Unit 1
Interactions Within Ecosystems

Suggested Time: 19 Hours

Unit Overview

Introduction

Ecosystems are comprised of both living and non-living things. Some ecosystems can be very large and cover vast areas of Earth. Other ecosystems, such as a small pond or a rotting log, can be localized to a very small area. Each ecosystem can be described by the types of organisms that live there and by the physical (non-living) conditions that exist there. The interactions between the organisms and the physical conditions work to create the ecosystem. By the end of grade 6, students have learned that the variety of living things on earth, as well as the places in which they live, are seemingly endless. Through their study of the concepts in this unit, students will further refine their understanding of the places in which organisms live and how the interactions between living and non-living things create these special living spaces as well as how humans can affect these spaces.

Focus and Context

The focus of this unit should be on inquiry and decision-making. Students should be encouraged to think about the ecological concepts they are learning with reference to their local community. While they are learning about the often fragile relationships that exist between the living and non-living parts of ecosystems, they should consider what impact they, individually and as part of a larger human population, have upon the ecosystems in their local area. Students should also be encouraged to think beyond the borders of their local community when thinking about the human impacts on ecosystems.

Questions directed to students concerning local ecosystems and the changes (or proposed changes) to them could elicit interest and discussion at the beginning of the unit. Questions such as, “What do you think will happen to the wildlife in an area if a golf course is constructed?” or “What kinds of animals would a community attract if a proposed land fill site were built?” could be used to heighten student interest in their local ecosystems. The answers to these could be developed throughout this unit.

Science Curriculum Links

By the end of elementary grades, students have learned that there is a great variety of living things on earth. They have also learned that these living things live in a variety of habitats. They have also learned that the habitats in which organisms live are often specific to that organism (i.e. the habitat provides things the organism needs in order to survive). In this unit students will further refine these understandings and will learn that living things interact with each other and with the non-living things in the habitat to create an ecosystem and how humans can impact these ecosystems. These concepts will be further developed in Science 1206, Science 2200, Biology 2201 and Environmental Science 3205.

Curriculum Outcomes

STSE

Students will be expected to

Nature of Science and Technology

109-1 describe the role of collecting evidence, finding relationships, and proposing explanations in the development of scientific knowledge

109-12 distinguish between terms that are scientific or technological and those that are not

109-13 explain the importance of choosing words that are scientifically or technologically appropriate

Relationships Between Science and Technology

111-1 provide examples of scientific knowledge that have resulted in the development of technologies

111-6 apply the concept of systems as a tool for interpreting the structure and interactions of natural and technological systems

Social and EnvironmentalContexts of Scienceand Technology

112-3 explain how society's needs can lead to developments in science and technology

112-4 provide examples of Canadian institutions that support scientific and technological endeavours

112-8 provide examples to illustrate that scientific and technological activities take place in a variety of individual or group settings

112-9 identify science- and technology-based careers in their community

113-1 identify some positive and negative effects and intended and unintended consequences of a particular scientific or technological development

113-9 make informed decisions about applications of science and technology, taking into account environmental and social advantages and disadvantages

113-11 propose a course of action on social issues related to science and technology, taking into account personal needs

Skills

Students will be expected to

Initiating and Planning

208-2 identify questions to investigate arising from practical problems and issues

208-3 define and delimit questions and problems to facilitate investigation

208-5 state a prediction and a hypothesis based on background information or an observed pattern of events

208-6 design an experiment and identify major variables

Performing and Recording

209-1 carry out procedures controlling the major variable

209-3 use instruments effectively and accurately for collecting data

209-4 organize data using a format that is appropriate to the task or experiment

Analyzing and Interpreting

210-1 use or construct a classification key

210-2 compile and display data, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, bar graphs, line graphs, and scatter plots

210-3 identify strengths and weaknesses of different methods of collecting and displaying data

Communication and Teamwork

211-2 communicate questions, ideas, intentions, plans and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language, and other means

211-3 work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise

211-4 evaluate individual and group processes used in planning, problem solving, decision making, and completing a task

211-5 defend a given position on an issue or problem, based on their findings

Knowledge

Students will be expected to

304-1 explain how biological classification takes into account the diversity of life on Earth.

304-2 identify the roles of producers, consumers, and decomposers in a local ecosystem, and describe both their diversity and their interactions

306-1 describe how energy is supplied to, and how it flows through, a food web

306-2 describe how matter is recycled in an ecosystem through interactions among plants, animals, fungi and microorganisms

306-3 describe interactions between biotic and abiotic factors in an ecosystem

306-4 identify signs of ecological succession in a local ecosystem

Ecosystems

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to	
• identify questions related to a local ecosystem such as "What types of species live in a particular ecosystem?" (208-2, 208-3)	Teachers could begin this unit with a brainstorming session in which students express their current conceptions of what an ecosystem is and what it looks like. From personal experiences and the elementary science program, students may generate examples of local areas, living things or local conditions (such as, wet, sunny, etc.). Students will have investigated and studied components and elementary relationships of and in ecosystems in grades 4 and 6. A "K-W-L" (What I Know - Want to Learn - Learned) chart could be started. With this approach, previous knowledge and understanding could be assessed and areas of common interests could be identified. Refer to Appendix B for more details on this and other teaching strategies mentioned in this guide.
- describe an ecosystem as a group of interacting living and nonliving things	Teachers could build a list of student "terms" or "concepts" that help describe ecosystems. These could be used to build a class definition of an ecosystem. The definition could be refined throughout the unit as more scientific concepts regarding ecosystems are covered. Students should realize that an ecosystem is not defined by its geographic size; they can be very small (e.g., a rotting log) or very massive (e.g., Atlantic Ocean). Therefore, there are many, many different ecosystems throughout the province, country and world.
- identify examples of ecosystems within Newfoundland and Labrador. Include: (i) coastline and ocean (ii) freshwater (iii) arctic (iv) forest	To broaden student perception and ensure that more than the immediate local ecosystem is described, teachers could show pictures of various Newfoundland and Labrador ecosystems. Many videos and television shows are available that illustrate ecosystems.
- list examples of organisms that live in each ecosystem	Students could create a list of organisms (flora and fauna) within each ecosystem. Teachers should help them to consider species that are less obvious. For example, a gull as a part of the Ocean ecosystem or mushrooms in the forest ecosystem. Students could make a journal entry related to this.

Ecosystems

Suggested Assessment Strategies

Journal

- Two questions I would like to investigate related to my local habitat are ..... (208-2, 208-3)
- "The thing that I would like to investigate the most when I visit our ecosystem is..." (304-2, 306-3)

Presentation

- Students can create a multimedia presentation depicting pictures of various Newfoundland and Labrador ecosystems. A collage would be useful here as well. (210-2, 306-3)
- Create a poster/collage/multimedia presentation showing several examples from typical Newfoundland and Labrador ecosystems. (210-2, 306-3)

Conventions used in Resources column

ST = Student Text

TR = Teacher Resource

TR AC = Assessment Checklist

TR PS = Process Skills Rubric

TR AR = Assessment Rubric

BLM = Black Line Master

BLM 8 Activity # = Additional BLMs for each grade level

Resources

http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html

ST pp. 4-6

BLM 1-3

TR AC 24

ST pp. 8-9

ST pp. 10-12

ST pp. 10-12

Components of an Ecosystem

Outcomes

Students will be expected to

- demonstrate the importance of choosing words that are scientifically appropriate (109-12, 109-13)

  - define and use terms in context. Include:
    (i) ecosystem
    (ii) abiotic
    (iii) biotic
    (iv) species
    (v) organism
    (vi) population
    (vii) community
    (viii) habitat
    (ix) niche

Elaborations—Strategies for Learning and Teaching

Teacher should note that these terms appear throughout the unit. All terms could be introduced and defined at once, or when required within the unit. Students would have encountered many of these terms in previous grades. They should be encouraged to use the appropriate language when discussing and exploring ecosystems.

After the terminology as been introduced teachers could use a Quiz-Quiz-Trade activity (Appendix B) to provide students with opportunity to practice and use these terms. Quiz cards could contain definitions of the terms, the term with an example, a question (with answer) associated with the term, etc. For example one Quiz card could have the term "abiotic" written on one side and the definition on the reverse side. When used in the Q-Q-T card could have the term "population" on one side and an example of this or question related to it on the other (e.g. "Which term best describes 200 moose, including males, females, and young in an area?"). Quiz cards for each of the terms could be created in this manner. Refer to Appendix B for more information on using Quiz-Quiz-Trade activities.

Teachers should conduct an activity to introduce the use of scientifically appropriate language to describe ecosystems. For example, students could write a paragraph, using scientific terms, to describe a forest. While students may not be able to use all the terms, they should be encouraged to use as many as they can. Students should be able to demonstrate their understanding of the terminology and related concepts associated with the interactions within one of the ecosystems previously discussed. Students are not expected to simply give definitions for these terms. These terms and concepts should be introduced in the context of the chosen ecosystem and students should be able to use them appropriately in context.

Teachers could have students start a mind map with "ecosystems" at the center (see Appendix B).

Components of an Ecosystem

Suggested Assessment Strategies

Paper and Pencil

- Students can create a foldable vocabulary book in which they can store definitions for the unit. (211-2)

Performance

- Create a poem or rap that uses as many of the "ecosystem" terms as possible. (109-13, 311-2)
- Write a letter to a friend that uses the "ecosystem" terms properly.
- Create a foldable to explain and illustrate the "ecosystem" terms. Share your creation with your classmates. (109-12, 109-13)

Journal

- How would you explain the following terms so that a grade 3 or 4 student would understand their meanings and relationships: niche, ecosystem, community, population, and habitat? (109-13)

Resources

http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html

ST pp. 8-9, 17-19, 24-25

TR AC 13

Components of an Ecosystem (continued)

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to • investigate the biotic and abiotic factors of a local ecosystem (306-3) - define range of tolerance - describe the following abiotic factors of local ecosystems (i) intensity of sunlight (ii) air, soil and water temperature (iii) wind direction and speed	Many other abiotic factors could be discussed, however it is important to note that a much more in-depth examination of this concept occurs in Science 1206 and Science 2200. Teachers should ensure that students understand that organisms may have a wide range of tolerance for one abiotic factor (e.g., temperature) and a narrow range of tolerance for another (e.g., soil acidity). Teachers could have students engage in a Think Pair Share (Appendix B) on which abiotic factors they think have the greatest impact on the local ecosystems.
• define and delimit questions to investigate in a local ecosystem (208-3) • organize and record information collected in an investigation of an ecosystem using instruments effectively and accurately (209-3, 209-4) • communicate questions, ideas, plans, and results, using lists, notes in point form, sentences, oral language, and other means (211-2) • work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise (211-3) • evaluate individual and group processes used in planning, decision making, and completing a task (211-4) • use a key to identify the biotic factors observed in the local ecosystem (210-1)	**Core Laboratory Activity: Field Trip to the Schoolyard** The laboratory outcomes 208-3, 209-3, 209-4, 211-2, 211-3, 211-4 and, in part, 306-3 are addressed by completing CORE LAB 1-2A "Field Trip to the Schoolyard". Students should brainstorm possible questions to investigate when visiting and observing a local ecosystem. Teachers should ensure that the brainstorming session elicits questions related to concepts such as the intensity of sunlight, air, soil or water temperature, wind direction and speed, soil type as well as the different species that inhabit the ecosystem. Teachers should inform students of the questions that will be investigated on the field trip to the local ecosystem. In groups, students should decide how they will record their observations. Teachers should realize that not all students will choose the same method of recording (eg. anecdotal recording vs. creating a table or chart). This may provide an opportunity for teachers to discuss the strengths and weaknesses of the different methods. Students could use instruments such as magnifying glasses, field binoculars, digital cameras, and hand-held microscopes to closely observe organisms in the ecosystem. Students could use thermometers (air and soil), light meters, anemometers (wind meters) and weather vanes to collect abiotic data. Students could use field guides or classification keys to identify some of the biotic factors present such as wild flowers or trees. Upon return to class, students should be prepared to look for specific items. For example, students should attempt to identify the biotic factors of the ecosystem they observed. Field guides or teacher-created posters/photos of local flora and fauna could be used. Identification should be based on observable characteristics only.

Components of an Ecosystem (continued)

Suggested Assessment Strategies

Performance

- Use a key, provided by the teacher, to identify the biotic factors from the ecosystem you observed in the field trip. (210-1, 209-3, 209-4)

Presentation

- Students can collect track impressions and scat samples during field excursions and display then on poster board in the classroom. This would/could show diversity of fauna. Ensure students follow proper safety protocols. (208-3, 306-3)
- Create a poster showing collected and identified flora from a local ecosystem. (210-2, 306-3)

Paper and Pencil

- Describe how abiotic factors such as sunlight intensity and wind speed differ as one moves from a forest to a bog. (306-3)

Resources

http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html

ST pp. 17-19

BLM 1-4

Core Lab #1: Field Trip to the Schoolyard, p. 20

TR 1.12-1.13

TR AC 1, 18, 21, 22

TR PS 2, 8, 10

TR AR 3, 5, 6

ST p. 455 (Science Skills)

Interactions Within an Ecosystem

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to	
• describe interactions between biotic and abiotic factors in an ecosystem. (306-3) Include: (i) biotic-abiotic (ii) abiotic-abiotic (iii) biotic-biotic	Students could describe interactions such as; worms aerate soil (biotic-abiotic), sunlight evaporates water (abiotic-abiotic), and insects eat plants (biotic-biotic). Teachers should focus on more than just feeding interactions as examples of biotic-biotic interactions. i.e., a bird makes its nest in a tree. Students could use terrariums, jars or pop bottles to construct their own ecosystem. In constructing these systems, students will need to make various decisions, such as: What organisms will be included? How will I make it sustainable? What biotic and abiotic factors must be taken into account in the design? Will I include animals or just plants? Can I construct an aquatic ecosystem?
• investigate an interaction between a biotic and an abiotic factor in an ecosystem (306-3) • design and carry out an experiment controlling major variables (208-6, 209-1) • organize, compile and display data using tables (209-4, 210-2) • defend a given position on an issue or problem based on their findings (211-5)	**Core Laboratory Activity: Salty Seeds** The laboratory outcomes 208-6, 209-1, 209-4, 210-2, 211-5 and , in part, 306-3 are addressed by completing CORE LAB 1-2B “Salty Seeds”. This will be the first lab in the Intermediate Curriculum to follow a formal methodology. Teachers should review the main components of scientific methodology with a focus on variables (manipulated, responding and control), the importance of controlling all but the manipulated variable, the role of careful observation and recording of data. Teachers should also emphasize the importance of safety in the lab setting. Teachers could also take this opportunity to discuss Nature of Science topics including the fact that there is no such thing as one “scientific method”. Teachers should note that the student textbook uses the terms independent and dependent instead of manipulated and responding respectively. The use of either is acceptable. Teachers may wish to use the resources Science Skill 1 and 2 at the back of the text book to review with students before starting the lab. Students could add the information on biotic-abiotic interactions to their mind map.

Interactions Within an Ecosystem

Suggested Assessment Strategies

Paper and Pencil

- Sketch a local ecosystem (pond, lake, forest, bog, etc.,) that you have recently visited. Include all living and non-living parts of the ecosystem. (306-3)
- Why is soil necessary for plant growth? (306-3)
- Create a list of all biotic and abiotic factors you interact with everyday. (306-3)

Journal

- Draw a natural ecosystem of the setting for a television show or novel. (306-3)
- Describe the biotic-biotic, biotic-abiotic, abiotic-abiotic interactions you have had today. (306-3)

Presentation

- Create a poster display to illustrate examples of each type of interaction (biotic-biotic, biotic-abiotic, abiotic-abiotic). (306-3)

Resources

http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html

ST p. 34

BLM 1-5, 1-7

Core Lab #2: Salty Seeds, p. 22

TR 1.13-1.14

TR AC 1, 4, 18

TR PS 2, 3, 5, 7, 8

TR AR 3, 5

ST pp. 455, 459-463, 472 (Science Skills)

Interactions Within an Ecosystem

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to • describe interactions between biotic and abiotic factors in an ecosystem. (306-3) **(continued)**	
- define symbiosis - define and give examples of parasitism, mutualism and commensalism	Teachers should use local examples of these relationships such as brain worm in caribou (parasitism), barnacles on a whale (commensalism) and the mutualistic relationship between the algae and fungus in a lichen or bees and flowers. To help students differentiate between the three symbotic relationships, teachers could represent the relationships symbolically. For example, mutualism could be represented using 2 happy faces, commensalism, one happy face and one expressionless face, and parasitism could be represented by one happy face and one sad face. Teachers could also choose to represent these using +, -, and 0. (commensalism is +, 0; mutualism is +,+; and parasitism is +,-). Teachers should also explain that the parasite's purpose is not to kill the host as it will then destroy its energy source. While students may suggest predator-prey relationships as examples of parasitism, these are not parasitic relationships and should be differentiated as such. Students could engage in a Quiz-Quiz-Trade activity to review the terms and concepts to this point (see Appendix B).
• identify the niche of producers, consumers, and decomposers in a local ecosystem (304-2) - define and use in context the terms producer, consumer and decomposer	By discussing the roles and the needs of the living things identified in the ecosystem, students could extend their understanding of the roles and relationships among the producers, consumers and decomposers. At this point in the unit, students should be able to define these terms in a general way such as; producers make their own food (green plants), consumers rely on other organisms for food and decomposers break down dead organisms. Teachers could also refer to microorganisms and fungi when referring to decomposers since both are used in the student textbook.
- define herbivores, carnivores and omnivores in terms of different types of consumers	Teachers should clarify that herbivores eat plants, carnivores eat animals, and omnivores eat both plants and animals.

Interactions Within an Ecosystem

Suggested Assessment Strategies

Paper and Pencil

- Students could devise their own symbolic representation of various symbiotic relationships. (306-3)
- What happens to the remains of a moose that dies of natural causes deep in the woods? (304-2, 306-2)
- Describe the niche of the decomposers in an ecosystem. (304-2)
- Plants are producers and fungi are decomposers. Use a Venn diagram to show which conditions, essential for growth and development, might be common for both? (304-2)

Presentation

- In small groups, students perform a role play showing symbiotic relationships (mutualism, commensalism, and parasitism) within an ecosystem. (306-3)

Performance

- In student groups of three, an interviewer will ask questions to a parasite and a host about their experiences in a parasitic relationship. (306-3).

Resources

http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html

ST pp. 34-37

BLM 1-9

ST pp. 25, 40-42

ST pp. 40-41

Interactions Within an Ecosystem (continued)

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to • given a diverse group of organisms, classify them as producers, consumers, or decomposers (304-1)	Students could identify the organisms of their schoolyard ecosystem as producers, consumers, or decomposers. Students should realize that scientists often classify or organize information in order to simplify it, i.e., make it more useful. For example, one way biologists classify living things is to use categories such as, producers, consumers, or decomposers. Teachers could point out that ecosystems can be classed or described by the types of organisms that are found there. For example, water striders, trout, frogs, lily pads, and sedges would allow one to classify the ecosystem as a pond ecosystem. The presence of moose, spruce, birds, foxes, and mosses denotes a forest ecosystem. Providing students with examples of a variety of organisms that could be classified as producers, consumers or decomposers will help students understand that a wide range of organisms can be associated under these categories. For example, students would come to understand that organisms as diverse as spiders, cats and moose can all be classified as consumers because of their reliance on producers or other consumers. Students could add this information to their mind map. As enrichment or as a further STSE connection, teachers could point out that decomposers pose problems to human food supply and that many techniques have been developed to protect food from decomposers. The student textbook provides several examples of these methods.

Interactions Within an Ecosystem (continued)

Suggested Assessment Strategies

Paper and Pencil

- After observing some form of media application (video, television show, magazine article, newspaper article, novel, web site, etc...,) classify organisms in the application as producers, consumers, or decomposers. (304-1, 210-1)

Performance

- Prepare a model of an ecosystem from modeling clay and identify distinguish between producers and consumers in their habitats. (304-1)

Presentation

- Use a bar graph or pie chart to represent the diversity of producer populations in your backyard. (304-1)
- Collect pictures of living organisms from various sources and label them as producers, consumers, and decomposers. (210-1, 304-1)

Resources

http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html

ST pp. 40-42

Energy Flow in an Ecosystem

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to	
• describe how energy is supplied to, and how it flows through, a food chain (306-1)	While this is the first introduction to photosynthesis, it is not a major component or focus of the unit. The depth of treatment should be limited to that which allows students to explain that a plant's energy is derived from the conversion of light energy, carbon dioxide from the air and water into food energy. Students could use a word equation to illustrate the process of photosynthesis as follows: Carbon dioxide + Water --> (in the presence of sunlight) Glucose + Oxygen
- recognize that producers use light energy, carbon dioxide, and water (photosynthesis) to produce energy for the ecosystem - define food chain	Students should describe that the most important role green plants have in any ecosystem is that of being a food (energy) source for consumers and decomposers. Production of oxygen would be considered a by-product of this process. Teachers could have students do a 2-minute review activity (Appendix B).
- construct simple food chains using local examples - classify the organisms within food chains as producers, herbivores, carnivores and omnivores	Students should construct simple food chains (introduced in grade 4) using the organisms identified in the local ecosystem. Their chains should have a maximum of four links. Teachers should emphasize that the direction of the arrows represent the flow of energy from producers to consumers. Teachers should provide examples of both terrestrial and aquatic food chains. Teachers could prepare cards with the names of organisms that are part of local food chains written on them. The number of food chains required would depend on the number of students in the class. To conduct the activity, each student would be given a card and instructed to find the other members of their chain. They must also place themselves in the correct position within the chain. Once this is done, the various chains created could be written on the board and students could be asked whether changes could be made. This activity could also be extended to concretely introduce students to the concept of the food web. Students could make a journal entry using the prompt "without plants, no living organisms could exist". After they have made their entry, teachers could have then engage in a Think-Pair-Share (Appendix B) to discuss their thoughts on this.

Energy Flow in an Ecosystem

Suggested Assessment Strategies

Paper and Pencil

- Students can cartoon or sketch a model of a food chain in action. (306-1)

Presentation

- In small groups, students perform a role play showing a local food chain. (306-1)

Performance

- In groups of two or three, create a food chain using index cards. The cards represent different organisms. Connect each organism with a string by placing holes in the cards. When completed, connect all food chains created by the groups to form one large food web. Display the food web in the classroom from the wall or ceiling. (111-6, 210-2, 306-1)
- Students can be given cards showing arrows and a variety of plants and animals. In groups (or with whole class) they can sort them to create food chain examples. (210-2, 306-1)

Resources

http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html

ST pp. 41, 50-53

ST p. 50

BLM 1-12

ST pp. 40-41, 50-53

BLM 1-11

BLM 7 Activity 2

Energy Flow in an Ecosystem (continued)

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to	
• apply the concept of a food web as a tool for interpreting the structure and interactions of an ecosystem (111-6)	Students should use their knowledge and understanding of food chains to interpret various food webs. It is important that students appreciate the potential complexity of a food web and that an organism in one food web may be part of a number of other food webs.
- define food web	As a supplementary activity teachers could have students construct "living food webs". Each student could represent a different organism in the ecosystem and yarn could be passed between them to represent the flow of energy. Students should gain an appreciation for the complexity of interactions within an ecosystem.
- interpret food webs using organisms from local ecosystems	Students could build on their observations and discussions of ecosystems they have previously investigated. They could use simple diagrams or models to depict the web. This could be done in a poster format using bristol board or a web-page. They could identify a number of the food chains previously constructed and begin to link the food chains together to form food webs. The flow of energy in food chains should be extended to food webs. Students should come to understand that many producers are usually required to provide the energy/food required for a small number of consumers. Teachers should limit this to a qualitative understanding. This new information could be added to their mind map. Students could engage in a Quiz-Quiz-trade activity as a review of the terms and concepts to this point.
• describe, using a pyramid, how energy flows through a food chain. (210-2, 306-1) Include: (i) that energy is transformed into other types of energy (ii) approximately 90% of the energy is lost at each level	Students may find the concept of "pyramids" difficult to understand. Since students will learn more about this concept in high school, teachers should limit their discussion to the points listed in the outcome. Using a simple food chain, such as plants--> hare--> fox, teachers could construct a pyramid with plants at the bottom, hares in the middle, and foxes at the top. The following numbers could be used to indicate the relative amounts of energy available at each level of the food chain/pyramid (plants: 1000 energy units; hares: 100 energy units; foxes: 10 energy units).
- interpret an energy pyramid	Teachers should clarify that the "missing energy" (i.e., 90%) in each level of the food chain/pyramid has either been used for living functions such as growth, movement, and reproduction or lost as heat from the bodies of the herbivores and carnivores involved. Teachers could relate the amount of energy available at each level of the food chain/pyramid to the relative number of organisms at each level (e.g. it takes a lot of plants to support a smaller number of hares; it takes a large number of hares to support a much smaller number of foxes; the number of foxes in a food chain are very much fewer than the number of plants that are at the bottom of the food chain/pyramid).

Energy Flow in an Ecosystem (continued)

Suggested Assessment Strategies

Paper and Pencil

- Some people say: “All flesh is grass”. Explain what is meant by this statement. (111-6, 306-1)
- Why is a triangle or pyramid used to represent the flow of energy in ecosystems? (306-1, 210-2)
- Explain why the population of earthworms is greater than the population of robins in an ecosystem. (210-2, 306-1)
- Given a blank pyramid and a local food chain (examples of plants/animals) students can correctly place the members of the food chain on the pyramid. They can also draw the pyramid themselves. (210-2, 306-1)

Performance

- Draw a food web of organisms from researching various media sources, and illustrate the flow of energy throughout the food web in the form of a poster. (111-6, 210-2, 306-1)

Resources

http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html

ST p. 54

BLM 1-13

BLM 7 Activity 3

ST pp. 55-57

BLM 1-14, 1-15

Energy Flow in an Ecosystem (continued)

Outcomes

Students will be expected to

- list the limitations of food chains, food webs, and energy pyramids (210-3)

- describe how matter is recycled in an ecosystem through interactions among plants, animals, fungi and microorganisms (306-2)
  - illustrate and explain the nutrient cycle

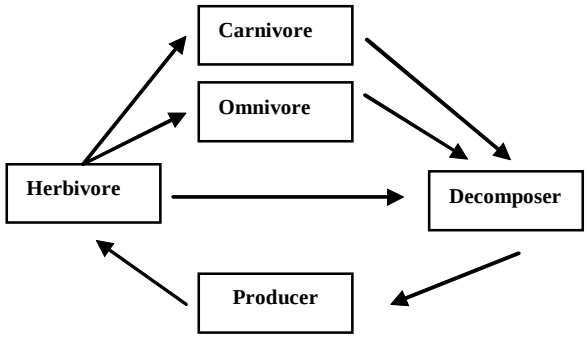
Elaborations—Strategies for Learning and Teaching

Teachers should clarify the fact that energy is transformed into other types of energy and is not always used just for growth. Students could prepare a chart of some other visual representation of the quantity of energy requirements.

Teachers should point out that food chains and food webs are very simplistic and do not represent all the interactions in the ecosystem. It is important that students be asked to identify and reflect upon the strengths and weaknesses in the types of representation used to illustrate energy transformations. Energy pyramids illustrate the direction and relative amounts of energy required and tend to restrict themselves to simple food chain examples.

It is important that the students begin to extend their understanding of the relationships in an ecosystem by including the role of decomposers and looking at the cyclic nature of an ecosystem.

Teachers should emphasize that nutrients are recycled in an ecosystem. All organisms are eventually recycled and their nutrients are returned to the soil through the action of decomposers. The following diagram could be used to illustrate the nutrient cycle:



This nutrient cycle should not be extended to include specific biogeochemical cycles such as nitrogen, water and carbon-oxygen cycles. These are covered in more detail in Science 1206 and Science 2200.

Students could perform activities in which decomposers can be more broadly and carefully studied to emphasize the fact that most decomposers are microscopic. For example, students could observe mould growing on a piece of bread or fruit. Observation and discussions about such things as rotting logs or stumps and compost in compost bins would help students understand and recognize the essential role decomposers play in an ecosystem.

Students could do a 2-minute review (Appendix B) to clarify their thinking on this topic.

Energy Flow in an Ecosystem (continued)

Suggested Assessment Strategies

Paper and Pencil

- If you eat a meal that is 1 kg, why doesn't your mass change by the same amount? (210-3)
- 1000 units of energy are present in the producer level of a food chain. If 10% of energy is lost at each level of a food chain, how many units of energy are present at the third consumer level? (210-3)
- In an essay, flow chart, or cartoon explain how vegetable peels are recycled in an ecosystem. (111-6, 210-2, 306-1, 306-2)

Journal

- Imagine that you are a nutrient in the soil. Describe your journey through the nutrient cycle back to the soil. (306-2)

Performance

- Create a role play to describe a nutrient's journey through the nutrient cycle. (306-2)
- Write a poem that describes the flow of energy from the sun to decomposer. (111-6, 306-1, 306-2)

Resources

http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html

ST pp. 50-57

ST pp. 60-62

Ecological Succession

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to	
• identify changes that have occurred in a local ecosystem over time (306-4) - define succession	The depth of treatment of this topic is limited because the concept of succession will be covered in greater detail and depth in Science 1206/2200. Teachers could have students view pictures, videos, or participate in a field trip to a local area to illustrate the changes that occur in an ecosystem over time. For example, an old farm field may be overgrown with shrubs and trees such as pin cherry, alders and aspen. Students should come to understand that ecosystems are very dynamic. The change may be slow and difficult to perceive over short periods of time such as in the establishment of pioneer species such as mosses and lichens in a mined-over area or it may be rapid as in the case of a forest fire.
• predict what an ecosystem will look like in the future based on the characteristics of the area (208-5) - define pioneer species - define climax community	Pioneer species are the first species to inhabit an ecosystem undergoing succession. Some examples are lichens and sedge grass. Climax community is the final community in the process of succession that remains unchanged for many years. Teachers could engage students in a discussion of the climax community in their region, including the dominant species of flora and fauna.
- distinguish between primary and secondary succession	Two types of ecological succession are generally recognized and should be addressed. First, there is primary succession which takes place in areas lacking soil (bare rocks, sand dunes, surface mining areas, and cooled volcanic lava). More common and recognizable to most students is secondary succession. Examples of secondary succession include abandoned farm land, burned forests, and polluted areas. Students could add to their mind maps.

Ecological Succession

Suggested Assessment Strategies

Presentation

- Using various sources, collect pictures of a certain area over a period of at least three decades. Use the changes in the pictures to illustrate the various stages of succession and to describe the processes that are taking place. (306-4)
- Prepare a video presentation of several local areas in which a number of stages of ecological succession are taking place at once. (208-5, 306-4)

Performance

- Draw a profile of the landscape surrounding a local pond. Describe how the differences in the landscape as you go further away from the pond represent succession. (306-4)
- Interview an individual who works in an ecosystem (e.g., farmers, loggers, fishers, etc.,) to prepare a report on ecological succession in a local area. (306-4)

Paper and Pencil

- Compare the growth and changes of a city to the succession in a natural ecosystem from a pioneer species to a climax community. How would primary succession and secondary succession be compared to the growth of a city? (306-4, 210-2, 208-5)
- Create a Venn Diagram to illustrate similarities and differences between primary and secondary succession. (208-5, 306-4)

Resources

http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html

ST pp. 68-72

ST pp. 68-72

TR AC 15

Ecological Succession (continued)

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to	
• construct a flow chart of images to illustrate the changes occurring during primary and secondary succession. (210-2) Include: (i) bare rock to forest (primary) (ii) forest re-growth after fire (secondary) - describe the ecosystem changes that occur in the examples above. Include: (i) soil composition (ii) plant types (iii) animal types (iv) amount of light	Students could be asked to prepare before and after pictures of local ecosystems. For example, a forest immediately after a fire and 50 years later. It could be advantageous to involve and ask older relatives and/or community members for historical information in order to gain a better appreciation of the magnitude of change over time within a particular ecosystem. Students could engage in a Quiz-Quiz-Trade activity to review the terms and concepts in this section to date.
• describe how our need for a continuous supply of wood resulted in the development of silviculture practice (112-3)	The CORE STSE component of this unit incorporates a broad range of Grade 7 science outcomes. More specifically, it targets, in whole or in part, 112-3, 113-9, 111-1, 113-1 and 112-9. The STSE component, “The Two Centimetre Forest” can be found in Appendix A.
• make informed decisions about forest harvesting techniques taking into account the environmental advantages and disadvantages (113-9)	
• provide examples of how our understanding of boreal forest ecology has influenced our harvesting practices identifying the positive effects of these practices (111-1, 113-1)	
• identify various science- and technology-based careers related to forest management and harvesting (112-9)	

Ecological Succession (continued)

Suggested Assessment Strategies

Presentation

- Role play or debate various points of view regarding the preservation of a local habitat that is about to undergo development (e.g., bridge over a salmon river, highway through a forest, building in a recreation area, etc.,). Students should be assigned the roles of the different stakeholders. (211-5)
- Describe or illustrate what a sidewalk, an abandoned farm, or a clearcut forest might look like ten years in the future. (208-5)

Journal

- Why are blueberries common in an area where a forest was destroyed by fire? (208-5)

Paper and Pencil

- Research why black spruce trees are the first type of tree to grow after a forest fire. (208-5)

Performance

- Order a series of photographs that show several phases of succession. (306-4)
- Draw a ditch/pond/flower bed/woodlot, etc., 20 years ago, at present, and 20 years in the future. (208-5, 306-4))

Resources

http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html

ST pp. 68-72

BLM 1-17, 1-18, 1-19

TR AC 14

ST p. 479 (Science Skills)

Appendix A

Environmental Action

Outcomes

Students will be expected to

- propose and defend a course of action to protect the local habitat of a particular organism (113-11)

  - recognize that humans have influenced the natural environment. Include:
    (i) habitat loss/ destruction
    (ii) harvesting resources
    (iii) pollution
    (iv) introduced species

  - discuss the pros and cons of habitat conservation

Pros

(i) sustainability of resource
(ii) preservation of biodiversity
(iii) eco-tourism

Cons

(i) artificial habitats
(ii) economic loss (job loss, etc.)
(iii) limited human use

Elaborations—Strategies for Learning and Teaching

Students could go to the federal government's committee on the status of endangered wildlife in Canada web site (www.cosewic.gc.ca) and use their "wildlife species search" feature to identify endangered or threatened organisms in a local ecosystem or in the province.

Teachers could conduct a brainstorming session to have students generate the many ways humans have affected their environment. Some examples of this could include the use of ATV's in wetland areas, logging, and open-pit mining.

Students could Think-Pair-Share which of these topics have had the greatest impact on their local ecosystems.

Teachers could use a variety of strategies to have students discuss the pros and cons of habitat conservation. For example, students could be instructed to write a letter to the editor, create a poster or participate in a role-play. Students could be asked to take a stand on the issue and conduct research to be able to support their position. Teachers could use the ideas generated by students, in these various activities, to engage in a class discussion of this topic.

Teachers could incorporate a discussion of sustainable development into this topic. Students could be challenged to identify the environmental, economic, and social/cultural implications of decisions made related to how their local environment is used. During their discussions, students should recognize that appropriate use of resources often involves compromise in one or more of the three aspects of sustainable development. For example, choosing to drain a bog for development or logging a forested area can result in negative environmental impacts (e.g., destroying ecosystems, removing habitat for certain species will reduce biodiversity); positive economic impacts (e.g., good paying jobs, money for government to build hospitals, etc); negative economic impacts (e.g., as people's income goes up, the price of housing also increases and some people may not be able to afford to buy a house); negative social/cultural impacts (e.g., can change the way of life for many communities, may increase the gap between rich and poor, etc); and positive social/cultural impacts (e.g., more government money may mean better schools and a better quality education for everyone, etc).

Students should develop an understanding that decisions to develop any resource should include a discussion of the potential positive and negative effects. Often the decision to develop, or not develop, a particular resource is made after consideration of the positive and negative effects and a "weighing" of these pros and cons.

Environmental Action

Suggested Assessment Strategies

Paper and Pencil

- Write a letter to the editor of a local newspaper outlining your stand for or against an issue related to habitat conservation. (113-11)

Presentation

- Prepare and deliver an oral presentation based on the preservation and protection of a particular habitat. (113-11)
- Explain what might happen to a bog ecosystem if it was exposed to excessive use of all terrain vehicles (ATVs). (306-3)

Performance

- Interview a politician or community leader about a decision made to alter an ecosystem and find out how/if science was used to make the decision. (113-10)
- Participate in a role play/debate on the pros and cons of habitat conservation. (113-11, 211-2)
- Role play or debate various points of view regarding the preservation of a local habitat that is about to undergo development (e.g., bridge over a salmon river, highway through a forest, building in a recreation area, etc.,). Students should be assigned the roles of the different stakeholders. (113-11, 211-5)

Resources

http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html

ST pp. 76-83

TR AC 5

BLM 1-20, 1-22

BLM 7 Activity 1

Environmental Action (continued)

Outcomes

Students will be expected to

- identify individuals or groups in Canada interested in protecting the environment. (112-4, 112-8) Include:
  - (i) local groups and individuals
  - (ii) national groups and individuals
  - (iii) international groups and individuals

Elaborations—Strategies for Learning and Teaching

It is not intended that students be knowledgeable of all the individuals or groups working to protect the environment. Teachers may wish to choose one individual or group from each category to look at in more detail (e.g., when they formed, where they are located, if they have local chapters, their mission and goals, their current and past projects, etc). Teachers could have students work in groups to investigate various local, regional, or national environmental organizations and present what they learn about the group to the class. The following lists provide a starting point for learning about the vast number of individuals and groups working to protect the environment in this province, country, and around the world.

Local groups and individuals could include:

- Protected Areas Association
- Conservation Corps Newfoundland and Labrador
- Department of Environment and Conservation
- Shane Mahoney

National groups and individuals could include:

- Parks Canada
- Canadian Nature Federation
- Nature Conservancy of Canada
- David Suzuki

International groups could include:

- Friends of the Earth
- World Wildlife Fund
- Ducks Unlimited

This list may change over time and teachers are encouraged to select current examples.

Depending on available time, teachers could have students expand their investigation of impacts on local habitats/ecosystems to regional, national and/or international groups that work to address this issue. This would help students identify and associate environmental conservation groups, federal and/or provincial government departments and even Canadians who are well-known for being responsible for, or interested in, aspects of environmental protection.

After completing outcomes 113-10, 112-4 and 112-8, students could use the “What? So What? Now What?” format to create a journal entry (Appendix B) related their thoughts on these issues. Teachers could ask students to share their ideas with the class.

Environmental Action (continued)

Suggested Assessment Strategies

Paper and Pencil

- Write to a group such as the Canadian Wildlife Federation to determine their position on a particular topic or to get information regarding the organization. (112-4, 112-8)

Performance

- Students could engage in an activity to protect and/or enhance a local environment For example, beach clean-up, recycling program, planting trees. (113-11, 211-3)

Presentation

- Give an oral presentation based on the research of a Canadian environmental organization. (112-4, 112-8)

Resources

http://www.ed.gov.nl.ca/edu/k12/curriculum/documents/science/index.html