

Biology 1101

Sustainability of Ecosystems

Curriculum Guide

Credit Value: 1

Biology Concentration

Biology 1101

Biology 2101A

Biology 2101B

Biology 2101C

Biology 3101A

Biology 3101B

Biology 3101C

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To the Instructor

I. Introduction to Biology 1101

Biology 1101, *Sustainability of Ecosystems*, is the first course in the **Biology Concentration** of the Adult Basic Education program. It introduces basic ecological concepts and analyzes ecosystems and their sustainability. This course will help students to understand the interrelationship of local ecosystems, our increasing awareness of ecosystems on a global scale, and a need to sustain ecosystems at all levels.

There is no pre-requisite for this course and the concepts in the course are not necessarily pre-requisite for completion of the other courses in the Biology concentration. However, it is recommended that students complete Biology 1101 first, if they are planning to do the remainder of the Biology courses. Biology 1101 is equivalent to the Life Science portion of Science 1206 in the current High School program.

II. Curriculum Guides

Each new ABE Science course has a Curriculum Guide for the instructor and a Study Guide for the student. The Curriculum Guide includes the specific curriculum outcomes for the course. Suggestions for teaching, learning, and assessment are provided to support student achievement of the outcomes. Each course is divided into units. Each unit comprises a **two-page layout of four columns** as illustrated in the figure below. In some cases the four-column spread continues to the next two-page layout.

Curriculum Guide Organization: The Two-Page, Four-Column Spread

Unit Number - Unit Title		Unit Number - Unit Title	
Outcomes Specific curriculum outcomes for the unit.	Notes for Teaching and Learning Suggested activities, elaboration of outcomes, and background information.	Suggestions for Assessment Suggestions for assessing students' achievement of outcomes.	Resources Authorized and recommended resources that address outcomes.

III. Study Guides

The Study Guide provides the student with the name of the text(s) required for the course and specifies the sections and pages that the student will need to refer to in order to complete the required work for the course. It guides the student through the course by assigning relevant reading and providing questions and/or assigning questions from the text or some other resource. Sometimes it also provides important points for students to note. (See the *To the Student* section of the Study Guide for a more detailed explanation of the use of the Study Guides.) The Study Guides are designed to give students some degree of independence in their work. Instructors should note, however, that there is much material in the Curriculum Guides in the *Notes for Teaching and Learning* and *Suggestions for Assessment* columns that is not included in the Study Guide and instructors will need to review this information and decide how to include it.

IV. Resources

Essential Resources

Science 10

Nelson Science 10 Teacher's Resource for Unit 1 - Sustaining Ecosystems

Recommended Resources

Science 1206: Sustaining Ecosystems Curriculum Guide:

<http://www.ed.gov.nl.ca/edu/sp/sh/sci/sci1206/unit1.PDF>

Nelson Publishing Web Site:

<http://www.science.nelson.com>

Computerized Assessment Bank for Nelson Science 10, Nelson.

Science 10 Teacher's Resource, Applied Supplement.

Other Resources

Center for Distance Learning and Innovation: <http://www.cdli.ca/>

V. Recommended Evaluation

Written Notes	10%
Labs/Assignments	20%
Test(s)	20%
Final Exam (<i>entire course</i>)	<u>50%</u>
	100%

The overall pass mark for the course is 50%.

Sustainability of Ecosystems

Unit 1 - Diversity in Ecosystems

Outcomes

1.1 Demonstrate an understanding of food chains.

1.1.1 Define ecosystem.

1.1.2 Define food chain.

1.1.3 Explain the role of each of the following:

- (i) producers
- (ii) consumers
- (iii) herbivores
- (iv) carnivores
- (v) omnivores
- (vi) detritus
- (vii) decomposers

1.2 Examine factors that effect the survival of a species.

1.2.1 Name several factors that result in population reduction.

1.2.2 Explain the classification system for at-risk species.

1.2.3 Explain the effects of humans on the extinction of species.

1.2.4 Explain the possible effects of extinction.

Notes for Teaching and Learning

Students who have recently completed Intermediate Science should be familiar with the terms and concepts at the beginning of this unit. For other students, this material will be new and may require extra practice for reinforcement.

Students will be introduced to many new terms throughout this course. Instructors could suggest that students start a vocabulary list and add to it regularly as they work through the unit.

Instructors may use the activity “Earth Under a Microscope” to illustrate how living things interact in a closed system. It is assumed that students already know how to prepare wet mounts and how to use the microscope. If students do not have these skills, they will need to complete an exercise to achieve them. Instructors can use various resources to find appropriate material to use for this purpose.

Instructors should review the relevant sections of the Skills Handbook, K: Planning an Investigation, with students before they begin working in the lab.

Instructors should encourage students to read Section 1.4 of the text “What is the Value of Wolves?”, as a thought provoking exercise examining a real situation where a species has declined.

Unit 1 - Diversity in Ecosystems

Suggestions for Assessment

Questions 1.1 - 1.5 in the Study Guide should be assigned to cover Outcome 1.1. Students will find the answers to these questions in Section 1.1 of the text.

Questions 1.6 - 1.9 in the Study Guide should be assigned to cover Outcome 1.2. Students will find the to these questions in Sections 1.2 and 1.3 of the text.

Instructors should assess the student's level of understanding by reading student answers to questions from the Study Guide and providing feedback.

Instructors should ensure that all necessary terms are being added to the student's vocabulary list and provide students with ideas about how to successfully remember definitions.

Blackline Master 1, "Assessment Template for the Microscope", can be used to assess student's knowledge of how to prepare wet mounts and use the microscope properly.

Blackline Master 1.2, "Classification System for at Risk Species", can be used for reinforcement and assessment.

Resources

Science 10, Chapter 1, pages 8 - 46, cover the outcomes for Unit 1.

Science 10 Teacher's Resource, Unit 1, Sustaining Ecosystems.

Science 10 Teacher's Resource, Applied Supplement.

Science 10, Computerized Assessment Bank.

Science 10, Skills Handbook, K: Planning an Investigation.

The center for distance learning and innovation website:
<http://www.cdli.ca/>

Textbook web site:
<http://www.science.nelson.com/>

Blackline Master 1, "Assessment Template for the Microscope".

Blackline Master 1.2, "Classification System for at Risk Species".

Unit 1 - Diversity in Ecosystems

Outcomes

1.3 Explain biotic and abiotic factors that keep natural populations in equilibrium.

1.3.1 Define ecology.

1.3.2 Define biotic and abiotic factors.

1.3.3 Define population and community.

1.3.4 Explain how ecotones guard against extinction.

1.4 Examine the flow of energy in an ecosystem's ecological pyramids (pyramids of energy, numbers and biomass).

1.4.1 Classify organisms as autotroph or heterotroph.

1.4.2 Distinguish between levels of consumers (primary, secondary, and tertiary).

1.4.3 Explain how many interrelated food chains (food web) provide for stability of the community.

1.4.4 Describe the pyramid of energy.

Notes for Teaching and Learning

It would be desirable to have students study a natural ecosystem. However, this is not always possible. 1.8 Case Study, "Comparing Ecosystems", or a computer simulation to illustrate basic components and interactions in an ecosystem, may be used here as an alternative to completing a lab.

Students should be reminded of their introduction to food chains when they were studying Section 1.1 "The Silence of the Frogs". They now should be able to use the terms they are learning in Section 1.11 of the text, in addition to those they previously studied, to classify organisms in food chains and food webs.

Applied Blackline Master 1.5, "Concepts in Ecology", can be photocopied and given to students to help them organize their ideas.

Unit 1 - Diversity in Ecosystems

Suggestions for Assessment

Questions 1.10 - 1.13 in the Study Guide should be assigned to cover Outcome 1.3. Students will find the answers to these questions in Section 1.5 of the text.

Questions 1.14 - 1.21 in the Study Guide should be assigned to cover Outcome 1.4. Students will find the answers to these questions in Sections 1.10 and 1.11 of the text.

Instructors should assess the student's level of understanding by reading student answers to questions from the Study Guide and providing feedback.

Blackline Master 1.5, "Ecological Reach for the Top", can be used for reinforcement and assessment of ecological terms.

Blackline Master 1.11a, "Relationships in Ecosystems" and Blackline Master 1.11b, "Constructing Ecological Pyramids", are good assessment tools for this section.

Resources

Blackline Master 1.5, "Ecological Reach for the Top".

Applied Blackline Master 1.5, "Concepts in Ecology".

Blackline Master 1.11a, "Relationships in Ecosystems".

Blackline Master 1.11b, "Constructing Ecological Pyramids".

Unit 1 - Diversity in Ecosystems

Outcomes

- 1.4.5 Describe the pyramid of numbers.
- 1.4.6 Describe the pyramid of biomass.
- 1.5 Analyze the roles of organisms in ecosystems.
 - 1.5.1 Define ecological niche and relate it to habitat.
 - 1.5.2 Describe the effects of introducing a new species into an ecosystem.

Notes for Teaching and Learning

Instructors should provide students with additional examples and diagrams to help them understand the three different types of ecological pyramids included in this unit. Many resources are available for this, or instructors could make up their own examples.

Unit 1 - Diversity in Ecosystems

Suggestions for Assessment

Given the necessary information about a food chain, students should be able to show the relationships in a pyramid of energy, a pyramid of numbers, and a pyramid of biomass.

This is the end of Unit 1. Instructors may assign questions from the Chapter 1 Review, and assess student answers.

Answers for all questions in the text are provided in the Teacher's Resource.

Instructors may also give a chapter quiz and the mark would be used as part of the final mark for the course.

Student's written work done for completion of 1.8 Case Study, "Exploring Ecosystems", may also be used for evaluation purposes.

Students could also be evaluated on research done for a written report to be submitted, based on 1.4 Explore an Issue, "What is the Value of Wolves". Such a report could be linked with the Language Arts program. This evaluation could include an assessment of the student's ability to find, select and integrate information from a variety of sources.

Resources

Science 10, Chapter 1 Review, pages 46 - 47.

Science 10 , Computerized Assessment Bank.

Unit 2 - Change and Stability in Ecosystems

Outcomes

2.1 Illustrate the cycling of matter through biotic and abiotic components of an ecosystem by tracking carbon, nitrogen, and oxygen.

2.1.1 Identify the elements that are common to living things.

2.1.2 Explain the importance of photosynthesis and cellular respiration to ecosystems.

2.1.3 Describe the importance of oxygen to ecosystems.

2.1.4 Define the carbon cycle and describe the process required to cycle carbon through ecosystems.

2.1.5 Define the nitrogen cycle and describe the process required to cycle nitrogen through ecosystems.

2.1.6 Describe what is being done to negate human impact on these cycles.

Notes for Teaching and Learning

Students who have recently completed Intermediate Science should be familiar with the structure of atoms and molecules. For other students, this material will be new and may require explanation.

Students may also have some familiarity with the carbon cycle from Intermediate Science. This course builds on that knowledge. For many students, however, this will be their first encounter with the carbon cycle.

Instructors should make sure that students realize that The **carbon cycle** is more accurately called the **carbon-hydrogen-oxygen cycle**, since it involves the recycling of all 3 substances. In this course they will use the term **carbon cycle** for short. They will not be learning a separate diagram for the oxygen cycle.

The water cycle is not covered in this course, but students should be reminded of its importance to life on earth.

Blackline Master 2.4, “Photosynthesis and Respiration Compared”, can be used as a handout for students to include with their notes.

Outcome 2.1.6 is covered by having students read and complete work for 2.8 Case Study, “Effects of Deforestation on Cycling”, and by reading Section 2.7.

Unit 2 - Change and Stability in Ecosystems

Suggestions for Assessment

Questions 2.1 - 2.2 in the Study Guide should be assigned to cover Outcome 2.1.1. Students will find the answers to these questions in Section 2.1 of the text. Ask students, from their definition of organic chemicals, to identify the elements that are common to living things.

Questions 2.3 - 2.7 in the Study Guide should be assigned to cover Outcomes 2.1.2, 2.1.3, and 2.1.4. Students will find the answers to these questions in Sections 2.4 and 2.5 of the text.

Questions 2.8 - 2.12 in the Study Guide should be assigned to cover Outcome 2.1.5. Students will find the answers to these questions in Sections 2.6 of the text.

Blackline Master 2.1 can be used to determine students' knowledge about the structure of atoms and molecules.

Blackline Master 2.5 and 2.6a can be used to for practice and to assess students' understanding of the carbon and nitrogen cycles.

Applied Blackline Master 2.5 can be used to give students the opportunity to test the effect of carbon dioxide levels on photosynthesis. This could be done as a lab activity and included in the evaluation for the unit.

Outcome 2.2.1 can be covered by studying Section 16.2 of the text. Questions 2.13 - 2.15 in the Study Guide should be assigned.

Instructors should assess the student's level of understanding by reading student answers to questions from the Study Guide and providing feedback.

Resources

Science 10, Chapter 2, pages 48 - 85, covers the outcomes for Unit 2.

Science 10 Teacher's Resource, Unit 1, Sustaining Ecosystems.

The center for distance learning and innovation website:

<http://www.cdli.ca/>

Textbook web site:

<http://www.science.nelson.com/>

Blackline Master 2.1, "Atoms, Elements, and Compounds".

Blackline Master 2.5, "The Carbon Cycle".

Blackline Master 2.6a, "The Nitrogen Cycle".

Applied Blackline Master 2.5, "Effect of Carbon Dioxide Levels on Photosynthesis".

Unit 2 - Change and Stability in Ecosystems

Outcomes

2.2 Describe how humans have altered the cycling of carbon, oxygen and nitrogen in ecosystems.

2.2.1 Describe the significance of the greenhouse effect and ozone depletion.

2.3 Analyze how the growth of populations is limited by available resources and other factors.

2.3.1 Identify factors that regulate population size (natality, mortality, immigration, emigration).

2.3.2 Identify factors that limit populations in their natural environment.

2.3.3 Explain the difference between density-dependent and density-independent factors.

2.3.4 Define carrying capacity.

2.4 Analyze the impact of external factors on ecosystems. Include:

- weather change
- introduced species
- pollution
- industry/agriculture

Notes for Teaching and Learning

The cycling of matter is a vital topic that will demonstrate human impacts on both smaller systems and the entire biosphere. All nutrients are cycled through systems, moving around in different forms. They never leave the planet. The basic cycle is from the atmosphere to the ecosystem and back to the atmosphere. How the nutrients move can be quite complex. Diagrams of each cycle are important and will become more useful if the impact created by humans is related to them. Discussions of global warming (covered in this unit) and eutrophication (covered in Unit 4) will completely sum up any discussion of the cycling of carbon, oxygen and nitrogen.

Students should realize that these are examples of major threats to ecosystems worldwide.

Unit 2 - Change and Stability in Ecosystems

Suggestions for Assessment

Instructors should assign work based on one or more of the Case Studies and/or Exploring an Issue sections listed to cover Outcome 2.4:

- Comparing Ecosystems, page 28.
- Pesticides, page 52.
- Effects of Deforestation on Recycling, page 72.
- Should We Use Pesticides to Control Pests?, page 81.
- The Great Lakes, page 140.
- Managing Fish Populations, page 150.
- How many Potatoes are Enough?, page 112.

The questions answered by students from the “Case Study” and “Exploring an Issue” sections that have been assigned can be assessed and given a mark. The content of these sections may be omitted from the final exam for the course.

This is the end of Unit 2. Instructors may assign questions from the Chapter 2 Review, and assess student answers.

Answers for all questions in the text are provided in the Teacher’s Resource.

Instructors may also give a chapter quiz that may be used as part of the final mark for the course.

Resources

Science 10, Chapter 16, Section 16.2, pages 625 - 628.

*Website for movie on ozone depletion:
<http://www.mcgrawhill.ca/school/booksites/biology/student+resources/>*

*Website for movie on global warming:
<http://www.mcgrawhill.ca/school/booksites/biology/student+resources/>*

Science 10, Chapter 2 Review, pages 84 - 85.

Science 10 , Computerized Assessment Bank.

Unit 3 - Sustaining Terrestrial Ecosystems

Outcomes

3.1 Explain why ecosystems with similar characteristics can exist in different geographic locations.

3.1.1 Define biome.

3.1.2 Analyze the climate, vegetation, and physical geography of Canadian biomes.

3.1.3 Relate the distribution of biomes within Canada to the impact of external factors.

3.2 Describe how soil composition and fertility can be altered and how these changes could affect the ecosystem.

3.2.1 Describe the components of soil.

3.2.2 Describe how soil fertility could be altered.

3.3 Explore the effects of acid deposition on the environment.

3.3.1 Define acid precipitation.

3.3.2 Identify the causes of acid precipitation.

3.3.3 Identify the effects of acid rain.

Notes for Teaching and Learning

Biomes are large systems and their distribution is largely based upon abiotic factors such as radiant energy, precipitation, nutrient levels, and elevation. A brief examination of the biomes in Canada can demonstrate clearly the importance of these abiotic factors and how external factors impact upon them. (Some authors have suggested the Taiga is vanishing as a result of global warming and disrupted nutrient cycles.)

Students could be given Blackline Master 3.1 to use for summarizing the information on biomes.

The study of acid rain is used as an example of a major threat to worldwide ecosystems. The study of the greenhouse effect and ozone depletion, covered earlier in this course, were also examples of global environmental problems.

Unit 3 - Sustaining Terrestrial Ecosystems

Suggestions for Assessment

Questions 3.1 - 3.3 in the Study Guide should be assigned to cover Outcome 3.1. Students will find the answers to these questions in Section 3.1 of the text.

Questions 3.4 - 3.5 in the Study Guide should be assigned to cover Outcome 3.2. Students will find the answers to these questions in Section 3.3 of the text.

Questions 3.6 - 3.8 in the Study Guide should be assigned to cover Outcome 3.3. Students will find the to these questions in Section 3.11 of the text.

If facilities and time permit, students could complete 3.12 Investigation, “Assessing the Effects of Acid Rain”. Their work could be evaluated and used as part of the mark for this course. (Applied Blackline Master 3.12 may be used as a student report for this lab.)

Students could complete 3.2 Case Study, “Biogeography”, as a demonstration of the importance of climate variation as an important abiotic factor in biome distribution. Their work could be used as part of the evaluation for this unit.

Instructors should assess the student’s level of understanding by reading student answers to questions from the Study Guide and providing feedback.

This is the end of Unit 3. Instructors may assign questions from the Chapter 3 Review, and assess student answers. Answers for all questions in the text are provided in the Teacher’s Resource.

Either Investigation 3.5 or 3.6 should be completed and used as part of the evaluation for the course.

Instructors may also give a chapter quiz that may be used as part of the final mark for the course.

Resources

Science 10, Chapter 3, pages 86 -123, covers the outcomes for Unit 3.

Science 10 Teacher’s Resource, Unit 1, Sustaining Ecosystems.

The center for distance learning and innovation website:
<http://www.cdli.ca/>

Textbook web site:
<http://www.science.nelson.com/>

Blackline Master 3.1, “Characteristics of Canadian Biomes”.

Applied Blackline Master 3.12, “The Effects of Acid Rain”.

Core Lab:

Investigation 3.5, Soil Nutrients and Plant Growth,

or

Investigation 3.6, The Animal Community in Soils.

Unit 4 - Sustaining Aquatic Ecosystems

Outcomes

4.1 Examine the factors that affect survival and equilibrium of populations in a freshwater aquatic ecosystem.

4.1.1 Identify the diverse abiotic factors of aquatic ecosystems.

4.1.2 Outline the general structure of lakes and ponds.

4.1.3 Identify two kinds of lakes (oligotrophic and eutrophic).

4.1.4 Define eutrophication.

4.1.5 Explain the effects of seasonal variations in lakes.

4.2 Examine sources of water pollution.

4.2.1 Define water pollution.

4.2.2 Identify categories of pollutants and possible sources of each.

4.2.3 Identify indicators of water quality.

Notes for Teaching and Learning

Instructors should make sure that students realize the importance of aquatic ecosystems to the sustainability of the planet and all its inhabitants.

Review the concept of sustainability with students. (They learned about it in Unit 1.)

Outcome 4.1 is covered in Section 4.1 of the text. Instructors should point out that this section deals with freshwater aquatic ecosystems, using lakes as an example. Make sure that students realize that freshwater aquatic ecosystems also include swamps, marshes, ponds and rivers. Marine aquatic ecosystems will be studied later in this unit.

Outcome 4.2 is covered in Section 4.2 of the text. Investigations 4.3, 4.4, and 4.6 are optional activities that may be used to enhance students' understanding of water pollution.

Unit 4 - Sustaining Aquatic Ecosystems

Suggestions for Assessment

Questions 4.1 - 4.7 in the Study Guide should be assigned to cover Outcome 4.1. Students will find the answers to these questions in Section 4.1 of the text.

Questions 4.8 - 4.9 in the Study Guide should be assigned to cover Outcome 4.2. Students will find the answers to these questions in Section 4.2 of the text.

If facilities and time permit, students could complete 4.3 Investigation, “Phosphate Identification”, 4.4 Investigation, “Oxygen Demand and Organic Pollutants”, or 4.6 Investigation, “Biological Indicators of Pollution in Streams”. Their work could be evaluated and used as part of the mark for this course.

Blackline Master 4.2 may be used to assess students ability to analyze information on the safety of drinking water.

Resources

Science 10, Chapter 4, pages 124 -157, covers the outcomes for Unit 4.

Science 10 Teacher’s Resource, Unit 1, Sustaining Ecosystems.

The center for distance learning and innovation website:
<http://www.cdli.ca/>

Textbook web site:
<http://www.science.nelson.com/>

Blackline Master 4.2, “Drinking Water: How Safe Is It?”

Unit 4 - Sustaining Aquatic Ecosystems

Outcomes

4.3 Examine the factors that affect survival and equilibrium of populations in a marine aquatic ecosystem.

4.3.1 Identify the major abiotic factor (salt) that makes marine ecosystems different from freshwater ecosystems.

4.3.2 Identify the major zones of the marine aquatic ecosystem.

4.3.3 Identify the major divisions of the coastal zone.

4.4 Examine the effects of crude oil on marine ecosystems.

4.4.1 Identify how crude oil reaches marine ecosystems.

4.4.2 Identify the effects if crude oil reaches marine ecosystems.

4.4.3 Recognize ways that oil spills may be cleaned up.

Notes for Teaching and Learning

Students should realize that all the abiotic factors that affect freshwater aquatic ecosystems, also affect marine aquatic ecosystems. In addition the salinity of the water in the marine environment makes it different in many ways.

Students may be provided with Applied Blackline Masters 4.10 and 4.10a to use as they complete the assignment for Section 4.10 of the text.

Unit 4 - Sustaining Aquatic Ecosystems

Suggestions for Assessment

Questions 4.10 - 4.12 in the Study Guide should be assigned to cover Outcome 4.3. Students will find the to these questions in Section 4.7 of the text.

An assignment should be used to cover outcomes 4.4 and 4.5. Instructors could compose their own questions or the assignment could consist of questions from the Understanding Concepts, Making Connections, and/or Reflecting sections of 4.8 and 4.9 and Understanding the Issue questions in 4.10 in the text. The assignment could also include completion of Applied Blackline Masters “The Fish Conference - National Position” and “Summary/critique of Other Nations’ Fishing Practices” found in the Applied Supplement Teacher’s Resource.

Alternatively, given that the study of marine ecosystems is such a relevant topic to life in this province, instructors may wish to have students explore these topics further. This could be done by having students complete a more in-depth study and presenting their results in a different way (through a written report, a class presentation or some other method). This would provide a good opportunity for links with the Language Arts program.

The assignment and/or presentation should be marked and used as part of the student’s evaluation for this course.

Resources

Applied Blackline Master 4.10, “The Fish Conference - National Position”.

Applied Blackline Master 4.10 a, “Summary/critique of Other Nations’ Fishing Practices”.

Unit 4 - Sustaining Aquatic Ecosystems

Outcomes

4.5 Analyze how fish populations may be managed.

4.5.1 Define sustainable yield.

4.5.2 Describe patterns of fish catches in recent years.

4.5.3 Suggest ways to create a sustainable fishery.

Notes for Teaching and Learning

See the Suggestions for Assessment section on the previous page for suggestions of how to cover outcome 4.5.

Unit 4 - Sustaining Aquatic Ecosystems

Suggestions for Assessment

Instructors should assess the student's level of understanding by reading student answers to questions from the Study Guide and providing feedback.

This is the end of Unit 4. Instructors may assign questions from the Chapter 4 Review, and assess student answers.

Answers for all questions in the text are provided in the Teacher's Resource.

Instructors may also give a chapter quiz that may be used as part of the final mark for the course.

Instructors should give a final examination at the end of the course which covers all units of the course.

Resources

Science 10 , Computerized Assessment Bank.