their data with species on the X axis and frequency (number) on the Y (figure 5.)

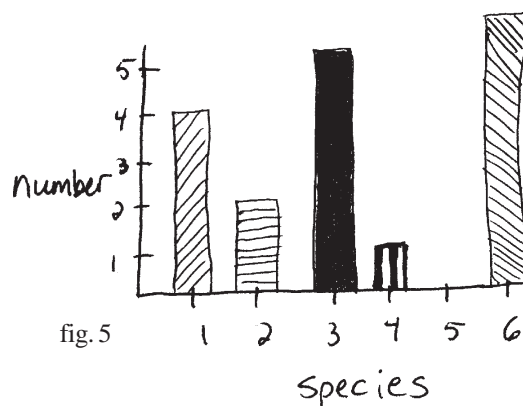


fig. 5

EXTENSION

Monitor other factors in the desert lot and the school field such as temperature, light intensity, moisture, wind speed, etc and see if these are different in each spot. Compare these factors to the biodiversity seen. What conclusions can you draw?