BugQuest:
The Hidden Biodiversity of Our Schoolyard

Grade(s):
9-12 (Adaptable)

Time:
75 minutes with options to extend

Materials:
- Outdoor Learning Space
- Student observation worksheet or notebook
- Magnifying Glasses
- Optional - Clipboards

Every schoolyard contains an incredible diversity of living organisms, many of which go unnoticed. In this lesson, students investigate the biodiversity of their local environment by thinking and acting like scientists. Through observation, questioning, and prediction, students prepare for their participation in BugQuest, a citizen science initiative that uses insect sampling and DNA barcoding to help monitor biodiversity across Canada.

This lesson introduces students to biodiversity, scientific inquiry, and the role of citizen science while laying the foundation for future analysis when their BugQuest results are returned.

Learning Goals

Students will:

- understand biodiversity as an indicator of ecosystem health
- explore how scientists investigate biodiversity
- develop scientific questions and evidence-based predictions
- identify environmental factors that influence biodiversity
- recognize the importance of citizen science in biodiversity research

The BIG Question

What can the biodiversity of our schoolyard tell us about the health of our local environment?

PART 1: What is Biodiversity & Can We Observe It? (25-30 minutes)

1 Introduce biodiversity through a video discussion

- **Watch the video *What is Biodiversity?***
  https://www.youtube.com/watch?v=b6Ua_zWDH6U

- **After watching, discuss:**
  - In your own words, what is biodiversity?
  - What examples of biodiversity did you notice in the video?
  - Why is biodiversity important? Why does it matter to humans?
  - The video discusses biodiversity loss around the world. What questions do you have about biodiversity in our own community?
  - Do you think biodiversity is the same everywhere around our school? Why or why not?

> ***Facilitation Tip:*** *Guide students toward the idea that different environments provide different resources and conditions that influence which species can survive.*

2 Connect biodiversity to scientific investigation

Biodiversity scientists do more than identify species. They collect evidence to understand where organisms live, what conditions they need, and how ecosystems change over time. Before participating in BugQuest, we will practice observing their environment and thinking like biodiversity researchers.

- **Discuss:**
  - If you were a scientist studying biodiversity around your school, what would you need to observe or measure?
  - How can scientists measure biodiversity?

> ***Facilitation Tip:*** *Highlight that scientists collect data on both the variety of species present and their abundance. Methods may include species surveys, insect sampling, camera traps, direct observation, and environmental measurements.*

  - Why is it important for scientists to use the same methods when collecting biodiversity data?

> ***Facilitation Tip:*** *Connect this to BugQuest. Standardized methods allow data collected by different schools and researchers to be compared and analyzed.*

  - What evidence would help you determine that one area has greater biodiversity than another?

> ***Facilitation Tip:*** *Ask students to think about measurable evidence rather than assumptions. Possible evidence includes the number of species identified, abundance of organisms, and variety of habitats present.*

  - Why might one area of the schoolyard support more insect diversity than another? What factors could influence insect populations?

3 Outdoor Observation Activity

Scientists often begin an investigation by observing an environment, identifying patterns, and asking questions. In BugQuest, students become citizen scientists by collecting standardized insect biodiversity data that researchers can use to better understand insect diversity across Canada.

- **Visit the BugQuest sampling area or a potential sampling area.**

- **Students observe and record features that could influence biodiversity in their notebooks, including:**
  - Types and variety of plants
  - Ground cover (grass, leaves, bare soil, mulch, etc.)
  - Shade or sunlight
  - Moisture or water sources
  - Soil conditions
  - Signs of insects or other wildlife
  - Evidence of human activity or disturbance

- **As a class, discuss:**
  - Which locations appeared most likely to support high biodiversity? Why?

    Facilitation Tip: *Encourage students to support their ideas with observations from the site.*

  - What evidence would scientists collect to test whether these locations actually have greater biodiversity?
  - What additional information would scientists need before drawing conclusions?

    Facilitation Tip: *Discuss how scientists collect repeated observations over time and across locations to identify reliable patterns. Additional information could include data from different seasons, weather conditions, habitat measurements, and multiple samples.*

PART 2: Think Like a Scientist (25-30 minutes)

Scientists use observations to develop questions, make predictions, and design investigations. In this activity, students use their observations of the schoolyard to plan an investigation about biodiversity.

1 Develop a Scientific Question

Scientists begin investigations by asking questions that can be answered through collecting evidence.

- **Based on their observations of the BugQuest sampling area, guide students to develop a question about biodiversity.**
- **Example questions:**
  - Which habitat around our school supports the greatest insect biodiversity?
  - How does sunlight exposure influence insect diversity?
  - How does plant diversity affect the number and variety of insects found in an area?
  - Does human activity influence biodiversity around our school?
  - Which environmental factors are most associated with insect diversity?

Facilitation Tip: *Encourage students to create questions that compare locations, investigate relationships between environmental factors, or explore how conditions affect biodiversity.*

2 Develop a Hypothesis

Scientists use existing knowledge and observations to make predictions before collecting data.

- **Have students create a hypothesis that explains what they think they will observe and why. Consider having students frame their hypothesis with "If...then...because"**
  - Example: If an area has greater plant diversity, then it will support greater insect diversity because plants provide food and habitat for many insect species.

Facilitation Tip: *Encourage students to include a reason based on scientific understanding, not just a prediction.*

3 Identify Variables

Scientists identify the factors they will study and measure.

- **Identify the variables in your investigation:**
  - **Independent variable:** The factor you will change or compare.
    Examples: habitat type, sunlight exposure, plant diversity, human disturbance
  - **Dependent variable:** The factor you will measure or observe.
    Examples: number of insects collected, number of species identified, insect diversity
  - **Controlled variables:** Factors that should remain consistent to make results reliable.
    Examples: sampling method, sampling time, sampling area size, weather conditions

Facilitation Tip: *Connect this to BugQuest. Following the same sampling procedure helps schools across Canada collect comparable biodiversity data.*

PART 3: Consolidation

Students reflect on how individual observations and local data contribute to larger scientific research.

- **Discuss as a class:**
  - Why is it important that every school follows the same BugQuest sampling procedure?

Facilitation Tip: *Connect standardized methods to reliable scientific data. When schools follow the same procedure, researchers can compare results across different locations and identify patterns in insect biodiversity.*

  - How does collecting biodiversity data from many schools strengthen scientific research?
  - How can citizen scientists help answer questions that individual researchers cannot investigate alone?

Extensions

Grade 9

- Research an endangered or threatened Canadian species and the factors affecting its population.
- Analyze how habitat loss, pollution, invasive species, or climate change can impact biodiversity.
- Conduct a schoolyard biodiversity audit and propose changes that could improve habitat for local species.
- Explore careers related to biodiversity conservation, environmental science, and wildlife management.

Grade 10

- Create a scientific report analyzing how factors such as habitat type, temperature, moisture, sunlight, or plant diversity influence insect populations.
- Compare biodiversity data from different sampling locations.
- Develop evidence-based conclusions about the relationship between ecosystem conditions and biodiversity.
- Connect findings to broader environmental changes, including climate change and changing habitats.

Grade 11

- Create a presentation, infographic, storybook, video, or other communication project explaining how biodiversity supports ecosystem health.
- Investigate the role of insects in ecosystems, including pollination, decomposition, food webs, and nutrient cycling.
- Explore how changes to one species or group of organisms can affect ecosystem relationships.
- Design a public awareness campaign promoting biodiversity conservation.

Grade 12

- Investigate why some organisms are difficult to identify using physical characteristics alone.
- Explore how DNA barcoding uses a small, standardized region of DNA to identify species.
- Examine how BugQuest uses DNA barcoding to identify thousands of insect specimens collected by students across Canada.
- Compare the advantages and limitations of DNA barcoding with traditional methods of species identification.
- Explore careers in genetics, biodiversity research, conservation biology, and biotechnology.

BugQuest:

Worksheet 1: Think Like a Biodiversity Scientist

Name(s): _____ **Date:** _____

BugQuest Sampling Location: _____

What Did We Observe?

Scientists begin investigations by observing the environment and identifying patterns.

What features of this habitat could influence biodiversity?

Environmental Factor	What did you observe?	How might this influence insects?
Plant diversity		
Sunlight / shade		
Ground cover		
Moisture / water sources		
Soil conditions		
Human activity		

Based on your observations:

Which area do you predict will support the greatest insect biodiversity?

Location: _____

What evidence supports your prediction?

BugQuest:

Worksheet 2: Think Like a Biodiversity Scientist

Name(s): _____ **Date:** _____

BugQuest Sampling Location: _____

Design a Biodiversity Investigation

Scientists use observations to ask questions, make predictions, and collect evidence.

1. Our Scientific Question

A strong scientific question can be investigated by collecting data.

Our Question:

2. Our Hypothesis

A hypothesis is a prediction supported by scientific reasoning.

If _____

Then_____

Because _____

3. Identify the Variables

What factor are we investigating (i.e., independent variable)?

How could we compare or measure this factor?

What biodiversity data could we collect (i.e., dependent variable)?

- ☐ Number of insects collected
- ☐ Number of species identified
- ☐ Variety of insect groups
- ☐ Other: _____

What should remain the same to make our results reliable (i.e., controlled variable)?

BugQuest combines data collected by many schools across Canada.

- Why is it useful for scientists to collect biodiversity data from many different locations?
- How does following the same sampling method help scientists compare results?