Schoolyard Biodiversity

What is Biodiversity?

Biodiversity can be defined on a variety of levels. Ecosystem biodiversity refers to the variety of habitats within a particular area or region.
The Schoolyard Biodiversity Investigation focuses on species biodiversity, or the variety of plants and animals in a particular habitat. On a more complex level, genetic biodiversity looks at the variety of characteristics within a particular species. The opposite of species diversity is monoculture. The term monoculture refers to a situation in which only one species occupies a particular area or region. Examples of man-made monocultures include lawns and farms (such as wheat fields or pumpkin patches).

Why is Biodiversity Important?

Habitats that have a greater variety of different species of plants and animals have a greater biodiversity. These habitats are also healthier and more stable. One reason diverse communities have greater levels of health is that organisms of the same species tend to be more spread out. This reduces the ability of a disease to spread throughout a habitat. Additionally, if a certain type of species of tree or plant does become infected, the other species will remain and continue to provide the habitat components for the organisms in that area.

In an area consisting of monoculture, an area with only one type of plant species growing, the plants are more susceptible to disease and other stresses because they are all the same and less spread out (no other types of plants between them). As a result, [the entire habitat can be dramatically altered when impacted by disease or other stresses]. Human-made monocultures (crops, etc.) are created to make harvesting easier. However, they typically require larger amounts of pesticides and herbicides (to prevent diseases and/or “weeds”) and larger amounts of energy and labor to maintain before harvesting.

Measuring Biodiversity

Biodiversity is a broad term used to describe the diversity of genes, species and ecosystems in a region (Enger & Smith, 2010). Genetic Diversity describes the number of different kinds of genes present in a population or a species. Species Diversity is a measure of the number of species present in an area. Ecosystem diversity is the measure of the number of kinds of ecosystems present in an area. Scientists use a variety of tools and methods to determine biodiversity. While some debate exists as to the most accurate means of calculating biodiversity, the Simpson and Shannon Indexes are the most widely accepted.

Calculate the Simplified Diversity Indices

Students can calculate the Simplified Diversity Index for each species category and for the total species in the habitat, using the following equation:

Simplified Diversity Index = $\frac{\text{Total Number of Different Species}}{\text{TOTAL Number of ALL PLANTS OR ANIMALS FOUND}}$

Analyze the Simplified Diversity Index – What does it all mean?
This Simplified Diversity Index measures how diverse each animal group is in their schoolyard. The closer the number is to 1, typically the more diverse the group of animals. A lower value for the Simplified Diversity Index may be due to the fact that there is a large number of the same species (a high species evenness). A higher value for the Simplified Diversity Index may be due to many different species, with only a few of each of the species present (a high species richness).

a. Species Richness: Count the Number of DIFFERENT SPECIES (specify plants or animals) in an area of the schoolyard

b. Species Evenness: Count the Number of ALL SPECIES (specify plants or animals) in the same area
Animals seek food and shelter in areas where there is adequate habitat, which includes the type and variety of plants and their arrangement in an area. Frequently, the types of plants on a school campus are affected not only by the types of activities that take place on the site, but also on the surrounding habitats and how the landscaping on the site is managed.

The Simplified Diversity Index is a decimal number between 0 and 1. The closer the diversity index is to 1 then the more the habitat is diverse and healthy (WDNR, 2005).
Diversity Index value of 0 indicates no diversity
Diversity Index value of 1 indicates high diversity
Diversity Index value of 0.5 indicates area is relatively diverse
Diversity Index of a healthy forest would typically range around 0.7- 0.8
Diversity Index of an agricultural field would typically range from 0.02 or less

In this investigation, students will conduct a biodiversity investigation (quantitative and qualitative field investigation) to determine what species are observed in the school football field area and calculate the diversity index. After calculating the diversity index of the second (less-human influenced) area, students will compare the diversity index between the school football field survey results and the second survey results, to determine relative biodiversity (a comparative field investigation).

Prelab Questions:

1. What is biodiversity?
   _____
   _____
2. Why is biodiversity important?
   _____
   _____
   _____
3. How have humans affected biodiversity?
   _____
   _____
   _____

PART 2: Exploring the Question

Inquiry Question:

What are your variables going to be?

- Independent (the one you are changing):

- Dependent (the one you will measure or observe):

- Control Variables

1. 3.

2.

Hypothesis (use what you have written above to construct a hypothesis and use IF, THEN, WHY format)

PART 3 (a) – Day 1: Mapping the School Yard

Student partners or teams can create maps of the entire school grounds(at back of school), working first to draw the main structures, boundaries, etc. and then adding details/descriptions of the various habitat/land types. Students must be sure they draw and label both natural and man-made features, while also labeling the habitat/ land types of each area. Students must include a approximate scale and N direction on their map.

Day 2

Students will **randomly** choose **4** sample sites within **each** of the areas designated to be high human impact and low human impact. Students will do an inventory of the number and kinds of different species found in the area. Identifying the scientific name for the species is not necessary. Students may use the common name, and if that is unknown, they may simply describe the species. Students will survey the biodiversity by conducting a quadrant sample. A quadrat is a known square area that is marked using a pre-made square of plastic, or stakes and string. Quadrats can range in size from 1 m2 to 20 m2, depending on the type of habitat surveyed. Different species and their numbers within the quadrat are counted. Counting is repeated many(4) times in different places throughout the habitat to get an accurate representation of biodiversity.

Day 3: Students will calculate the biodiversity index for each of their two habitats. Students should combine their data with classmates in order to have a higher sample size to improve accuracy. The reason larger sample numbers increase your chance of finding a significant difference between the two areas is because they more reliably reflect the population mean.

MATERIALS: List all the equipment and materials you would use to conduct your lab	SAFETY: What safety rules must be remembered and followed in this experiment

Step 1:
Step 2:
Step 3:
Step 4:
Step 5:
Step 6:
Step 7:
Step 8:
Step 9:

PART 4: Observations

Use the blank page below to set up an organizer for data collection.
Do not begin your experiment until this has been set up!

PART 5: Conclusions

Answer the following questions in complete sentences:

1. **Write a conclusion.** (A conclusion will always answer your inquiry question. It uses data to support the conclusion. It will always refer to the hypothesis and give a scientific explanation for the results observed. Sources of error will be discussed, especially, if results are not as expected and the researcher is not convinced of the validity of the results. The relevance of findings are discussed and next steps or future experiments are mentioned)

2. List 2 possible sources of error in the. Explain how each one may have affected the outcome of the experiment. Human error is within your control and is not considered a source of error.

Sources of Error	How this May Have Affected The Experiment

3. List 2 improvements that could be made to the procedure to make the experiment better. Explain why each improvement would help to make the experiment better.

Improvement	Why This Would Make The Experiment Better

Questions:

1. Why is understanding biodiversity important?

_____
_____
_____
_____
_____
_____

2. How have humans impacted the biodiversity in the world in general?

_____
_____
_____

3. Pollution is a major cause of decreasing biodiversity. Often the effects on biodiversity are seen higher up on the food chain through the process of bioaccumulation and biomagnification. Research these two terms and explain why pollution of the stream may be impacting the biodiversity of the area surrounding the stream or the birds which feed in the stream.

_____
_____
_____
_____
_____
_____
_____
_____
_____

4. How might spraying to kill insects or weeds on the football field lead to a decrease in biodiversity in the stream area?

5. Do you think fertilizing the grass would be beneficial or harmful to biodiversity. Explain.

5. What can students do to help protect the biodiversity of Bateman Highschool?

Science 1-DB Scientific Method Name

Thinking & Inquiry Criteria	Level 1	Level 2	Level 3	Level 4	Comments
BACKGROUND Questions	Background information has not been used	Background information has limited use	Background information is used in some supporting details	Background information is used with plenty of supporting details	__ 6
VARIABLES identifies independent, dependent and control variables quantifies variables	I.V. and D.V. are not correctly identified control are not specific	I.V. and D.V. are partially correct some controls are specific	I.V. and D.V. are correctly identified all controls are specific	I.V. and D.V. are correctly identified and quantified controls are specific and quantified	__ 6
HYPOTHESIS correct format used nature of the relationship between the I.V. and the D.V. outlined quality explanation provided	does not used correct format no explanation provided	uses correct format explanation is limited	Uses correct format variable relationship is specific satisfactory explanation	Uses correct format variable relationship is specific insightful explanation	__ 4
Procedure	Procedure cannot be repeated.	Procedure is somewhat correct, but lacks the deetail to accurately repeat the procedure.	Procedure is mostly correct, but may be missing units, detailed instructions or may not be in the third person past tense.	Procedure is detailed, is in correct order and is in thrid person past tense. Procedure could be duplicated easily.	6
OBSERVATIONS table contains descriptive title, appropriate headings and units of measurement	table is incomplete headings are not specific	table is complete headings are not specific	table is complete some observations are quantified	meets all criteria all observations I.V. and D.V. are used as headings. Graph included	__ 5
CONCLUSION Discussion of whether or not the observations support the hypothesis	conclusion is incomplete	Conclusion is stated but not accurately supported by results and observations	Conclusion is mostly complete makes a good attempt to support it with results and observations. Student has referred to hypothesis and has attempted to explain their findings. Relevancy of findings may not have been discussed.	Conclusion is extensive and is accurately supported by the results . Results are explained and relevancy of findings are discussed.	__ 5

QUESTIONS	Questions are mostly incomplete.	Questions are not complete or accurate	Questions are mostly complete and accurate.	Questions are complete, accurate with well written explanations..	
SOURCES OF ERROR AND DESIGN IMPROVEMENT suggests reasonable sources of error and the impact of such errors suggests improvements to the design	sources of error discussed with limited effectiveness limited suggestions	sources of error discussed with some effectiveness some suggestions	sources of error discussed with considerable effectiveness considerable suggestions	sources of error discussed with a high degree of effectiveness detailed suggestions	