Topic 1.1
What are ecosystems, and why do we care about them?

Specific Expectations

- **B2.1** use appropriate terminology related to sustainable ecosystems and human activity, including, but not limited to: biodiversity, biotic, ecosystem, equilibrium, species diversity, sustainability, and watershed
- **B2.2** investigate the characteristics and interactions of biotic and abiotic components of a terrestrial or aquatic ecosystem, and describe the importance of these components in a sustainable ecosystem
- **B3.1** identify similarities and differences between terrestrial and aquatic ecosystems, and describe these similarities and differences using diagrams
- **B3.2** describe the interdependence of the components within a terrestrial and an aquatic ecosystem, and explain how the components of both systems work together to ensure the sustainability of a larger ecosystem

Skills

- communicate ideas and conclusions

Materials

Please see the teaching notes for each activity for a list of the materials required. Please see page TR-37 for a summary of the materials required in this topic.

Overview

In this topic, students will discover the diverse components of ecosystems and why we as humans should be concerned about their interactions and sustainability.

Common Misconceptions

- **Some students may believe that ecosystems are not a functioning whole, but simply a collection of organisms.** Using the illustration on page 6 as a sample ecosystem, identify the interactions between biotic and abiotic components. Have students consider what each animal in the ecosystem depends on and what they would find difficult about living in the arctic or in a desert. Emphasize relationships. Plants also depend on other components of their ecosystem.
- **Students may think that species live together in an ecosystem because they have similar needs and behaviours.** Examine an ecosystem and note the differences in each species niche. Some species needs are incompatible, which leads to competition or predation.

Background Knowledge

An ecosystem is a complex, self-regulating system in which living (biotic) and non-living (abiotic) components interact. The biotic components might include plants, animals, fungi, protists, and monerans. The abiotic components might include rocks, air, and water as well as temperature, pH, daylight hours, etc. A group of similar organisms living together in an ecosystem is called a *species*. Members of the same species form populations that interact with other species and with the abiotic components. Some ecosystems are aquatic and others are terrestrial but even these are interdependent, as students will see in Activity 1.3. The diverse interactions that we observe allow for the survival of all species and maintains a sustainable system. Any disruption to this harmony by human intervention or by the introduction of new species will alter the overall balance.

Literacy Strategies

Before Reading

- Draw students' attention to the features and organization of the Topic. Have them read the topic title and then read the head on each spread and explain how they relate to the topic title. Show students where to look for Key Term definitions (margins) and how the sections are split into main headings and subheadings.
- ELL Demonstrate how to quickly find an important fact or reference by scanning through the heads and subheads. Explain that being able to navigate through a text and find what you need is a skill that will be useful throughout high school.
- Have students use a Predict-Read-Verify strategy individually as they read the text. Students should combine background knowledge with the headings and the opening sentences to predict what is being studied in each spread. Break up text into manageable chunks for students to synthesize and have them verify their predictions as they read.

During Reading

- Have students draw diagrams to help with their notes. Pictures can help relate pairs of terms such as *biotic* and *abiotic* or *terrestrial* and *aquatic*. Invite students to share the pictures they develop for each concept to help others see how they help organize and illustrate information.

- Students can create a picture glossary to help understand the new terms in the Topic. Recommendations for creating a Picture Glossary can be found in the Unit 1 Review, question 4 on page 84.
- As students take notes on the topic, encourage them to use sub-headings or sub-topics to organize notes.
- ELL English language learners can use sticky notes to identify passages that they do not understand. After every spread, discuss these passages with the students to help clarify meaning. Encourage students to ask classmates for clarification, as well.

After Reading

- Have students work with a partner to share their picture maps, add to them based on their partner's feedback, and discuss any questions they might have after completing the Topic.

Assessment FOR Learning		
Tool	**Evidence of Student Understanding**	**Supporting Learners**
Learning Check, page 13	Students describe the importance of connections in an ecosystem.	• Place students in pairs to define ecosystem in their own words, then develop a class definition. Emphasize connections. • Ensure students understand the interactive nature of the Internet. • Allow students to use a diagram or graphic organizer to compare ecosystems and the Internet. • DI Alternatively, have students explain how a school or home is like an ecosystem with their varied parts and interactions.
Activity 1.3, page 14	Students identify interaction in and between parts of terrestrial and aquatic ecosystems.	• Have students use diagrams or a graphic organizer to display the interactions they identify. • If necessary, have students work systematically through pairs of ecosystem components and ask themselves if and how these parts interact. Students could work with a partner to identify interactions. • DI Share results as a class to help students see that there are many interactions.
Learning Check, page 15	Students identify similarities and differences between terrestrial and aquatic ecosystems.	• Students may have difficulty recognizing general features on ecosystems. Encourage using broader terms like biotic and abiotic parts instead of focusing on specific items or species. • Work together to list similarities and differences. • ELL English language learners may not have the necessary vocabulary to answer these questions on their own. Model appropriate vocabulary in a class discussion. English language learners could also draw diagrams to show similarities and differences. • To help students organize their answers, distribute **BLM G-38 Venn Diagram**.

Topic 1.1 (Student textbook pages 8–17)

Using the Topic Opener (Student textbook pages 8–9)

- Provide a series of terms/musical genres/hit songs/movies/athletes/teams, etc. and determine if students can make the connections. For example, in the movie industry, some actors will work together on specific movies, while others will work with the same director but never each other, or all the movies could have the same producer. Then provide a list of organisms and abiotic elements and have students make connections.
- Invite students to share information about the needs of a living thing that is of interest to them. Ask questions about what other species or natural features (such as temperature, water, and shelter) are depended on in the situation.
- Spend some time with the students here to develop the inquiry and literacy strategies that they will find useful throughout this unit. Encourage active listening and acceptance of others' opinions, demonstrate how to extract information from visuals, and introduce the idea of inferring an answer to a question, such as why some organisms inhabit different ecosystems, by using the facts we are given.
- A guest speaker would be appropriate as you introduce this unit, or later, as students explore ecosystems in more detail. Consider inviting a naturalist or an ecologist who can introduce the idea of an ecosystem and the connections among all parts of the ecosystem.

Starting Point Activity

Pedagogical Purpose

Students develop an understanding that ecosystems are everywhere around them and that these interactions provide the balance that allows all organisms to co-exist. By interpreting the simple diagrams provided, students should begin to appreciate that all living organisms use their habitats to provide them with the necessary tools for survival.

Planning	
Materials	**BLM 1-4 Topic 1.1 Opener Ecosystems** **BLM G-38 Venn Diagram** (optional)
Time	20 min in class 5 min preparation (making an overhead of the BLM)

Activity Notes and Troubleshooting

- After reading the Topic Opener, display **BLM 1-4 Topic 1.1 Opener Ecosystems** on an overhead to simplify the exercise by allowing students to point to the part of the diagram they are referring to as they speak. Ask students why each organism makes their home in that ecosystem.
- In the human body, some students may find the idea of mites, bacteria, and fungi living on or in them unappealing. Point out that although the needs of these organisms are met by living on or in humans, they are not found on all people. The exception is the digestion-helping bacteria, which are actually required to extract nutrients from our food.
- Have students begin by discussing the possible interactions that they can observe in the tree ecosystem. They should notice that the tree is food for the bark beetle, which in turn is food for the mouse and woodpecker. Some students may think that woodpeckers are eating the tree when they make their holes; point out that the woodpeckers are searching for their real food: insects in the tree.

Additional Support

- ELL English language learners can work with a fluent English speaking classmate to answer these questions, or can answer them orally or using diagrams.
- Enrichment—Ask students to brainstorm what other organisms they might find in the tree ecosystem.
- Enrichment—Use a Venn diagram to compare and contrast the two ecosystems. See **BLM G-38 Venn Diagram**.

Answers

1. Ecosystems are systems composed of the interactions between living and non-living components in a certain place. The human body is an ecosystem containing eyelash mite, fungus (athlete's foot), gut bacteria, armpit bacteria, and other components. A tree is an ecosystem containing moss or lichen, mice, birds, bark beetles, and other components.
2. Answers may vary. For example, survival depends upon supply of oxygen, food, shelter (habitat), temperature, availability of water, and ability to resist disease.
3. The woodpecker is more suited to the spruce tree because it provides a suitable habitat, shelter, and a suitable source of food.

Instructional Strategies for Topic 1.1

Ecosystems are about connections. (Student textbook pages 10–11)

- Have students construct a Picture Glossary using key terms as they are introduced. Recommendations for creating a Picture Glossary can be found in the Unit 1 Review, question 4 on page 84.
- Have students draw a picture of Earth. Ask if they draw political borders, or just differentiate between land and sea. Ask them how this relates to the quote from Sultan bin Salman bin Abdulaziz Al Saud on page 10, or to question 4 in the Learning Check.
- Have students explain how they interpret the word connection in the context of this spread. Ask them how they are connected to students elsewhere in the school, in the country, and around the world.
- ELL Use diagrams or photographs to help English language learners understand whenever a new concept is introduced. Ask how the uses of the word *connection* compare.
- ELL When introducing the Learning Check questions, demonstrate for students how to look back into the text to locate the necessary information to answer the questions. Have students think aloud while scanning the text as they search for key words from the questions.

Ecosystems are made up of biotic and abiotic parts that interact.
(Student textbook pages 12–13)

- Have students preview the Key Terms in the margin before reading the text to themselves. This will aid them in understanding the concepts as they encounter them.
- DI If possible, have students act out the interactions in an ecosystem by each student taking on the role of one of the components of the ecosystem and identify interactions by having students touch or hold a length of string between them.
- Alternatively, use string to connect labels of components of the ecosystem on the chalkboard or around the classroom. Remind students that the ecosystem is not just the parts represented by the labels, but also the interactions represented by the string.
- DI Ask students how the prefix *eco-* modifies the word *system* in ecosystem, and how it relates ecosystems to ecology and ecologists.

- Ask students for examples of exotic ecosystems they may know of or have seen in other countries.

Interactions between terrestrial and aquatic ecosystems keep all ecosystems healthy. (Student textbook pages 14–15)

- Use the large print copies or overheads of the text materials to demonstrate the interactions between biotic and abiotic components.
- Discuss with students how something can be part of more than one ecosystem. Examples for discussion could include the frog in Figure 1.3A on page 15, insect larvae that live in water before becoming flying insects like mosquitoes, migratory birds, and the beavers in Activity 1.3 on page 14.
- To extend the idea represented in Figure 1.3C, have students list ways they affect other ecosystems without ever visiting them.

Learning Check Answers (Student textbook page 11)

1. Ecology is the branch of science that studies the relationships between living things and the environment.
2. An ecologist studies how living organisms interact with each other and with their environment.
3. Large ecosystems include the ocean, the forest, the desert, and the Earth. Small ecosystems include the pond, the lake, a drop of water, and the tree.
4. When viewed from a distance, the astronauts began to see the planet as a whole, not a collection of separate nations or regions.

Activity 1.1 Inspiring Connections (Student textbook page 11)

Pedagogical Purpose

The literacy focus in this activity provides an opportunity for students to read and to share other students' understanding of the possible interconnections that ecosystems provide for all people on the planet Earth. Students develop their reading and writing skills as well as sharing their own understanding of the connections we all make.

Planning	
Materials	None required
Time	15 min in class

Skills Focus

- communicate ideas

Activity Notes and Troubleshooting

- This activity offers lots of opportunity for literacy development as students focus on reading, writing, and stating and supporting opinions.
- Have individual students volunteer to read each quote to the class first. If assistance is required, simply provide the necessary terminology. Have students read the quotes again silently, reflecting on the role connections play in each quote. Then as a group, have students read the quotes again and proceed with the activity. Assign a recorder and other possible roles for the group.
- For the What Did You Find Out? question, avoid having students simply agreeing with or modifying one of the three quotes. Students should come up with an all new statement in their own words.

Additional Support

- For students who require support reading, reproduce the quotes in larger print, or read them aloud again.
- Use other quotes deemed appropriate (senior students might be the inspiration for these), or have students volunteer to share their quotes and invite the class to comment on them. This is a good opportunity to model and encourage respect for group members and for different perspectives.
- ELL Allow the use of diagrams if students are having difficulty phrasing their ideas.

Activity 1.1 Answers

What Did You Find Out?

1. Answers will vary. Sample answer: On Earth, all organisms have inter-relationships that allow them to survive and to co-exist.

Activity 1.2 Pondering Ponds (Student textbook page 12)

Pedagogical Purpose

By examining Figure 1.2 on page 13 students will gain an appreciation for biotic and abiotic components of an ecosystem and how the different components interact.

Planning	
Materials	**BLM G-33 Concept Map** (optional)
Time	10 min in class 5 min preparation (have labels ready to identify components of the ecosystem)

Background Knowledge

A pond is defined as a still pool of water, often shallow, that is smaller than a lake. Often, because ponds are not part of a river or stream, they are a closed ecosystem to aquatic life.

Activity Notes and Troubleshooting

- By identifying the components of an ecosystem in this activity, students are prepared for the introduction of the terms biotic, abiotic, and ecosystem, without using them.
- Provide students with a graphic organizer such as **BLM G-33 Concept Map** to summarize the components that they have identified in the pond. Using a concept map will give students the opportunity to practise organizing ideas.
- As an alternative, if students are unsure about the components of the pond ecosystem, use an ecosystem students might be more familiar with such as a local park, ravine, or shoreline.

Additional Support

- DI Body-kinesthetic learners may benefit from acting out the various components of the pond ecosystem. Repeat the string activity described in Instructional Strategies. To help students identify connections in a pond ecosystem, have them work in groups of 8–10, take roles, and show connections between roles with string.
- Enrichment—Once students identify the living and non-living components of the pond ecosystem, have students determine the importance of these components and any relationships that exist among the components.
- ELL Have students keep a list of words they encounter and are not sure they understand. Explain any new and/or necessary terminology.
- ELL English language learners may be more familiar with an ecosystem in another part of the world. Encourage them to describe components and relationships in that ecosystem to the class.

Activity 1.2 Answers

1. Ponds are found all over the province of Ontario.
2. Depending on your location, plants found in or near ponds include cattails, reeds, algae, sedges, sedum, sumac, honeysuckle, and pussywillows.
3. Depending on your locations, animals found in or near ponds include bacteria, snails, frogs, skunks, mink, egrets, cranes, ducks, geese, muskrat, raccoons, beavers, and deer.
4. Other living organisms may include fungi and lichen.
5. Non-living examples might include rocks, shells, sand, gravel, soil, water, and air.

Learning Check Answers (Student textbook page 13)

1. Answers may vary. For example, animals consume plants and fungi help other organisms decompose. Sunlight heats water and moving water erodes rocks into sand.
2. Students examples may vary. Like an ecosystem, the Internet connects a lot of different people with a lot of different needs. Some websites are connected directly and others do not seem to be connected at first, but are connected through longer chains. Like an ecosystem, different parts of the Internet have different needs and objectives. The Internet, like an ecosystem, includes biotic (people) and abiotic (technology) components.
3. Answers may vary. Interactions could include breathing air, drinking and using water, watering plants, caring for a pet, and eating plants, animals, and animal products.

Activity 1.3 Interaction ID (Student textbook page 14)

Pedagogical Purpose

Students will begin to appreciate the number of possible interactions between terrestrial and aquatic ecosystems that allow life to be sustained. Students will also develop positive group dynamics and learn to appreciate their own contributions and the contributions of others made in a brainstorming session.

Planning	
Materials	**BLM G-37 T-chart** (optional)
Time	15 min in class 5 min preparation (larger photocopies of the picture could be made)

Background Knowledge

The picture shows a winter pond scene. The inset picture shows insect larvae which live in the water until ready for adulthood. During this phase, depending on the species, they feed on plants, algae, or smaller larvae and are in turn prey to many species of small animals. Galls, abnormal plant growths often caused by insect larvae, can be seen in the foreground.

Activity Notes and Troubleshooting

- Before beginning the identifying part of the activity, have students use **BLM G-37 T-chart** to separate the components of the terrestrial and aquatic ecosystems. For the activity, choose to place each component only in one ecosystem (for example, beavers are in the aquatic ecosystem and snow is in the terrestrial ecosystem).
- Students can work individually or in small groups to complete the activity, then report back to the class to discuss the various interactions that are identified.

Additional Support

- Some students may need a reminder of how to use a T-chart. Create a simple one about two popular music groups. Together list qualities of each, as well as qualities they both share.
- Have students who are having difficulty with the activity select two components from the T-chart and try to find an interaction between the two. Have them continue matching pairs until they have identified three of each type of interaction.
- Students may prefer to record interactions on a diagram adding simple labels of the interactions between components. Diagrams, or names of the components, can also be attached to magnets and students can then manipulate them on the chalkboard, drawing lines to show connections.
- ELL English language learners may not be familiar with the plants and animals shown. Have them work with a classmate to complete the activity, or draw and identify interactions in an ecosystem with which they are more familiar.

Activity 1.3 Answers

Answer may vary. For example:
Interactions in the land ecosystem: trees shelter birds, moose feed on plant life, and squirrel eat nuts and berries.
Interactions in the water ecosystem: the turtle hibernates in the mud at the bottom of the pond, molluscs feed on organisms on and near the pond bottom, and marine micro-organisms consume other micro-organisms.
Interactions that involve both ecosystems: snow melts and adds more water to the pond, the pond provides the water for the survival of the trees, and beavers cut down plants and small trees to build their lodges.

Learning Check Answers

1. Answers may vary. Sample answer:

Terrestrial	Aquatic
forests	deep ocean
deserts	rivers
cities	marshes
our bodies	lakes
trees	shoreline

2. Both are ecosystems: they are systems made up of all the biotic and abiotic parts of a certain place. Both support animal and plant life and there are connections among the parts of each ecosystem. Aquatic ecosystems are based mostly or totally in water while terrestrial ecosystems are based mostly or totally on land.

Activity 1.4 Ecosystems Where You Live (Student textbook page 16)

Pedagogical Purpose

Students will investigate how ecosystems apply to the local environment and the role that human activities play in maintaining and/or harming that environment. They will also practise skills of collaboration, cooperation and giving and receiving positive feedback.

Planning	
Materials	1 large sheet of paper for each student Coloured markers for each student
Time	30 min in class 10 min preparation

Activity Notes and Troubleshooting

- Summarize how to determine north, south, east, and west on the map. If possible, provide a map of the neighbourhood or draw a rough map on the chalkboard to help students begin theirs. Connect this activity with what the students are learning about mapping in Geography class.
- Carefully consider the structure of student groupings to maximize the possibility of a positive experience from group work.
- Sharing and collaboration are skills that students must begin to appreciate; reinforce good skill development here, as students work in homogenous groups.
- As this is the last activity before the Topic Review, use discussion to reinforce vocabulary; encourage students to use mnemonic strategies to retrieve unfamiliar words.
- Time the activity to ensure that students remain on task.

Additional Support

- Choose a range for the maps based on the number and types of ecosystems in the area. You may want to establish the map ahead of time, then assign students to a quadrant or region.
- If students have difficulty imagining consequences of human activities, have them play a game. Name an action (cutting the grass, getting a ride to school, etc.), then choose 3 students to suggest a possible effect of that action. Allow others in the class to state which effect they think is most likely and why. You can begin with examples close to students' experiences, and move toward environmental issues.
- Students who are new to the area may not be familiar with local ecosystems. Place them in groups with students who are familiar with them. Alternatively, take a neighbourhood walk to explore some local ecosystems.
- ELL This activity involves a lot of reading. Make sure English language learners are in a group with fluent readers who can summarize what to draw at each stage of the activity.
- DI Point out to linguistic learners that *biotic* has the same root as *biology,* the study of life. The prefix *a-* in *abiotic* means "without" or "absence of."

Activity 1.4 Answers

What Did You Find Out?

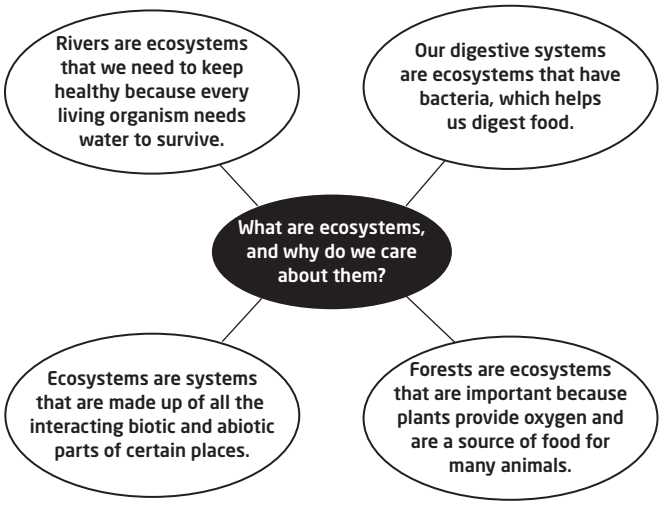
1. Answers may vary. Human activities could either harm or benefit the individual ecosystem through activities such as urban sprawl, re-forestation, and banning or managing the use of pesticide.
2. Answers may vary. Sample answers:
   - **a)** birds living in trees, birds eating insects, and insects pollinating flowers
   - **b)** the Sun warming the pond water, rain adding water to a pond, the motion of water determining the shapes of the shoreline, weather patterns affect both the temperature and the shoreline
   - **c)** the rocks providing habitat for snails and small fish, sunlight providing warmth for both aquatic plants and fish, animals drinking water
3. Answers may vary. Daily activities that are connected to the ecosystem around the home might include recycling, composting, littering, driving patterns, size of vehicle driven, and walking as opposed to cycling.

Topic 1.1 Review (Student textbook page 17)

Please see also **BLM 1-5 Topic 1.1 Review (Alternative Format)**.

Answers

1. Answers may vary. For example:



2. Answers may vary. For example:
The connection with plants provides oxygen and food. The connection with soil helps grow these plants. The connection with aquatic organisms provides fish to eat.

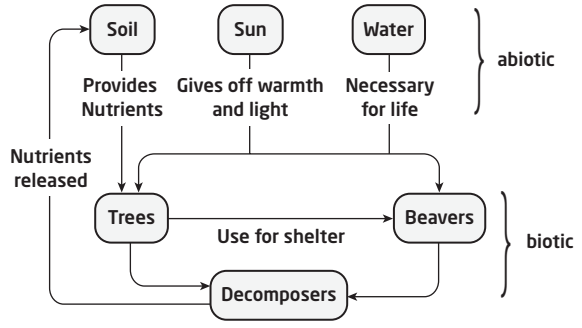
3. a) Answers may vary. For example:

- beavers eat plants
- plants need decomposing organisms to build nutrient-rich soil
- birds eat small fish

b) Answers may vary. For example:

- Plants will interact with soil and water to help meet their need for water and nutrients.
- Air provides plants with carbon dioxide which gives animals oxygen.
- The Sun supplies needed light and warmth.

4. Answers may vary. For example:
Using the ecosystem from Figure 1.2 on page 13:



5.

Biotic	Abiotic
salmon	stream
microscopic living things	Pacific Ocean
seals	nutrients
sea lions	calcium
other predators	nitrogen
salmon eggs	phosphorus
grizzly bear	
decomposers	
trees and other plants	
forest-dwelling animals	

6. Answers may vary. For example:
The salmon brings many nutrients such as calcium, nitrogen, and phosphorus from its aquatic ecosystem in the Pacific Ocean to the forest ecosystem. The bear eats the salmon directly obtaining the nutrients from the salmon. The carcass of the salmon along with the bear's feces provide nutrients for the trees and plants, which in turn provide food for forest-dwelling animals.