

Schoolyard Bioblitz Education Kit



For Grades 9-12

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Introduction to the Schoolyard Bioblitz Education Kit

About the Kit

- Welcome to the Schoolyard Bioblitz Education Kit! This education kit is intended to be a step-by-step resource on how to incorporate bioblitzes into your teaching curriculum. The kit is meant to compliment the documentary film *Every Living Thing: Experiencing a Bioblitz*.
 - **Film link:** <https://curio.ca/en/video/every-living-thing-experiencing-a-bioblitz-10566/>
 - **Note:** we recommend that teachers preview this film before showing it to their class to ensure that terminology and content is appropriate for your grade level.
(Recommended for ages 14+)
- The activities in this kit will help you introduce concepts of biodiversity, plan and hold your own bioblitz in the schoolyard, encourage greater understanding and appreciation of local plants and animals, and introduce different scientific career opportunities to your students.
- **The kit is written primarily for New Brunswick teachers, but the activities are applicable to curricula across Canada.** The information and activities in this kit are tailored to the high school school level, with specific curriculum links listed for each activity (as per the *Atlantic Canada Science Curriculum, 2002*, and the *Atlantic Canada Science Curriculum for Biology 11 and Biology 12, 2008*). Kits are also available for the elementary school and middle school levels.
- The information and activities in this kit are organized for you to use easily. Each section focuses on a different step of planning and holding a bioblitz, and activities cater to a variety of different learning styles. You can pick and choose the activities that fit best with your curriculum, or you can complete all the activities in the kit for the full bioblitz experience!

About Nature NB

- Nature NB is a non-profit, charitable organization whose mission is to celebrate, conserve and protect New Brunswick's natural heritage, through education, networking and collaboration. Founded in 1972 as the New Brunswick Federation of Naturalists, the organization is presently comprised of a dozen naturalist clubs and hundreds of members across the province.
- In addition to encouraging a better understanding of the natural environment and awakening concern for our province's natural heritage, Nature NB recognizes the importance of actions to preserve and maintain that natural heritage. We achieve both through various programs for youth and adults, and through the development of educational materials.

Acknowledgements

This kit was made possible with contributions from:

- Natural Sciences and Engineering Research Council of Canada
- New Brunswick Wildlife Trust Fund
- Canadian Wildlife Federation

Thanks to committees and others:

- Review committee
- Atlantic Canada Conservation Data Centre
- CBC Curio



SECTION 1 Introducing concepts

1.1

What is Biodiversity?

- **Biodiversity** (biological + diversity) refers to the wide variety of life on earth and all the ways that different living things interact with each other.

1.2

Why is Biodiversity important?

- Biodiversity is important because we **depend on it to survive**, as do other living things. As humans, we rely on a wide variety of living things that we might eat as food, use for medicine, or turn into clothes or shelter.
 - Other living things do this too; for example, a bird might eat earthworms and berries, and build a nest in a tree using twigs, grasses, and lichens. A mushroom might find its home in a safe spot at the base of a tree and eat the leaves that fall from it.
 - When there are lots of things to eat, or lots of places to find shelter and build homes, there is more space for more living things to find what they need to survive.
- The diversity of life – which includes differences in genes, in species, and in ecosystems – also helps living things **respond to environmental changes**.
 - Ecosystems that are diverse can recover from change more easily than those that are not. If an environment changes and something within an ecosystem is lost, living things in a diverse ecosystem can more easily replace what was lost.
 - For example, if birds living in a diverse forest suddenly lost the blackflies that they eat, they could easily find another food to eat instead, like houseflies or beetles or caterpillars or berries.
 - If their environment was not diverse – if blackflies were the only food available to the birds – then they would not be able to find another food to eat, and the birds would also die.

Biodiversity supports us, and also helps us continue to survive in the face of a changing environment.

What is a Bioblitz?

Definition and Purpose

- A **bioblitz** is a fun activity that helps you find and understand the biodiversity near you.
- A bioblitz is done over a set period of time (e.g. 1 day) in a specific area (e.g. your schoolyard) to find, identify, and record all of the organisms that live within the area. A bioblitz can provide you with a “snapshot” of the biodiversity found in your area.

Importance

- A bioblitz is an important scientific tool of discovery that can reveal valuable information about the biodiversity in your area. Even a relatively small bioblitz can find preliminary information that can be used for larger-scale research. Over the years, bioblitzes in New Brunswick have led to the discovery of several species not previously recorded in the province!
- Using bioblitzes to help us understand the biodiversity in an area helps us to protect species at risk, manage resources and land that are used by living things, and monitor climate change and its effects on biodiversity.

Biodiversity in New Brunswick

- There are estimated to be over 33,000 unique species that live here in New Brunswick.
- To help illustrate the diversity of species in New Brunswick, we can group the species that live here into 10 major categories, called **taxonomic groups**. Taxonomic groups are categories of organisms that are closely related and therefore share certain characteristics.
- For each taxonomic group (below), you will find the characteristics that define the group, species that are examples of the group, and estimates of the number of species within the group that live in New Brunswick (as of 2017). (Note: Groups that would be unlikely or difficult to find in a schoolyard, e.g. marine species, have been excluded from this list.) (Data from ACCDC.)



Vascular Plants



- Vascular plants are terrestrial plants that have special tissues called xylem and phloem that help transport water and sugars throughout the plant.
- Examples of vascular plants include ferns, gymnosperms (like pine, spruce, cedar, and other conifers), and angiosperms (fruit-bearing plants like apple, pea, corn; other flowering plants like rose, orchid, buttercup, dandelion, etc.)
- (Mosses and algae are non-vascular plants.)
- 1827 species: 1315 **native species** that have evolved in and always lived in New Brunswick, 612 exotic or potentially exotic (that people brought to New Brunswick from somewhere else and planted here).



Fungi



- Fungi are classified in an entirely different Kingdom than plants or animals. Fungi can't **photosynthesize** and have to absorb nutrients from other organisms. To do this, many fungi secrete **digestive enzymes** that help to break down other organisms into molecules the fungi can absorb. This act of **decomposition** is very important to our ecosystems!
- Examples of fungi include yeast, mould, and mushrooms, though without a microscope you would be most likely to find mushrooms in a New Brunswick schoolyard.
- 808 species.



Terrestrial Mollusks



- Mollusks are **invertebrate** animals that generally have a shell, a muscular “foot”, and specialized organ systems for breathing and eating. Some mollusks live on the land (terrestrial mollusks) and some live in the ocean (marine mollusks).
- Examples of terrestrial mollusks include gastropods, such as snails and slugs. (Examples of marine mollusks include conch, squid, octopus, clams, oysters, scallops, and mussels.)
- 123 terrestrial species (number of marine mollusk species is currently unknown).





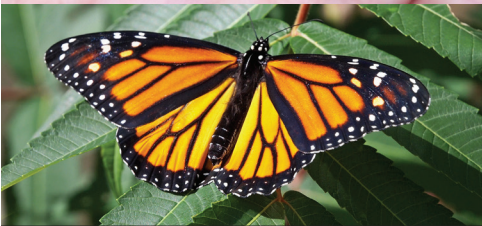
Arachnids

- Arachnids are invertebrate animals with eight legs. They do not have antennae or wings, like insects do. The only type of arachnid that lives in New Brunswick is spiders.
- Examples of arachnids include crab spiders, cellar spiders, and orb-weaver spiders.
- 392 species confirmed, but is probably a significant underestimate of what is actually here but undocumented.



Insects

- Insects are invertebrate animals with three body segments, six legs, antennae, and an **exoskeleton**. Adult insects typically have two pairs of wings, though certain groups of insects have modified one or both pairs to serve a purpose other than flying (e.g. beetles). Most insects hatch from eggs, go through several stages of growth as a larva or nymph, and may undergo **metamorphosis** before developing their adult body. Insects are the most diverse group of animals in the world.
- Examples of insects include beetles, flies, dragonflies, butterflies, moths, bees, wasps, ants, mayflies, grasshoppers, caddisflies, mosquitoes, crickets, and leaf hoppers.
- 5658 insect species confirmed, but that doesn't include thousands of species that would be here but are not yet documented.



Freshwater Fish

- Freshwater fish are **vertebrate** animals that spend the majority of their lives in fresh water, like rivers and lakes, as opposed to salt water. These fish are ray-finned, bony fish, meaning that their skeleton is made of bone (as opposed to cartilage) and their fins get their structure and support from spoke-like bones ("rays") in the fin.
- Examples of freshwater fish include trout, bass, and salmon (during their breeding season and early life).
- 49 species.



Amphibians



- Amphibians are vertebrate animals that spend part of their life living in the water, and part of their life living on land. They typically spend their early life in the water, breathing with gills, and then undergo a metamorphosis to develop lungs and other features conducive to life on land. Many amphibians also have thin skin, covered with a layer of mucous, that they can breathe through while on land!
- Examples of amphibians include frogs, toads, and salamanders.
- 16 species.



Reptiles



- Reptiles are vertebrate animals that live on land. Their exposed skin is covered in scales or **scutes** and is waterproof. Because the skin is so tough, it can't stretch as a reptile's body grows, so reptiles need to shed their skins periodically throughout their life.
- Examples of reptiles include turtles and snakes.
- 8 species (including 2 sea turtles only present offshore).





Birds

- Birds are vertebrate animals that have feathers and beaks. Their feathers and wings allow most birds to be able to fly. Birds can live in a variety of habitats, from forests to mountains to ocean, and many birds **migrate** between habitats twice a year.
- Examples of birds include chickadees, sparrows, warblers, finches, gulls, crows, hawks, owls, thrushes, ducks, geese, hummingbirds, grouses, cranes, sandpipers, and woodpeckers.
- 410 species (258 live in New Brunswick year-round or migrate to New Brunswick for part of the year; the remainder are rare vagrants that are in New Brunswick temporarily and accidentally, for example if they were blown here by a storm.)



Mammals

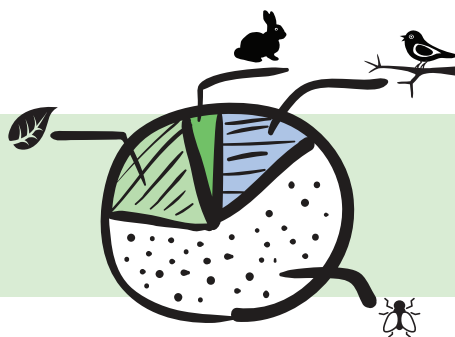
- Mammals are vertebrate animals with hair and **mammary glands**. Mammals can live on land or at sea.
- Examples of mammals include mice, rats, squirrels, bats, shrews, hares, coyotes, bobcats, foxes, raccoons, seals and whales.
- 76 species (including whales only present offshore).



ACTIVITY 1

The Wheel of Life

- Students will create a graph illustrating the biodiversity of New Brunswick and will describe how different organisms are connected.



MATERIALS



Paper, pens or pencils.

LOCATION



Indoors.

TIME REQUIRED



60 minutes.

CURRICULUM LINKS

- **Grade 10 Life Science: Sustainability of Ecosystems 318-6:** Explain how biodiversity of an ecosystem contributes to its sustainability.
- **Grade 10 Life Science: Sustainability of Ecosystems 214-1:** Describe and apply classification systems and nomenclature used in the sciences.
- **Grade 10 Life Science: Sustainability of Ecosystems 214-3:** Compile and display evidence and information, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots.
- **Biology 11 Unit 2: Biodiversity 214-2:** Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies.
- **Biology 11 Unit 2: Biodiversity 214-3:** Compile and display evidence and information, by hand or computer in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots.
- **Biology 11 Unit 2: Biodiversity 318-6:** Explain how biodiversity of an ecosystem contributes to its sustainability.

KEY TERMS

- **Taxonomic group:** a category of living things that are closely related and therefore share certain characteristics.
- **Species:** a group of organisms that is unique or different from all other groups.
- **Decomposer:** an organism that breaks down other dead or dying organisms.

BACKGROUND INFORMATION

- See section 1.1 for background info on biodiversity.
- See section 1.4 for information about biodiversity in NB.
- *The Wheel of Life* activity looks at all the kinds of organisms that are currently known in our province. It is fascinating to consider that the living things that people know best, such as plants, mammals, fish and birds, make up less than 5% of all the species estimated to live in the province!
- Few people realize that fungi (**decomposers**) and insects (consumers or decomposers) are the groups with the largest number of species. Without them, the earth would be buried deep in old leaves, dead plants, and animal carcasses. Insects and fungi, along with bacteria, break down dead plants and animals into their basic components. Like these decomposers, many other species have important, but not always obvious, roles to play in an ecosystem. *The Wheel of Life* divides these species into a pie chart to not only illustrate species diversity, but to emphasize how all organisms are connected to each other.

INSTRUCTIONS

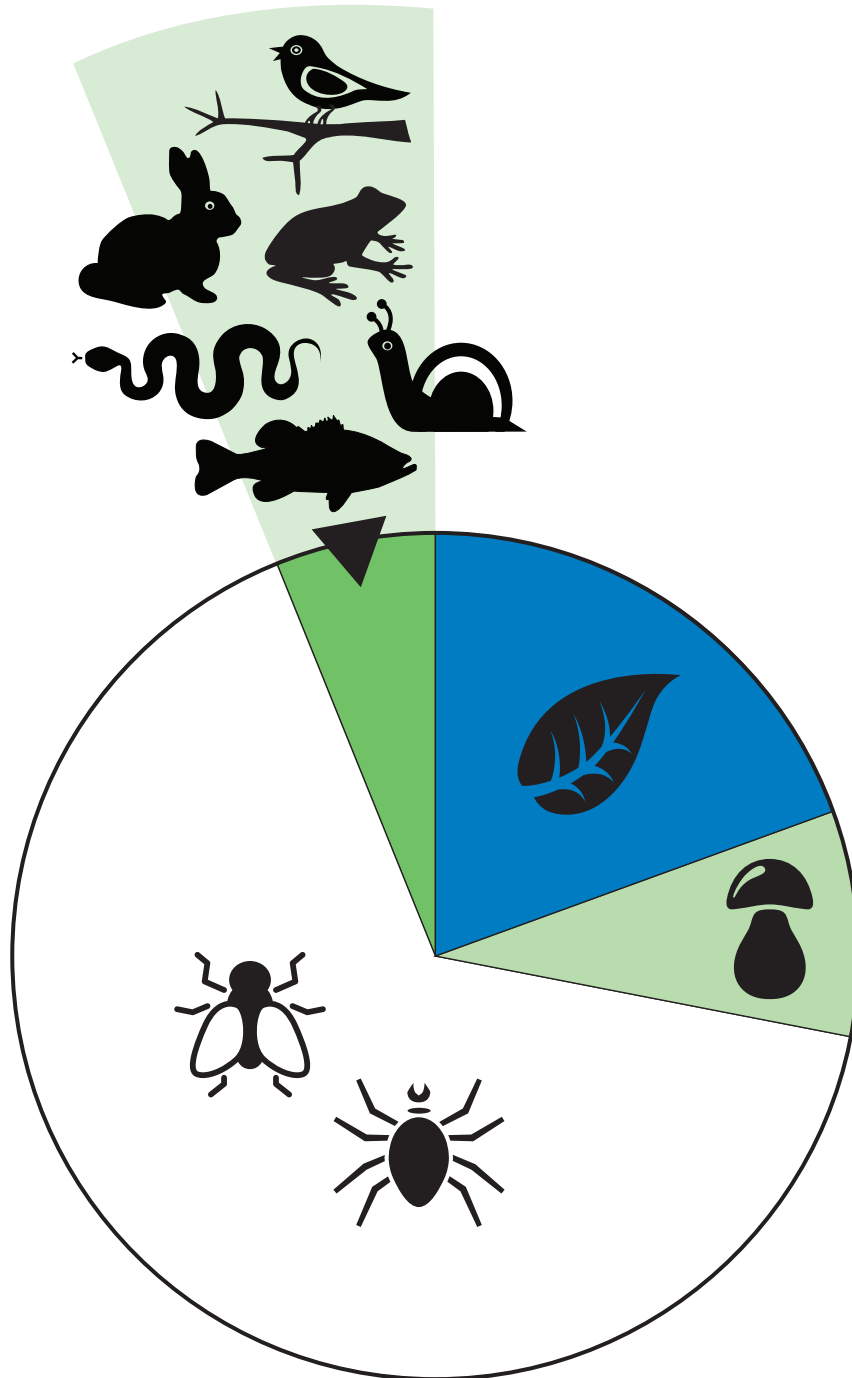
- 1 Review the concept of biodiversity using background information from section 1.1.
- 2 Explain the difference between **species** and **individuals** – for example: students are being asked how many different kinds of birds live in NB (e.g. robins, crows, blue jays = 3 species), rather than the total number of individual robins, crows, and blue jays that live in NB (many thousands!).
- 3 Explain that scientists like to put species into groups (**taxonomic groups**). Ask the students why? What are the advantages of grouping species? (e.g. naming and classifying organisms in a standardized way makes them easier to study; scientists can more easily communicate their findings and understand more about organisms through their classifications).
- 4 Ask students to brainstorm different taxonomic groups of species, and write their suggestions on the board. Then write the 10 taxonomic groups listed in section 1.4 on the board. Ask students to describe the characteristics of the different groups.

- 5** Write the number of species for each group on the board and have students create a pie chart (*The Wheel of Life*) of New Brunswick biodiversity. Explain that because of huge differences between the groups (for examples, 8 reptile species vs. 5,658 insect species), it will not be possible to draw a pie chart of the 10 groups on the board and they will need to combine some of the groups together. Have the students decide which groups they will combine; tell them not to combine randomly, but to think about the most logical way to combine these groups together.
- 6** When students have completed their charts, discuss the following questions:
- Which groups did you combine together and why? (The most logical combination: all invertebrate animals together and all vertebrate animals together).
 - What group makes up the largest percentage of organisms in New Brunswick? Why? (i.e. Why are there so many more species of invertebrates than vertebrates?)
 - We drew this as a pie chart (rather than a bar graph) as it illustrates how all biodiversity is connected. What are some ways different groups interact? If you removed a group of organisms, how would that affect the other groups? Try thinking of interactions that are not obvious (i.e. food chain).
 - What would happen if you removed plants? fungi? insects? mammals?
 - What organisms were not represented by the taxonomic groups in this activity? (Protists, bacteria.) How do these organisms factor into the web of life?

| Taxonomic Group | Number of Species | % of Species |
|-----------------|-------------------|--------------|
| Plants | 1827 | 19.50% |
| Fungi | 808 | 8.63% |
| Mollusks | 123 | 1.31% |
| Arachnids | 392 | 4.18% |
| Insects | 5658 | 60.40% |
| Freshwater fish | 49 | 0.52% |
| Amphibians | 16 | 0.17% |
| Reptiles | 8 | 0.09% |
| Birds | 410 | 4.38% |
| Mammals | 76 | 0.81% |
| Total | 9367 | |

| Group | Number of Species | % of Species |
|----------------------|-------------------|--------------|
| Plants | 1827 | 19.50% |
| Fungi | 808 | 8.63% |
| Invertebrate animals | 6173 | 65.90% |
| Vertebrate animals | 559 | 5.97% |
| Total | 9367 | |

The Wheel of Life



SECTION 2 Watching the Documentary Film

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ACTIVITY 2

Bioblitz Bingo

Note: we recommend that teachers preview this film before showing it to their class to ensure that terminology and content is appropriate for your grade level. Recommended for ages 14+.

► While watching the documentary film *Every Living Thing: Experiencing a Bioblitz*, students will play a game of Bioblitz Bingo to learn about scientific terminology used in the film.



MATERIALS



List of terms, copies of the Bioblitz Bingo Card (1 for each student or group), pencils or pens.

LOCATION



Classroom.

TIME REQUIRED



Homework; 45 minutes in classroom to watch film.

CURRICULUM LINKS

- **Grade 10 Life Science: Sustainability of Ecosystems 214-1:** Describe and apply classification systems and nomenclature used in the sciences.
- **Biology 11 Unit 2: Biodiversity 214-1:** Describe and apply classification systems and nomenclature used in the sciences.

Every Living Thing: Experiencing a Bioblitz was funded by: Echo Foundation, New Brunswick Tourism, Heritage & Culture, New Brunswick Environmental Trust Fund, New Brunswick Wildlife Trust Fund, New Brunswick Museum, and Indiegogo Crowdfunding Contributors.

INSTRUCTIONS

- 1 Before watching the documentary film *Every Living Thing: Experiencing a Bioblitz*, provide students with the following list of terms that are mentioned in the film. Either in class or as homework, have students define some or all of the terms. (Students can work in teams of 2 or 3 to divide the work and define all the terms.)

- | | | |
|--------------------------|----------------------|--------------------|
| • Natural History | • Frond | • Embryology |
| • Botany | • Fauna | • Keystone species |
| • Zoology | • Mammal | • Boreal forest |
| • Paleontology | • Academia | • Endemic species |
| • Bioblitz | • Vocation | • Larvae |
| • Biodiversity | • Mammalogy | • Predator |
| • Protected Natural Area | • Model organism | • Symbiotic |
| • Wetland | • Population ecology | • Mycelium |
| • Fungal spore | • Evolution | • GIS |
| • Camouflage | • Speciation | • Conservation |
| • Hardwood stand | | |

- 2 In class, provide each student with a copy of the **Bioblitz Bingo Card**. Ask students to use terms from the list to fill in their card.
- 3 Watch the documentary film. As terms are mentioned by scientists in the film, students can mark their bingo cards. Students are working toward the goal of getting BINGO – a full line of marked terms, either horizontally, vertically, or diagonally. Students can call out “Bingo!” when they have a full line.
- 4 To “win” the game, the student who called Bingo must be able to correctly define all the terms in their winning line.
- 5 Continue playing until the end of the film or until all terms have been defined by bingo winners.

| B | I | N | G | O |
|---|---|----------|---|---|
| | | | | |
| | | | | |
| | | Bioblitz | | |
| | | | | |
| | | | | |

ACTIVITY 3

22

Questions about key themes in the film

- After watching the documentary film *Every Living Thing: Experiencing a Bioblitz*, students will answer questions about key themes and have group discussions. This activity can be done in the classroom or as homework.

MATERIALS


Discussion question handout, pencils or pens.

LOCATION


Classroom.

TIME REQUIRED


Homework, 30-40 minute discussion in class.

CURRICULUM LINKS

- **Grade 10 Life Science: Sustainability of Ecosystems 318-6:** Explain how biodiversity of an ecosystem contributes to its sustainability.
- **Grade 10 Life Science: Sustainability of Ecosystems 118-1:** Compare the risks and benefits to society and the environment of applying scientific knowledge or introducing a new technology.
- **Biology 11 Unit 2: Biodiversity 318-6:** Explain how biodiversity of an ecosystem contributes to its sustainability.
- **Biology 11 Unit 2: Biodiversity 214-8:** Evaluate the relevance, reliability, and adequacy of data and data collection methods.

KEY TERMS

- **Biodiversity:** the wide variety of life on earth and all the ways that different living things interact with each other.
- **Bioblitz:** a fun activity that helps you find and understand the biodiversity near you by observing and recording all the living things you find in a specific area.

INSTRUCTIONS

- 1 Provide each student with a copy of the discussion question handout. Students can answer the questions as homework and then discuss their answers in class the next day, or students can be given time in class to answer the questions before a discussion.
- 2 When you are ready to begin a discussion, break students into small groups (3-4 students) and have them discuss their answers amongst the group. After 10-15 minutes of discussion, discuss the questions with the class as a whole. Ask students to share what they discussed in their groups.



About the film *Every Living Thing: Experiencing a Bioblitz*:

- 1** What is a bioblitz? Why is it important to hold a bioblitz?

- 2** What information gets collected during a bioblitz?

- 3** Who can participate in a bioblitz?

- 4** Describe the methods one of the scientists uses to collect a particular type of organism. Why is this method effective?

- 5** How do human influences, e.g. construction of highways, impact natural areas and the organisms that live there?

- 6** What can the health of an organism tell you about the health of an ecosystem?

For discussion:

- 1 What are the limitations of a bioblitz in terms of capturing all the biodiversity in an area? What are some ways that you could improve the method? (e.g. If you are surveying an area for 2 weeks, what information could be missing?)
- 2 How can the information collected during a bioblitz be used in the present?
In the future?
- 3 Why should the public learn about the biodiversity in their community?
- 4 How would you encourage other young people to develop an interest in nature?
- 5 What do you think a natural scientist does as a job?
- 6 Many scientists describe how they became interested in nature as a child, catching frogs and insects and exploring the natural world. Did you do this as a child? Describe a time when you made an exciting nature discovery.

SECTION 3 Planning your Bioblitz

3.1

Background Information

- An important step in planning your bioblitz is deciding where in your schoolyard or neighbourhood to focus your observation efforts. Do you want to survey the whole schoolyard to find out what lives there? Are there special areas in the schoolyard that might have unique organisms living there? To help you decide where to start, think about the different habitat types you might have nearby.
- **Habitat** is simply where an animal or plant lives – its home. A habitat is more than just a geographical place; it includes the food and shelter without which a species would not survive, as well as the climate to which it is adapted.
- Having access to suitable habitat is the single most important requirement for any species, including humans. Generally we think of habitat as being made up of four main components: **food**, **water**, **shelter**, and **space**. It is important to note that these components must be arranged properly and be available in large enough quantities to support a species. For instance, many animals need food that is in close proximity to their shelter, to reduce their exposure to predation or severe weather.
- The idea of food, water, shelter, and space may be easier to apply to animals, but it does apply to plants as well. For example, does a plant obtain its energy or ‘food’ from the sun, or does it rely on another plant or fungus to provide nutrients? Does the plant grow on well-drained dry soils, or does it occupy wet areas such as marshes, wetlands or shorelines? With regard to shelter, does the plant live under the protection of a canopy of trees or does it grow in exposed areas? Does it live on north-facing slopes, to avoid full sunlight?
- What makes a “good” habitat varies from species to species, and the needs of a species may change according to its maturity or the season. One thing remains constant: if an organism does not have access to the right habitat, in the right arrangement, and in large enough quantities, it simply will not survive.
- The type of habitat available in an area can often help predict the kind of organisms that will live there. For example, if you have a pond in your schoolyard, you would expect to find organisms that love wet habitats, like frogs or cattails. Understanding the different types of habitats present in your schoolyard will help you be able to predict the kind of organisms you might find there, as well as the number of organisms that might be able to live there.

ACTIVITY 4

3.2

Map the schoolyard

- Students will create a map of the schoolyard and outline different habitat types present in the yard. Students will make predictions about what kind of organisms live in these habitat types and what they might find during their bioblitz.

MATERIALS


Paper, pens or pencils, clipboards, compass (optional), ruler/metre stick/measuring tape (optional).

LOCATION


In-class and outdoors in the schoolyard or neighbourhood.

TIME REQUIRED


45 minutes.

CURRICULUM LINKS

- **Grade 10 Life Science: Sustainability of Ecosystems 212-4:** State a prediction and a hypothesis based on available evidence and background information.

KEY TERMS

- **Bioblitz:** a fun activity that helps you find and understand the biodiversity near you by observing and recording all the living things you find in a specific area.
- **Habitat:** where an animal or plant lives, including the food and shelter it needs to survive and the climate to which it is adapted.
- **Resource:** an object or substance that a living thing needs to survive.

BACKGROUND INFORMATION

- The first step in planning your bioblitz is deciding where in the schoolyard you will focus your observation efforts. Do you want to survey the whole schoolyard to find out what lives there? Are there special areas in the schoolyard that might have unique organisms living there? To help you decide where to start, think about the different habitat types you might have in the schoolyard.
- See section 3.1 on habitat.



INSTRUCTIONS

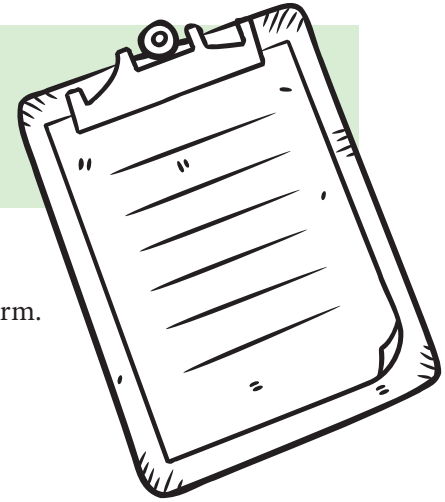
- 1** Explain to students that they will be investigating the different habitat types present in the school yard, and discuss the background information with them.
- 2** Tell students that they are going to be making a map of the schoolyard and the different habitats that can be found there. Students will be going into the schoolyard, observing the features of the land, and drawing a map that corresponds to the layout of the schoolyard. Students can work individually or as a group. Students can be given the option to do this in the neighbourhood instead of the school yard, particularly if the school is located in an urban environment. Choose a location nearby that you can visit as a class. (But don't discount an urban environment – there might be more biodiversity there than you think!)
- 3** Give students a blank sheet of paper, a pencil, and a clipboard or other writing surface that can be used outside.
- 4** Before going outside, discuss and decide as a class what features will be important for students to include on their maps. Does the map need to be to scale, and what should the scale be? Does the map need to include or be accurate to compass direction? Do you want to include man-made features on the map? How should you record things like trees, water, etc.? These details will be important in determining what types of habitat are present in the school yard. Students can include a scale bar and take measurements to draw their map as closely to scale as possible. Challenge students to include other environmental features, such as topography.
- 5** Go outside with your class! Give them a set amount of time (30-40 minutes; one period) to make observations in the yard and record the details on their maps. If students need more time to detail their maps, have them complete the exercise as homework.
- 6** If students mapped different sections of the schoolyard, have them present their maps to the class. How are the different areas similar or different to each other? Can the students identify any distinct habitat types? Ask students to predict different plant and animal species that might live in each area.
- 7** Ask students to decide whether they should conduct their bioblitz in a specific location or whether they should survey the entire schoolyard area. As a class, discuss the advantages and disadvantages for each option. (Older students might find it interesting to survey two different areas and compare their results afterward.)

ACTIVITY 5

3.3

Plan collection method for different taxonomic groups

- Students will learn about different ways to collect data, and will make a plan to collect information during their bioblitz.


MATERIALS


Paper, pencils or pens, brainstorming worksheet, example data collection form.

LOCATION


In the classroom.

TIME REQUIRED


30 minutes.

CURRICULUM LINKS

- **Grade 10 Life Science: Sustainability of Ecosystems 214-3:** Compile and display evidence and information, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots.
- **Grade 10 Life Science: Sustainability of Ecosystems 215-1:** Communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others.
- **Biology 11 Unit 2: Biodiversity 214-8:** Evaluate the relevance, reliability, and adequacy of data and data collection methods.
- **Biology 11 Unit 2: Biodiversity 214-10:** Identify and explain sources of error and uncertainty in measurement and express results in a form that acknowledges the degree of uncertainty.
- **Biology 11 Unit 2: Biodiversity 215-1:** Communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others.

KEY TERMS

- **Bioblitz:** a fun activity that helps you find and understand the biodiversity near you by observing and recording all the living things you find in a specific area.
- **Observation:** data or information that you collect and record while observing something (using your senses to gather information).
- **Organism:** an individual living thing.
- **Taxonomic group:** a category of living things that are closely related and therefore share certain characteristics.

BACKGROUND INFORMATION

- During a bioblitz, scientists collect detailed observations about the organisms they find in an area. Detailed information about the organism and where it was found can help scientists identify the organism and learn more about it. It's not always possible for a scientist to find an organism over and over again to make observations about it (especially if they are observing a mobile organism, like a bird or insect), so it's important for them to write down as much information as possible while they are in the field!

INSTRUCTIONS

- 1 Give students a blank sheet of paper and ask them to sit at their desks. Explain to them that for the next 5 minutes, they will be making observations about their surroundings, and they should write down anything they observe. Students can make observations about anything (e.g. what they see, what they hear, what they smell).
- 2 Start a timer and let the students make their observations.
- 3 When the 5 minute observation period is over, ask students to share a few of their observations. Discuss with students the level of detail used in their observations, and discuss ways that they could record more identifying details about something they observed (e.g. if you observed a desk, what colour was it? How tall is it? Where is it located relative to other desks?).
- 4 Explain to students that scientists use these observation skills when they are recording information during a bioblitz. Scientists need to record as much information as they can about an organism when they find it in its natural habitat. Now that students have tested their observation skills inside the classroom, they are going to think about what they should observe while doing their bioblitz in the schoolyard.

- 5 Divide the class into small groups. Give each group a copy of the brainstorming worksheet and select one of the following taxonomic groups for them to focus on: Plants, Fungi, Mollusks, Arachnids, Insects, Fish, Amphibians, Reptiles, Birds, Mammals (see section 1.4). Walk through the questions on the worksheet with the class and use an example to help them understand what they are being asked to do, e.g.:
 - Taxonomic group: *Furniture*.
 - Give 3 example organisms for your group: *Desk, chair, bookshelf*.
 - What are some important identifying features that you should record about these organisms? *Colour, dimensions, material*.
 - What are some important features of their habitat that you should record? *Type of room it is found in, exact location in room*.
 - What senses should you use to record these things? *Sight, touch*.
 - Are there any other tools that you could use to record these things? *Ruler, measuring tape*.
- 6 Give students 10 minutes to brainstorm and record their ideas on the worksheet. When students are finished, ask each group to present their ideas and ask students if they have additional suggestions. Remind students that the ideas they have presented are going to be things that they will actually be recording in the schoolyard during the bioblitz – if necessary, ask them to help you decide which of their ideas are actually feasible to collect. Decide together which features will be most important to record in the schoolyard.
- 7 Explain to students that scientists prepare forms for themselves to take into their study area, to help them collect all the information they need. Show them the example data form included here. You can use these forms during your bioblitz, or you can ask students to create their own (next step).
- 8 **OPTIONAL** Ask students to return to their groups. After showing them the example data sheet, ask them to design one for their taxonomic group that includes all the important information they decided will be important to collect during the bioblitz.

3.3

BRAINSTORMING WORKSHEET

Group members:

Taxonomic group (Circle one):

Plants
Fungi
Mollusks
Arachnids

Insects
Fish
Amphibians
Reptiles

Birds
Mammals

Give 3 example organisms in your taxonomic group:

Describe your taxonomic group.
How is it similar or different from other taxonomic groups?

BRAINSTORMING WORKSHEET Continued

3.3

What are some important identifying features that you should record about these organisms?

What are some important features of their habitat that you should record?

What tools could you use to record this data in the field?

3.3

EXAMPLE DATA COLLECTION FORM

| |
|---------------------------|
| Taxonomic Group |
| Date |
| Observers (student names) |

| | | |
|---------------------------------------|---------------------------------|-------------------------------|
| | At the start of the Bioblitz | At the end of the Bioblitz |
| Time | _____ | _____ |
| Temp (°C) | _____ | _____ |
| Cloudy? (yes or no) | _____ | _____ |
| Windy? (yes or no) | _____ | _____ |
| Precipitation? (yes or no, what type) | _____ | _____ |

Record all the different living things that you find in your sample area that are part of your Taxonomic Group.

If you don't know its name, describe its features or draw a sketch.

| Name, description, and/or sketch | Number Found |
|----------------------------------|--------------|
| | |

SECTION 4 Conducting your Bioblitz

ACTIVITY 6

4.1

Conducting your Bioblitz

- Students will observe organisms in their school yard and record their observations.

MATERIALS



Clipboards, pen or pencil, copies of data sheet, specimen jars, magnifying glass, ruler, flagging tape. Optional: binoculars, insect nets, device with *iNaturalist*.

LOCATION



Outside in school yard or neighbourhood.

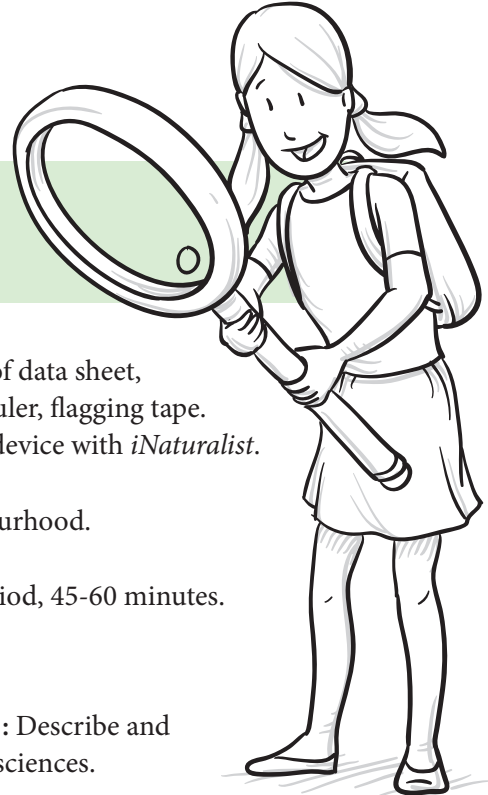
TIME REQUIRED



As much as possible – 1 whole period, 45-60 minutes.

CURRICULUM LINKS

- **Grade 10 Life Science: Sustainability of Ecosystems 214-1:** Describe and apply classification systems and nomenclature used in the sciences.
- **Grade 10 Life Science: Sustainability of Ecosystems 214-3:** Compile and display evidence and information, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots.
- **Biology 11 Unit 2: Biodiversity 213-8:** Select and use apparatus and materials safely
- **Biology 11 Unit 2: Biodiversity 214-1:** Describe and apply classification systems and nomenclature used in the sciences.
- **Biology 11 Unit 2: Biodiversity 215-1:** Communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others.
- **Biology 11 Unit 2: Biodiversity 215-2:** Select and use appropriate numeric, symbolic, graphical, and linguistic modes of representation to communicate ideas, plans, and results.
- **Biology 11 Unit 2: Biodiversity 316-5:** Use organisms found in a local or regional ecosystem to demonstrate an understanding of fundamental principles of taxonomy.
- **Biology 11 Unit 2: Biodiversity 316-6:** Describe the anatomy and physiology of a representative organism from each kingdom, as well as from a representative virus.



KEY TERMS

- **Bioblitz:** a fun activity that helps you find and understand the biodiversity near you by observing and recording all the living things you find in a specific area.
- **Taxonomic group:** a category of living things that are closely related and therefore share certain characteristics.
- **Organism:** an individual living thing.
- **Observation:** data or information that you collect and record while observing something (using your senses to gather information).

BACKGROUND INFORMATION

- For complete, detailed information on planning and executing a full-scale Bioblitz: http://bioblitzcanada.ca/project_bioblitz-in-a-box.aspx.
- If your classroom is equipped with mobile devices such as laptops or iPads, you might want to consider using a website and App called *iNaturalist*. Using *iNaturalist* is optional, but it can be an excellent resource to have on-hand during the bioblitz. When you take a picture in *iNaturalist* on an iOS device, *iNaturalist* will suggest possible identifications for the organism in the photo. This can help students make correct identifications, in real time. For more information: <https://www.inaturalist.org>.

INSTRUCTIONS

- 1 Before the activity, decide on the area of the schoolyard where you will be making observations with your class. You can mark the area with flag tape or pylons if necessary.
- 2 Prepare your supplies and have them ready for students to grab on their way outside. Each group of students will need: a clipboard, pen or pencil, copy of data sheet, specimen jar, magnifying glass, ruler. Optional: binoculars, insect nets.
- 3 Divide students into groups or teams of 2-3 students. Each group will be responsible for collecting information about one taxonomic group (Plants, Fungi, Mollusks, Arachnids, Insects, Fish, Amphibians, Reptiles, Birds, Mammals). If you don't expect to see some of these taxonomic groups in your area (e.g. Fish), you can partition other taxonomic groups into subgroups to replace them (e.g. Plants can be subdivided into Trees, Flowers, Ferns, Grasses, Shrubs, etc.).

Note: For guaranteed observation success, these groups will be found easily in your schoolyard:

- **Plants** (trees, flowers, grasses, shrubs)
If your schoolyard is particularly plant-heavy, you can break this assignment into smaller groups (Trees, Flowers, etc.) to make it easier for students to make observations.
- **Fungi** (mushrooms)
- **Mollusks** (slugs, snails)

- **Arachnids** (spiders)
 - **Insects** (flies, bees, ants, butterflies, grasshoppers, beetles)
 - **Birds** (crows, starlings, robins, gulls)
- 4 Explain to students that you are about to go outside to start your bioblitz! Each group of students will be responsible for collecting information about the taxonomic group they were assigned. For example, if a group is focusing on Trees, they will need to find, observe, and record all the trees they can! Every observation counts – if you see the same kind of organism 5 times, record that you saw it 5 times (e.g. “5 dandelions, 1 rose, 13 daisies”, not “dandelions, roses, daisies”). A **tally** would be useful here.
 - 5 Show students the data collection sheet that they will be using and make sure they understand how to use it. An example sheet is included here; feel free to make your own or have students make their own as per Activity 3.3. Explain how other materials (rulers, magnifying glasses, etc.) could be useful to help them collect information.
 - 6 Remind students that there are lots of jobs to do within their group! These jobs can include discovering organisms, making and describing observations, taking measurements, taking photos, writing/recording information on a data sheet. Each student can take on a specific role or students can rotate through the different roles.
 - 7 Take your students outside and let them explore! This is the main event, so let students explore for as long as your schedule allows. Encourage students to take lots of notes and photos to help them identify organisms. Students don’t need to identify organisms now if they aren’t able to – with the help of their field notes, they can do this later using extra resources like textbooks, field guides, or online identification guides. The level of observation detail students should focus on is up to you and the goals you need to meet with your curricula.
 - 8 **OPTIONAL** During the bioblitz, students can use flag tape to mark any objects that they think are interesting and want to show the rest of the class. During the final 10-15 minutes of your bioblitz, ask students to come together again, and as a class you can take a tour of all the interesting things students flagged.

Variations

- Consider repeating this activity the next day and comparing what was found on Day 1 vs Day 2. You could also repeat the activity at a different time of day, in different weather conditions, or at a different time of year. .
-
- Stretch the Bioblitz out over several days. Instead of splitting the class into small groups, have the whole class survey for a single taxonomic group each day. For example, Monday is a bird survey, Tuesday is an insect survey, Wednesday is a plant survey, etc. This setup is ideal if you have short periods (≤ 60 minutes) and/or if you want to explore and discuss different taxonomic groups in detail.

SECTION 5 Investigating your findings

ACTIVITY 7

5.1

Visualizing results of the Bioblitz

► In this section, students will categorize and identify organisms they found during their bioblitz. Then students will create graphs to help them visualize the results of their bioblitz. Finish with discussion questions.

MATERIALS



Observations from bioblitz, paper and pencils, field guides or internet resources.

LOCATION

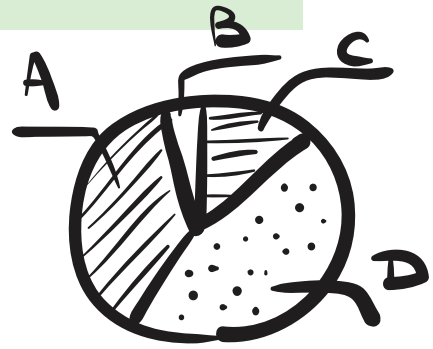


In the classroom.

TIME REQUIRED



60 minutes.



CURRICULUM LINKS

- **Grade 10 Life Science: Sustainability of Ecosystems 318-6:** Explain how biodiversity of an ecosystem contributes to its sustainability.
- **Grade 10 Life Science: Sustainability of Ecosystems 214-1:** Describe and apply classification systems and nomenclature used in the sciences.
- **Grade 10 Life Science: Sustainability of Ecosystems 214-3:** Compile and display evidence and information, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots.
- **Biology 11 Unit 2: Biodiversity 214-1:** Describe and apply classification systems and nomenclature used in the sciences.
- **Biology 11 Unit 2: Biodiversity 214-2:** Identify limitations of a given classification system and identify alternative ways of classifying to accommodate anomalies.
- **Biology 11 Unit 2: Biodiversity 214-3:** Compile and display evidence and information, by hand or computer in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots.
- **Biology 11 Unit 2: Biodiversity 214-10:** Identify and explain sources of error and uncertainty in measurement and express results in a form that acknowledges the degree of uncertainty.
- **Biology 11 Unit 2: Biodiversity 215-3:** Synthesize information from multiple sources or from complex and lengthy texts and make inferences based on this information.
- **Biology 11 Unit 2: Biodiversity 313-1:** Analyze and explain the life cycle of a representative organism from each kingdom, as well as of a representative virus.

- **Biology 11 Unit 2: Biodiversity 316-4:** Outline evidence and arguments pertaining to the origin, development, and diversity of living organisms on Earth.
- **Biology 11 Unit 2: Biodiversity 316-5:** Use organisms found in a local or regional ecosystem to demonstrate an understanding of fundamental principles of taxonomy.
- **Biology 11 Unit 2: Biodiversity 316-6:** Describe the anatomy and physiology of a representative organism from each kingdom, as well as from a representative virus.
- **Biology 11 Unit 2: Biodiversity 318-6:** Explain how biodiversity of an ecosystem contributes to its sustainability.

KEY TERMS

- **Organism:** an individual living thing.
- **Species:** a group of organisms that is unique or different from all other groups.
- **Ecosystem:** a community of organisms (living things) that interact with each other and depend on each other.
- **Taxonomic group:** a category of living things that are closely related and therefore share certain characteristics.

BACKGROUND INFORMATION

- Now that bioblitz observations in the schoolyard are complete, students will need to synthesize this information to get an idea of the “big picture” biodiversity in the schoolyard. This biodiversity can be represented in two ways: the number of individual organisms in the area, and the number of species in the area.
- An individual organism is just that – one thing. One student in a classroom, one dandelion on a lawn, one bird in the sky. Knowing how many individual organisms are in an area tells us how much life the area can support. Your schoolyard might be able to support five organisms, or 100, or 5000, or more!
- But it’s also important to know what *kind* of life your schoolyard can support. Different organisms rely on others to help them survive, and knowing which ones are living in your schoolyard can help you understand what organisms live there and why, and how those organisms interact with each other in the ecosystem.
- Scientists have developed rules to help them organize individual organisms into groups, based on their similarities and differences. These groups are called “taxonomic groups” (Domain, Kingdom, Phylum, Class, Order, Family, Genus, and Species). At each level of organization, the similarities and differences between organisms becomes more specific. A species is a group of organisms that is unique/different from all other groups.
- It is often difficult to identify different species from observations alone. Many scientists rely on DNA information to be able to separate groups of organisms at that level. Students certainly aren’t expected to be able to identify their observations to the species level, but encourage them throughout these activities to think carefully about the similarities and differences between organisms they found in the schoolyard.

INSTRUCTIONS

A) Total number of individual organisms in the schoolyard

- 1 Divide students into groups. Let students work with the same group as they did during the bioblitz activity.
- 2 Have each group count the number of observations they made, and record this number as “total number of individuals” (e.g. 5 dandelions, 1 rose, 13 daisies = 19 flowers, not dandelions, roses, daisies = 3 flowers).
- 3 Draw axes for a graph on the board. The Y-axis is for the number of individual organisms observed in the school yard
The X-axis is for the taxonomic groups that students observed in the school yard.
- 4 Ask one student from each group to come to the board, write their group’s organism type along the X-axis, and mark the number of individuals that the group observed. Continue taking turns until all the groups are represented on the graph.
- 5 Have a quick discussion with the class about the graph – how many total individuals were observed? Add groups together – how many animals were observed? Plants?



B) Total number of species in the schoolyard

- 1 Students will repeat the activity, but with the number of species observed instead of the number of individuals.
- 2 Students may or may not have been able to identify species as they were making observations during the bioblitz. Ask students to take a quick inventory of their observations and mark which observations have and have not been identified. If you used *iNaturalist* during your bioblitz, most of this identification work has already been done for you!
 - You can decide what level of identification is appropriate for your class – is “butterfly” an acceptable identification, or would “monarch butterfly” be better?
- 3 Give students some time to identify any unidentified organisms, using online resources or field guides. Many of the organisms in the same taxonomic group will have similarities, so encourage students to think about how the different organisms they found are different from each other. Challenge students to divide the organisms they found into categories, based on these differences. Students can focus on size, shape, and colour of the organisms, and maybe other identifying features such as number of limbs, antenna, visible patterns, etc. Some organisms will be easier to identify than others, so students who finish quickly can help other students with any challenging identifications.

- **Note:** It's okay if students aren't able to specifically identify all the species they find! The main idea here is to get them to notice the similarities and differences between organisms. If students notice unique groups like "pink flowers with 4 petals" and "pink flowers with 5 petals", these can count as "species".
- 4 When students are finished identifying all their organisms, have each group count the number of individual species they found (e.g. 5 dandelions, 1 rose, 13 daisies = 3 species of flowers).
 - 5 Repeat the graphing activity, with the Y-axis representing the number of species observed. You can do this as a separate graph or as a second set of data on the same graph.

C) Discussion questions

- 1 How many different species were found?
- 2 Compare the number of species found for each taxonomic group to the number of individuals found in each taxonomic group.
- 3 Where in the schoolyard were the different species found? Why?
- 4 Do any species live closely together?
- 5 Do you think you missed anything when you were collecting your data in the schoolyard? Why?
- 6 What aspects of the bioblitz were easy? Challenging?
- 7 What do you think you would observe if you repeated this activity in a different season? At a different time of day?

Variations/Extensions

- Compare the number of species found in the schoolyard, per taxonomic group, to the number of species estimated to live in New Brunswick (see section 1.4).
-
- As a follow-up to Activity 2, *The Wheel of Life* (section 1.5), make a pie chart of the same taxonomic groups, but using the number of species found during your schoolyard bioblitz. How does your pie chart differ and why? (For example, there are probably fewer insects/invertebrates because they are small and hard to see or find).

SECTION 6 Learning about Careers in Science

ACTIVITY 8

6.1

Careers in Science

- Students will think about different careers that have a background in natural science, and will use profiles of real science professionals to compare and contrast possible careers.

MATERIALS



Pens and paper, copies of Career Profiles.

LOCATION



In the classroom.

TIME REQUIRED



45 minutes.



CURRICULUM LINKS

- **Grade 9 and 10 Personal Development and Career Planning 3.3:** Evaluate life/work information.
- **Grades 7-9 Science 427:** Consider many career possibilities in science- and technology-related fields.
- **Grades 10-12 Science 441:** Consider further studies and careers in science- and technology-related fields.
- **Biology 11 and 12:** During the progression of Biology 11 & 12, it is appropriate to make students aware of the career opportunities that exist in various areas of this science.

BACKGROUND INFORMATION

- The scientists featured in the documentary film *Every Living Thing: Experiencing a Bioblitz* come from a wide variety of educational and professional backgrounds. A background in the natural sciences can lead to careers in many different sectors or industries. The following activity aims to highlight the range of career options available to students with an interest in natural science. The activity includes career profiles of science professionals who live and work in New Brunswick.

INSTRUCTIONS

- 1 As a class, ask students to brainstorm careers in natural science. Write suggestions on the board as students make them. If students have watched the documentary film, encourage them to think about the different careers held by scientists in the film.

6.1

Continued

- 2 After the brainstorming session, introduce students to the career profiles included in this kit (see Appendix). Read the job titles and compare them to the list on the board; add them if they are not already present. Ask students why they did or did not think to include this career in their list.
- 3 Assign each student in your class one of the careers. Ask students to do some preliminary research on the career, answering these questions:
 - What do you think are typical job duties?
 - In what context do you think this job is done (i.e. in an office, in a lab, etc.)?
 - What are the qualifications for the job (education and experience)?
 - Based on your research, what do you think the salary might be for this job?
 - **OPTIONAL** Pair students who researched the same career, and ask them to compare the results of their research. How are their answers similar or different? Allow time for each pair to discuss for a few minutes.
- 4 When students are finished with their independent research, hand out copies of each career profile. Ask students to compare and contrast their research with the information provided in the career profile. Students can use the following questions as prompts:
 - Are the job duties for this career different than your expectations? Why or why not?
 - Does this career require more or less education and training than you expected?
 - Which seems more important to be able to do the job, formal education or on-the-job training/experience? Why?
 - Is the salary for this job what you expected? What are some factors that might influence salary?
 - What other aspects of the career profile are surprising or interesting to you?
- 5 As a class, go over the details of each career profile and compare the different aspects of each career. Careers in this field are very diverse, and you will find lots to discuss when comparing them! Discuss some of the following questions with the class:
 - Which careers are in the private sector? Public sector? Explore other aspects of employers – which are government? Not-for-profit? Industry?
 - Which career has the highest salary? What factors influence that salary (e.g. seniority, level of education, etc.)?
 - How do contract positions differ from full-time positions?
 - Are any of the job duties similar?
 - Are any of the job challenges similar?
 - Do you think the people profiled here enjoy their jobs?

Variations

- Students can do their career research in groups. In step 3, divide students into groups and assign each group a different career. Let the group work together to answer the research questions, and continue working in groups for the rest of the activity. Each group could present their career profile to the rest of the class.
- Ask students to write a list of things that are important to them in their life and career (e.g. flexible hours, travel, continuous learning, collaboration, etc.). Give students copies of all the career profiles and ask them to find careers that meet some or all of the students' criteria. Discuss how careers in science can be varied and can suit a variety of interests!

APPENDIX 1 Career Profiles

A1

Arielle DeMerchant

Wetland Biologist

EMPLOYER

Department of Environment & Local Government, Government of New Brunswick

LENGTH OF TIME EMPLOYED IN THIS POSITION

Two years

TYPE OF EMPLOYMENT

Full-time permanent

LEVEL OF EMPLOYMENT

Professional

AVERAGE YEARLY SALARY FOR THIS POSITION (RANGE)

\$47,000-65,000

IS THIS POSITION SALARIED, HOURLY, OR OTHER?

Salaried

HOURS WORKED IN A TYPICAL WORK WEEK

Monday-Friday, 8:15-4:30, but often later if doing field work.

DESCRIPTION OF A TYPICAL WORK DAY AND/OR WORK WEEK

During a typical work week, I receive several applications for Watercourse and Wetland Alteration (WAWA) permits. This means people are applying to do work in a wetland or brook or lake. I review the wetland applications and often go to look at the sites in person. Sometimes I have to go analyze the wetland to see how big it is and where it ends and begins.

OTHER DUTIES

Meeting with communities, students and others to teach them about wetlands.



EDUCATION OR TRAINING REQUIRED FOR THIS POSITION

At least a science degree from a university and a wetland delineation training course.

BRIEF DESCRIPTION OF YOUR CAREER PATH

I obtained a Bachelor of Science in environment and natural resources and then a Masters in Environmental Management. I worked at GNB's Department of Natural Resources in various contract jobs as biologist before moving to Department of Environment.

FAVOURITE ASPECTS OF YOUR JOB

Getting to work outside!

CHALLENGES OF YOUR JOB

People often get upset when they do not get the permits to do the work they want in a wetland. Delivering this information can be challenging.

HOW DO YOU MAINTAIN WORK/LIFE BALANCE?

I try to avoid working on weekends unless there is an emergency that requires it.

Douglas Campbell

Canada Research Chair in Phytoplankton Ecophysiology

EMPLOYER

Mount Allison University

LENGTH OF TIME EMPLOYED IN THIS POSITION

17 years

TYPE OF EMPLOYMENT

Full Time

LEVEL OF EMPLOYMENT

Professional

AVERAGE YEARLY SALARY FOR THIS POSITION (RANGE)

\$130,000-160,000

IS THIS POSITION SALARIED, HOURLY, OR OTHER?

Salaried, plus some consulting fees.

HOURS WORKED IN A TYPICAL WORK WEEK

~50 h/wk, flextime (few fixed hours, lots of long days).

DESCRIPTION OF A TYPICAL WORK DAY AND/OR WORK WEEK

Most mornings I spend about an hour from 8-9 am answering email questions from colleagues around the world about their research. Then I meet for 2-3 h with students and researchers to review and plan our experiments and data analyses. Most days I spend 2-3 h doing some computer-based data analyses, or work on a publication of our own research work.

Most weeks I spend about 2 h reading and assessing a scientific manuscript by somebody else to determine if it is worth publishing. I also write proposals and reports for funding the projects we do. Some weeks I spend in the lab or the field doing measurements myself, but more often I am training someone else to do the measurements with my help.



About once a month I give a presentation or seminar to a research group, or a citizen's group, or a scientific conference. I spend about 1-2 months a year travelling internationally, and have worked in about 20 countries so far.

OTHER DUTIES

Designing experiments and assembling or developing the instruments to do the work. Writing computer scripts to analyze data, to help understand our experiments. Writing reference letters to help people get positions.

EDUCATION OR TRAINING REQUIRED FOR THIS POSITION

Ph.D. followed by international post-doctoral research experience. I got the CRC when I was 36, 18 years after I finished high school.

BRIEF DESCRIPTION OF YOUR CAREER PATH

I worked as a musician to save money for university, while taking as many math and science courses as I could at Memorial High School, Sydney Mines, NS. I did a B.Sc. in

Continued

Biology at Acadia University, and got my first science job with the National Research Council in Saskatoon. There I met my wife, who was a scientist working in the next lab (now she is the Dean of Science at Mount Allison). Then I did a Ph.D. in Plant Science at the University of Western Ontario. I won a fellowship to learn molecular biology at a Marine Biology Laboratory in Massachusetts, and then moved to Paris, to learn microbiology at the Institut Pasteur for 2 years. Then I got a research position in northern Sweden for 3 years, where my first daughter was born. We moved back to Canada and I started at Mount Allison University, and won a national competition for a Canada Research Chair in 2001. Along the way we started a spin-off company, Environmental Proteomics, that designs and makes molecular systems for measuring processes in the environment. Over that time I worked on many scientific questions, mostly about how photosynthetic organisms grow in variable environments. My current work is mainly on phytoplankton

– tiny floating organisms that support life in the oceans. I have worked with about 100 students and junior researchers so far, and have collaborations around the world, with people coming and going from the lab each month.

For the past 4 years I have been working to improve my coding skills, to analyze large data sets.

FAVOURITE ASPECTS OF YOUR JOB

Figuring out scientific questions, working with other researchers.

CHALLENGES OF YOUR JOB

Deciding what good thing to do next. Each morning I get asked to do a weeks worth of work, and need to decide what to pursue. Communicating difficult concepts to diverse people.

HOW DO YOU MAINTAIN WORK/LIFE BALANCE?

I have 3 sled dogs that need exercise every day, and most days I leave work by ~4 pm to take them out. I used to play in rock bands, and aim to pick that up again.

Ian Smith

Parks NB Program Manager



EMPLOYER

Government of NB,
Parks and Attractions Branch

LENGTH OF TIME EMPLOYED IN THIS POSITION

Parks NB: 15 years

TYPE OF EMPLOYMENT

Full Time

LEVEL OF EMPLOYMENT

Program Manager

AVERAGE YEARLY SALARY FOR THIS POSITION (RANGE)

\$40,000-60,000

IS THIS POSITION SALARIED, HOURLY, OR OTHER?

Salaried

HOURS WORKED IN A TYPICAL WORK WEEK

40-50 hours per week, frequent weekends and evenings.

DESCRIPTION OF A TYPICAL WORK DAY AND/OR WORK WEEK

½ day office work, ½ day program delivery/ outreach/community building.

EDUCATION OR TRAINING REQUIRED FOR THIS POSITION

Bachelor level education, bilingual, background in interpretation, facilitation, outdoor education.

BRIEF DESCRIPTION OF YOUR CAREER PATH

40+ years of outdoor education including: youth corrections, Outward Bound Instructor and First Nation Youth Counsellor leading to Parks NB Employment.

FAVOURITE ASPECTS OF YOUR JOB

Facilitating Outdoor Education Programs.

CHALLENGES OF YOUR JOB

Managing the bureaucratic components of the job.

HOW DO YOU MAINTAIN WORK/LIFE BALANCE?

Lots of outdoor time alone and shared with others especially family and dogs allowing for time to just be. ☺

Julie Reimer

Education Specialist

EMPLOYER

Ducks Unlimited Canada

LENGTH OF TIME EMPLOYED IN THIS POSITION

5 months

TYPE OF EMPLOYMENT

Contract

LEVEL OF EMPLOYMENT

Regional coordinator (somewhere between managerial and entry-level).

AVERAGE YEARLY SALARY FOR THIS POSITION (RANGE)

\$35,000-45,000

IS THIS POSITION SALARIED, HOURLY, OR OTHER?

Salaried

HOURS WORKED IN A TYPICAL WORK WEEK

Monday-Friday, 8:30-4:30, plus overtime and travel as required.

DESCRIPTION OF A TYPICAL WORK DAY AND/OR WORK WEEK

Delivering education programs to school classes, daycares, and youth groups; writing funding proposals and reports; developing new education programs and action projects; coordinating programs and partner organizations.

OTHER DUTIES

Data tracking, budget tracking, basic administration.

EDUCATION OR TRAINING REQUIRED FOR THIS POSITION

Bachelor's degree in environmental field (i.e., biology, environmental science, environmental management); knowledge of local flora and fauna; experience interpreting nature for the public; teaching experience; comfort in public speaking; experience in report writing; bilingualism.

BRIEF DESCRIPTION OF YOUR CAREER PATH

I have completed a Bachelor of Science (Honours) in Biology and a Master of Marine Management. I have held many positions, all of which have been contracts of 1 year or shorter in duration. There have been times in my career where I have had to step away from the environmental sector for work, but have found myself more engaged and passionate about my work when it is in this field. I have conducted research in whale conservation, while concurrently holding several teaching assistant positions for university classes. I've worked two seasons for a whale watching company, developing my skills in nature interpretation and delivering exciting nature information to a wide range of audiences. In my current position, I draw from skills developed through my education and my work experience on a daily basis. Each position I have held has provided some value to my current role.

FAVOURITE ASPECTS OF YOUR JOB

Watching young people connect with nature and having the opportunity to support organizations that want to do amazing and ambitious action projects!

CHALLENGES OF YOUR JOB

I have a large portfolio for one staff member, so it can be overwhelming! It can be challenging to feel that you're making headway every day, but staying positive and organized helps!

HOW DO YOU MAINTAIN WORK/LIFE BALANCE?

Your early career is a lot of work! I'm constantly looking to the future and what I will be doing at the end of this contract. It's important to plan ahead, and build this into your work/life balance. I've learned from a lot of jobs that it is important to have boundaries about when your work day ends and begins, but have found that when you love your job these boundaries get blurred. I always find time for myself in a day, even if it's just 20 minutes, and time for my family. Each day I try to further my work, my career, and my personal life by just a tiny bit!



A1

Continued

Karen Vanderwolf

Bat Conservation Specialist

EMPLOYER

Canadian Wildlife Federation

LENGTH OF TIME EMPLOYED IN THIS POSITION

5 years

TYPE OF EMPLOYMENT

Contract

LEVEL OF EMPLOYMENT

Independent contractor

AVERAGE YEARLY SALARY FOR THIS POSITION (RANGE)

~\$40,000

IS THIS POSITION SALARIED, HOURLY, OR OTHER?

Salaried

HOURS WORKED IN A TYPICAL WORK WEEK

Monday-Friday, 9:30am-5:30pm, some evening work.

DESCRIPTION OF A TYPICAL WORK DAY AND/OR WORK WEEK

Writing blogs; responding to email; reading scientific literature; drafting manuscripts for publication in scientific journals; doing media interviews (mostly in the winter); conducting research activities (in my case this consists of maintaining and identifying isolates of molds, fungi, and conducting field surveys of hibernating bats in caves and collecting samples for analysis).

OTHER DUTIES

Some minor supervisory duties overseeing people preparing bats as museum specimens; presenting research at public talks and scientific conferences; editing outreach materials.



EDUCATION OR TRAINING REQUIRED FOR THIS POSITION

MSc in biology; training for working with fungi and bats; caving skills; writing skills (blog writing and scientific writing are different writing styles); communication skills for talking with the media and presenting research at scientific conferences.

BRIEF DESCRIPTION OF YOUR CAREER PATH

I got a BSc in biology and worked at a provincial park during the summers conducting research. I made connections during the course of my MSc that led to the position with the Canadian Wildlife Federation.

FAVOURITE ASPECTS OF YOUR JOB

The field work!

CHALLENGES OF YOUR JOB

Designing research projects.

HOW DO YOU MAINTAIN WORK/LIFE BALANCE?

This is quite a challenge as I do take work home with me. Some ways to combat this are: taking weekend trips away from the city and email; making time for hobbies and social interaction; occasionally taking small breaks during the day for short walks.

Michelle Evans

Teaching Assistant/Instructor/Summer Camp Coordinator

EMPLOYER

Maritime College of Forest Technology

LENGTH OF TIME EMPLOYED IN THIS POSITION

1.5 years

TYPE OF EMPLOYMENT

Full time

LEVEL OF EMPLOYMENT

Entry level

AVERAGE YEARLY SALARY FOR THIS POSITION (RANGE)

\$30,000-40,000 (or more!)

HOURS WORKED IN A TYPICAL WORK WEEK

Monday-Friday, 7:30-5:30.

DESCRIPTION OF A TYPICAL WORK DAY AND/OR WORK WEEK

During a typical week I get to do a TON of different activities. I plan and teach classes, put on tutorials on subjects students are having a hard time with, and mark lots of assignments and tests. At least once a day I get to go outside and help with a “lab” class (a practical hands-on class). Whether we are building a bridge, looking at machinery, navigating through the woods or talking about ecological changes and factors that affect an area, we spend lots of time observing what is around us. Every day I check on our resident critters; we have about 20 tanks and cages of fish, amphibians, reptiles, insects and even a couple of guinea pigs. I make sure they are being fed, cared for and are content.



OTHER DUTIES

There are always lots of projects to help make happen. Whether it is coordinating a summer kids camp program or organizing an outdoor survival night where students spend 12 hours alone in the woods, there are no limits to the possibilities.

EDUCATION OR TRAINING REQUIRED FOR THIS POSITION

Graduated from a 2-year Forest Technologist and well as Advanced Fish and Wildlife diploma program. Have an interest in teaching and coaching, and experience doing so. Able to be flexible with schedule and willing to be away for camps.

BRIEF DESCRIPTION OF YOUR CAREER PATH

Mine specifically has been quite varied. Most of the experience that got me the job besides graduating from the program was summer jobs with Parks NB and volunteering with Girl Guides and other youth leadership programs. Within the organization I have the opportunity to become a full instructor and specialize in particular subjects I am interested in.

Continued

FAVOURITE ASPECTS OF YOUR JOB

I love how every day is completely different and rather unexpected. Being outside with the students is super rewarding as you can see their faces light up when they grasp a difficult concept or start teaching each other. I really enjoy taking care of all the creatures and am always looking for ways to improve their habitats to make them more comfortable.

CHALLENGES OF YOUR JOB

It is very busy and there are always at least 10 things that need done quickly. Often I will have a plan to finish a task within a set time, but then a student pops by with an issue or an instructor needs help with a class and I have to quickly adjust what I am doing.

HOW DO YOU MAINTAIN WORK/LIFE BALANCE?

This job is great, because it offers some flexibility of specific work hours. Depending on the week, if I have been early/late often I will leave early on Friday. Sometimes I can combine work and life, for instance, if I need to set up a navigation exercise in the woods, I go get my dogs and take them for a walk.

APPENDIX 2 Key Terms

Bioblitz – a fun activity that helps you find and understand the biodiversity near you by observing and recording all the living things you find in a specific area.

Biodiversity – the wide variety of life on earth and all the ways that different living things interact with each other.

Ecosystem – a community of organisms (living things) that interact with each other and depend on each other.

Habitat – where an animal or plant lives, including the food and shelter it needs to survive and the climate to which it is adapted.

Observation – data or information that you collect and record while observing something (using your senses to gather information).

Organism – an individual living thing.

Resources – an object or substance that a living thing needs to survive.

Species – a group of organisms that is unique or different from all other groups.

Taxonomic group – a category of living things that are closely related and therefore share certain characteristics.





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