

Adult Basic Education  
Science

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# Science 2100C

## A Global View of Ecosystem Sustainability and Weather

### Curriculum Guide

**Prerequisites:** Science 2100A and Science 2100B

**Credit Value:** 1

**Science Courses [General College Profile]**

Science 2100A

Science 2100B

**Science 2100C**

Science 3101A

Science 3101B

Science 3101C

Science 3102A

Science 3102B

Science 3102C



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## To the Instructor

### **I. Introduction to Science 2100C**

This course is intended to help students expand upon the knowledge that they gained through completing the first two science courses for the General College Profile and to apply that knowledge to some of today's major global environmental issues.

The course is divided into two units. The first unit, "*Sustaining Ecosystems*", introduces students to the terrestrial biomes in Canada. They examine the concept of sustainable development and how it applies to ecosystems. Using acid precipitation as an example, students will investigate the extent of a major ecological problem, its causes, and possible solutions.

The second unit, "*A Global Weather Model*", discusses two of the factors that are responsible for weather and climate on a global scale: winds and ocean currents. Students are then given the opportunity to describe and explain the formation of some extreme weather events. They finish the unit by investigating the causes and impacts of climate change.

**Science 2100A and Science 2100B are prerequisites to this course.** Science 2100A, 2100B and 2100C are equivalent to Science 2200 in the high school program.

The textbook for this course is *Nelson Science 10: Concepts and Connections*; Nelson Thomson Learning; 2002.

**\*Note** that students are **not** permitted to receive credit for both the ABE course **Biology 1101 and/or Earth Systems** (or Science 1206 in the current high school program) and **Science 2100C**, since there is too much overlap of content.

**To the Instructor**

**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**

<b>Unit Number - Unit Title</b>		<b>Unit Number - Unit Title</b>	
<b>Outcomes</b> Specific curriculum outcomes for the unit.	<b>Notes for Teaching and Learning</b> Suggested activities, elaboration of outcomes, and background information.	<b>Suggestions for Assessment</b> Suggestions for assessing students' achievement of outcomes.	<b>Resources</b> 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***

*Nelson Science 10: Concepts and Connections; Nelson Thomson Learning; 2002*

*Nelson Science 10: Concepts and Connections - Teacher's Resource  
Nelson Thomson Learning; 2002*

### ***Recommended Resources***

*Nelson Science 10: Concepts and Connections - Student Record of Learning; Nelson Thomson Learning; 2002*

*Science 2200 Curriculum Guide:*

<http://www.ed.gov.nl.ca/edu/sp/sh/sci/science2200jun04.pdf>

*Science 10 Teacher's Resource, Applied Supplement.*

*Nelson Publishing Web Site:*

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

### ***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%



# **A Global View of Ecosystem Sustainability and Weather**

## Unit 1 - Sustaining Ecosystems

### Outcomes

1.1 Explain why ecosystems with similar characteristics can exist in different geological locations.

1.1.1 Define biome.

1.1.2 Define biogeography.

1.1.3 Describe the four Canadian Biomes in terms of abiotic factors that contribute to their formation and maintenance.

1.1.4 Describe the four Canadian Biomes in terms of their representative dominant plant and animal species.

1.1.5 Discuss how abiotic factors such as light, temperature, and water affect the distribution of organisms on Earth.

### Notes for Teaching and Learning

This section provides a cursory examination of the flora and fauna of the four main biomes found in Canada. In the province of Newfoundland and Labrador, the tundra is found in northern Labrador. The remainder of Labrador and the entire island portion of the province is boreal forest.

While this course limits the study of biomes to the four large land biomes of Canada, students may find it interesting to learn about other biomes, especially the aquatic biomes of this province. Instructors may want to give an assignment that asks students to research and report on other biomes.

## Unit 1 - Sustaining Ecosystems

### Suggestions for Assessment

There are many opportunities for research and additional assignments in this course. Working on assignments in various forms provides good opportunities for links with the English Language Arts program. Instructors should develop and assign work when they feel it is necessary either for review or for extension or enrichment of a particular topic. All assignments should be given a mark that is used as part of the final evaluation for the course.

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

Students could be assigned the Extension Activity, "*Canadian Biomes*", on page 59 of the Student Record of Learning (SRL).

If students are working through this course as a group, they could complete the activity in the Blackline Master (BLM) 1.13a, "*Who's Where and What's What in Canadian Biomes?*".

Instructors should note that answers for all BLMs are given in the Teacher's Resource.

Students could be given an assignment to research and report on the other biomes that exist.

### Resources

*Science 10: Concepts and Connections*, page 15 and pages 42 - 44.

*Science 10: Concepts and Connections, Teacher's Resource*, pages 1 - 61 to 1 - 64.

The Centre for Distance Learning and Innovation website:

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

Textbook web site:

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

Student Record of Learning (SRL), page 59, "*Canadian Biomes*".

Blackline Master (BLM) 1.13a, "*Who's Where and What's What in Canadian Biomes?*".

## Unit 1 - Sustaining Ecosystems

### Outcomes

1.2 Explain why an ecosystem may respond differently to short-term stress and long-term change.

1.2.1 Explain the ecological importance of forests.

1.2.2 Explain what is meant by clear cutting and selective cutting.

1.2.3 Describe the potential ecological impact that a large scale clear-cut logging project could have, including temperature increase, water loss, food web disruption, and habitat loss.

1.3 Understand that sustainable development is a shift in the way people view resource development.

1.3.1 Define sustainable development.

1.3.2 Distinguish between renewable and nonrenewable resources.

1.3.3 Define integrated resource management.

1.4 Compare the risks and benefits to the environment of applying new technology in an industry such as logging.

### Notes for Teaching and Learning

This section will present an opportunity to study an example of how human activities affect two important terrestrial biomes in Canada, the temperate deciduous forest and the boreal forest. Logging of vast areas of land is always a controversial and complex issue. The issue of deforestation and clear-cutting is very topical. Instructors could supplement this section with reports from local and national media.

Students may think that if logging companies replant trees, this is good for the ecosystem. However, logging companies usually only replant trees that are valuable to them. This produces a forest with less biodiversity than a natural forest. Such a forest is very susceptible to insect and pest damage.

The issue of sustainability should be stressed as students study this section. They will be introduced to the term in the assignment for the unit.

## Unit 1 - Sustaining Ecosystems

### Suggestions for Assessment

Students are required to complete an assignment designed to cover Outcomes 1.3 to 1.6. Instructors could use the assignment included in Appendix A or develop another assignment to cover these outcomes.

**Note** that copies of the assignments for this course are not included in the Study Guide. Instructors will need to copy assignments and provide them to the students.

Instructors should decide and make it clear to students whether or not the material covered in the assignment will be tested. It is suggested that students are not tested on the material covered in the assignments.

### Resources

*Science 10: Concepts and Connections*, pages 50 - 51.

*Science 10: Concepts and Connections, Teacher's Resource*, pages 75 - 79.

Assignment 1, "Sustainable Development", Appendix A.

Government Forest Resources Website:  
<http://www.nr.gov.nl.ca/forestry/industry>

## Unit 1 - Sustaining Ecosystems

### Outcomes

1.5 Describe the potential impact of new technology on a native species.

1.5.1 Describe the impact of clear cut logging on the Newfoundland marten.

1.6 Discuss the potential impacts with respect to resource harvesting or conservation in an area such as Main River.

1.7 Examine the extent of a major ecological problem and some possible solutions.

1.7.1 Define acid precipitation.

1.7.2 Using the technologies that produce acid precipitation as examples, explain how these technologies can be seen as a “double edged sword”.

1.7.3 List the gases that dissolve in water to produce acid precipitation.

1.7.4 Describe the effects of acid precipitation on man-made materials, humans and ecosystems.

1.7.5 Describe how increasing automobile use leads to acid precipitation.

### Notes for Teaching and Learning

The species that has been chosen to illustrate the impact of the technology used in the logging industry is the pine marten. The conservation area that has been chosen is the Main River. Current information for both of these is available on the websites listed in the resources.

Many students will not be familiar with pH measurement. Instructors should explain that pH is the measure of how acidic ( $\text{pH} < 7$ ) or basic ( $\text{pH} > 7$ ) a substance is. Substances that have a  $\text{pH} = 7$  are neutral. It is important for students to understand that small changes in pH value indicate very large changes in level of acidity (i.e. pH scale is logarithmic). Therefore each decrease of 1.0 on the pH scale means a ten-fold increase in the amount of acid present. For example, a solution with  $\text{pH} = 3$  is 10 times more acidic than one that is  $\text{pH} = 4$  and 100 times more acidic than one that is  $\text{pH} = 5$ .

BLM 1.18c, “*Formation of Acid Rain*”, is a copying exercise that can be used to help students understand the production of acid rain.

## Unit 1 - Sustaining Ecosystems

### Suggestions for Assessment

Instructors could assign the Extension Activity, “*Logging Forests*”, pages 75 - 76 in the SRL as part of the assignment or as an additional activity.

BLM 1.18a, “*Acid Precipitation Case Study*”, can be used as practice in interpreting data.

BLM 1.18b, “*Do You Know What Canadian Technologies Have Been Developed to Reduce Acid Rain Emission?*”, can be used as an assignment or enrichment activity. It requires careful reading of 9 web sites.

### Resources

*Science 10: Concepts and Connections*, pages 52 - 55.

*Science 10: Concepts and Connections, Teacher’s Resource*, pages 80 - 85.

Main River websites:

[http://www.chrs.ca/Rivers/Main/Main\\_e.htm](http://www.chrs.ca/Rivers/Main/Main_e.htm)

<http://www.env.gov.nl.ca/parks/rivers/main/>

Pine Marten websites:

[http://www.speciesatrisk.gc.ca/search/speciesDetails\\_e.cfm?SpeciesID=134](http://www.speciesatrisk.gc.ca/search/speciesDetails_e.cfm?SpeciesID=134)

<http://www.env.gov.nl.ca/snp/AnimalCare/EndSpecies/PineMarten/PineMarten.htm>

SRL, “*Logging Forests*”, pages 75 - 76.

BLM 1.18a, “*Acid Precipitation Case Study*”.

BLM 1.18b, “*Do You Know What Canadian Technologies Have Been Developed to Reduce Acid Rain Emissions?*”.

## Unit 1 - Sustaining Ecosystems

### Outcomes

1.8 Investigate the effects of acid rain on both biotic and abiotic aspects of the environment.

### Notes for Teaching and Learning

Outcome 1.8 is accomplished by completing Investigation 1.19, "*The Effects of Acid Precipitation*", pages 54 - 55.

Instructors should consult the Teacher's Resource for background, a list of materials required, and answers to the investigation questions.



## Unit 1 - Sustaining Ecosystems

### Suggestions for Assessment

Students are required to complete the **Core Lab**, Investigation 1.19, “*The Effects of Acid Precipitation*”. Pages 83 - 85 in the SRL can be used as a report for the investigation/lab.

The mark obtained on the investigation/lab should be used as part of the final evaluation for the course.

Instructors should assess the student’s level of understanding for this unit by reading student answers to questions from the *Study Guide* and providing feedback. It is suggested that the written notes are given a value of 10% of the final mark for the course.

This is the end of Unit 1. Instructors may give a unit test to assess students’ knowledge and understanding of the material covered in this unit. The mark given for the test should be included to determine the final mark for the course.

### Resources

BLM 1.18c, “*Formation of Acid Rain*”.

#### **Core Lab:**

Investigation 1.19, “*The Effects of Acid Precipitation*”, pages 54 - 55.

SRL, pages 83 - 85.

## Unit 2 - A Global Weather Model

### Outcomes

2.1 Use weather data to describe and explain heat transfer in the atmosphere and hydrosphere showing how these affect air currents.

2.1.1 Define jet stream and prevailing winds.

2.1.2 Identify the different prevailing winds around the Earth.

2.1.3 Describe the formation of global winds.

2.1.4 Explain the importance of convection and the Earth's rotation in causing prevailing winds.

2.2 Use weather data to describe and explain heat transfer in the atmosphere and hydrosphere showing how these affect ocean currents.

2.2.1 Define ocean currents.

2.2.2 Identify factors that are responsible for causing ocean currents, including solar energy, wind, and water density.

### Notes for Teaching and Learning

The text is very brief in its discussion of global winds. Students may not have the prerequisite knowledge and understanding to explain what they will read. They should concentrate on description rather than explanation of the factors that cause global air movement.

Students are encouraged to examine Figure 3 on page 231. Instructors should make sure that students are familiar enough with global geography to locate Canada, particularly Newfoundland and Labrador, and Europe.

Instructors could use the global winds activity outlined on the NASA website to help students identify the locations and names of the various global winds.

Students should realize that many of the global winds impact our weather and climate, even though they are thousands of kilometers away. For example, the mid-latitude westerlies bring a lot of unsettled weather in from the south. Also, these winds carry pollution from the industrial areas of the eastern United States to our shores.

Students may have encountered the term density before but they may not be clear on what it means. Instructors should make sure that students realize that some substances are more dense than others (e.g. water is more dense than air). They should also ensure that students know that cold air (or water) is denser than warm air (or water). Therefore the cold air sinks and the warm air rises causing a convection current.

## Unit 2 - A Global Weather Model

### Suggestions for Assessment

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

Instructors should ensure that all necessary terms are being added to the student's vocabulary list for this unit.

Students could be given a couple of copies of BLM 4.15, "*Map of the World*", and asked to sketch in the global wind patterns on one and to draw and label the warm and cold currents adjacent to Canada on the other.

Students could complete the questions on page 364 of the SRL for review of Global Winds.

### Resources

*Science 10: Concepts and Connections*, pages 230 - 235.

*Science 10: Concepts and Connections, Teacher's Resource*, pages 4 - 52 to 4 - 58 .

NASA website on global winds:  
<http://kids.earth.nasa.gov/archive/nino/global.html>

SRL, page 364.

## Unit 2 - A Global Weather Model

### Outcomes

- 2.2.3 Identify the two ocean currents (Labrador current and Gulf stream) that impact the weather and climate in Newfoundland and Labrador.
- 2.2.4 Describe two effects that ocean currents have on weather and climate. Include temperature change and precipitation change.
- 2.3 Describe and explain the effects of heat transfer on the development, severity and movement of weather systems.
- 2.3.1 Distinguish between weather watch, weather advisory and weather warning.
- 2.3.2 Define and identify the main features of the following extreme weather events:
- (i) thunderstorms
  - (ii) tornadoes
  - (iii) hurricanes
  - (iv) blizzards
  - (v) floods
- 2.3.3 Describe how to protect yourself during the following extreme weather events:
- (i) thunderstorms
  - (ii) tornadoes
  - (iii) hurricanes
  - (iv) blizzards
  - (v) floods

### Notes for Teaching and Learning

Students are encouraged to examine Figure 1 on page 232 carefully. They may need a brief geography lesson to make sure they can locate Canada and other land masses as appropriate.

Students should understand that the meeting of the Labrador Current and the Gulf Stream off the southeast coast of Newfoundland results in large amounts of fog in these areas.

Since this course covers only three of the factors involved in the global weather model described in Section 4.16 of the text, there are no specific outcomes or questions to cover this section. However, students should understand that there is no single event that creates weather and climate. Instead, weather and climate are influenced by many factors which are summarized in Section 4.16.

If possible, students should access the Meteorological Service of Canada website and the Environment Canada Weather Office website for more information and current weather conditions.

Instructors could use Environment Canada's "*Top 10 Weather Stories*" website to allow students to look at the most extreme weather events of the past year (or for other years in the archive).

## Unit 2 - A Global Weather Model

### Suggestions for Assessment

The Extension Activity on page 365 and/or the Questions on pages 366 - 367 of the SRL may be used for review and reinforcement of the concepts covered in Section 4.15 of the text.

There are many opportunities for additional assignments on the topics covered in this unit. These could include the Activity outlined on pages 236 - 237 of the text (pages 372 - 378 are the corresponding pages in the SRL) or the debate outlined on page 243 of the text.

Students could also be assigned the Extension Activity on pages 379 - 383 of the SRL.

Students may be interested in further researching some extreme weather events. This would be a good opportunity to link with the English Language Arts program.

### Resources

SRL, pages 365 - 367.

Government website on sustaining resources:  
<http://www.environmentalresources.gc.ca/default.asp?lang=En&nav=B3BE4E55-00>

Meteorological Service of Canada:  
<http://www.msc-smc.ec.gc.ca/>

Weather warnings:  
[http://www.msc-smc.ec.gc.ca/cd/brochures/warning\\_e.cfm](http://www.msc-smc.ec.gc.ca/cd/brochures/warning_e.cfm)

Environment Canada weather office:  
[http://weatheroffice.ec.gc.ca/canada\\_e.html](http://weatheroffice.ec.gc.ca/canada_e.html)

Top 10 weather stories:  
[http://www.msc-smc.ec.gc.ca/media/top10/index\\_e.html](http://www.msc-smc.ec.gc.ca/media/top10/index_e.html)

## Unit 2 - A Global Weather Model

### Outcomes

2.4 Describe the human impact on climate change/global warming.

2.4.1 Define climate change and global warming.

2.4.2 Describe how human activities impact climate change/global warming.

2.4.3 Describe the impact of climate change on economic, social and environmental conditions.

2.4.4 Identify ways in which you as an individual might help solve the problem of global warming.

### Notes for Teaching and Learning

This section relates back to the study of the environment in Science 2100A and sustainability of ecosystems in the first unit of this course.

Outcome 2.4 will be covered by completing Assignment 2, “*Climate Change and Global Warming*” (Option 1, 2, or 3) found in Appendix A. Instructors may choose the option or give students the choice.

Instructors will need to provide students with the necessary resource material to complete the assignment. The *Center for Distance Learning and Innovation* (CDLI) site has two lessons that could be useful; Unit 1, Section 2, Lesson 3, and Unit 2, Section 4, Lesson 3. Some other appropriate websites are listed in the ‘**Resources**’ on the opposite page. This list is not meant to be exclusive. Instructors should preview them to ensure they are appropriate to the academic level of the student.

If Option 1 of the assignment is chosen, instructors could use the questions provided or develop their own questions based on the resources chosen.

## Unit 2 - A Global Weather Model

### Suggestions for Assessment

The mark given for Assignment 2 should be used as part of the evaluation for the course. Instructors should decide on the value of the assignment and let students know before they begin. Students should be made aware that the material covered in the assignment will not be tested.

A final examination covering the entire course (excluding the outcomes assessed by the assignments) should be given. The exam should comprise at least 50% of the evaluation for the course.

### Resources

Taking Action on Climate Change:  
<http://www.climatechange.gc.ca/english/>

Websites on climate change and global warming:

<http://www.ec.gc.ca/envh/ome.html>

<http://www.einnews.com/canada/newsfeed.php?nid=14115&afid=73>

[http://news.bbc.co.uk/2/hi/uk\\_news/england/london/3623961.stm](http://news.bbc.co.uk/2/hi/uk_news/england/london/3623961.stm)

<http://www.csrwire.com/article.cgi/2634.html>

<http://www.theage.com.au/articles/2004/04/12/1081621895301.html>

[http://www.dailytimes.com.pk/default.asp?page=story\\_12-4-2004\\_pg6\\_5](http://www.dailytimes.com.pk/default.asp?page=story_12-4-2004_pg6_5)

Assignment 2, “*Climate Change and Global Warming*”, Options 1, 2, and 3, found in Appendix A.





# **Appendix A**



## Assignment 1, Part I

**Instructions:** Read the article, “*Sustainable Development*”, and write answers for the *Analysis* questions at the end.

### *Sustainable Development - Part 1 - The Pine Marten*

Sustainable development can be defined as development that meets the needs of the people today without reducing the ability of people in the future to meet their needs. This means that people today who are using the world’s resources must remember that the people yet to come will also need these resources. We cannot, therefore, use up all the world’s resources now at their expense.

How does this apply to the concept of ecosystem balance? When we use resources, many of them that are *renewable* still need time to replenish. Even the *nonrenewable* resources, because of the cycling of matter, can be replaced eventually but it usually takes millions of years. In either case, the *natural cycles* take time and it can sometimes be too long for those who need the resources to live their lives today. Our actions often disrupt the natural cycles that give the environment balance, therefore making it difficult to find resources. To reduce this disruption, environmentally conscious people practise sustainable development.

In Newfoundland and Labrador, sustainable development has been the goal of the provincial governments since the 1980s. They have generally focused on the natural renewable resources, such as our forests, trees and wildlife. Within the government’s framework there are a number of key principles.

**Responsibility** - The acknowledgment by government, industry and individuals that we are responsible for the condition of our environment.

**Respect for cultural heritage** - In our effort to protect the environment we must also remember our strong cultural link to the environment.

**Conservation** - There has to be a need for conservation for sustainable development to succeed.

**Accountability** - We must acknowledge our responsibility for our actions and be prepared to demonstrate a willingness to be fully accountable for them.

To ensure everybody, from government to individuals, uses these principles to create a sustainable society; integrated resources management can be used.

**Integrated resource management** refers to the management of natural resources using an integrated or collective approach to resource development. For example, forest management usually means removing trees from the forest for wood or paper. Integrated forest management would consider conservation of animal habitats and water resources, economic factors, and cultural factors. This approach requires much more planning and involvement by the various government agencies, industries, and individuals directly affected.

In Newfoundland and Labrador, the most common method of harvesting the forest is **clear-cutting**. This involves cutting down all the trees in a selected cutting area. Many people feel this is not the best way to harvest trees because it has negative environmental consequences. These include loss of habitat for animals, increased water run-off on sloped land, disruption of natural **forest succession**, and loss of natural beauty. Those in favor say that clear-cutting permits new habitat for different animals and plants, and the results are similar to what a forest fire does. They both create new growth.

Currently on the island portion of Newfoundland and Labrador, there are two major struggles concerning clear-cutting and its role in integrated forest management. First is the Newfoundland pine marten's struggle to survive in the face of vanishing old growth forests. The second is the struggle to preserve the Main River watershed from clear-cutting.



Newfoundland Pine Martin

The people on the island of Newfoundland have been seeing martens since 1795. They were probably never abundant due to low food supply. Three major factors contributing to the early decline of marten in Newfoundland are habitat loss (due to logging and fire), over-trapping, and low food supplies. The fur of the marten was highly valued and their keen sense of smell and great curiosity allowed trappers to easily take them. Declining numbers resulted in the permanent closure of the trapping season in 1934. Today, the loss of old growth forest is a real threat to the continued existence of marten on the Island. In Labrador, the marten populations continue to remain stable and healthy because the factors affecting the Newfoundland marten do not affect them.

In the early 1980's, it was estimated by the Provincial Wildlife Division that there were between 630 and 875 marten in Newfoundland. Recent data indicate that there are now around 300 marten on the island. Habitat loss due to clear-cutting within their **home range** is probably the main reason why recovery of marten on the Island is slow. In addition, the accidental capturing of marten in traps and snares set for other animals, such as rabbits, mink, fox and lynx, may be limiting their spread into other areas.



Habitat damage from logging must be minimized for the marten population to grow. Large areas of undisturbed mature forest need to be preserved as home ranges for marten, or at least managed to ensure that some mature forest is always available.

Preserving some mature coniferous forest for marten may involve a conflict of values: economics versus environmental. Newfoundlanders and Labradorians have a unique opportunity to conserve the remaining old growth forests and the essential character of the land and its wildlife. On the other hand, Newfoundland and Labrador depends on industries such as forestry for its economic base.

Martens prefer to live in undisturbed mature coniferous or mixed forest, with large evergreens and scattered birch and other hardwood trees. Preferring thick shady woods with a dense canopy, they usually avoid large openings or clearings. For *denning* and nesting sites, marten use hollow trees, stumps and logs.

Marten have been observed crossing large cutovers, but they did not use the logged areas for hunting or as part of their home range. During autumn, cutovers may offer short-term food sources such as raspberries or blueberries for the marten to feed on. However, there are indications that marten avoid previously logged areas until dead woody debris characteristic of older-growth forests is again present on the forest floor.

A Newfoundland Pine Marten Recovery Team was founded in 1990. The team's goal is to develop a plan to increase the marten population on the island portion of the province and to ensure the marten doesn't become yet another extinct species. To help, some marten have been moved to the shelter and protection of Terra Nova National Park where they could be studied and hopefully their population increased.

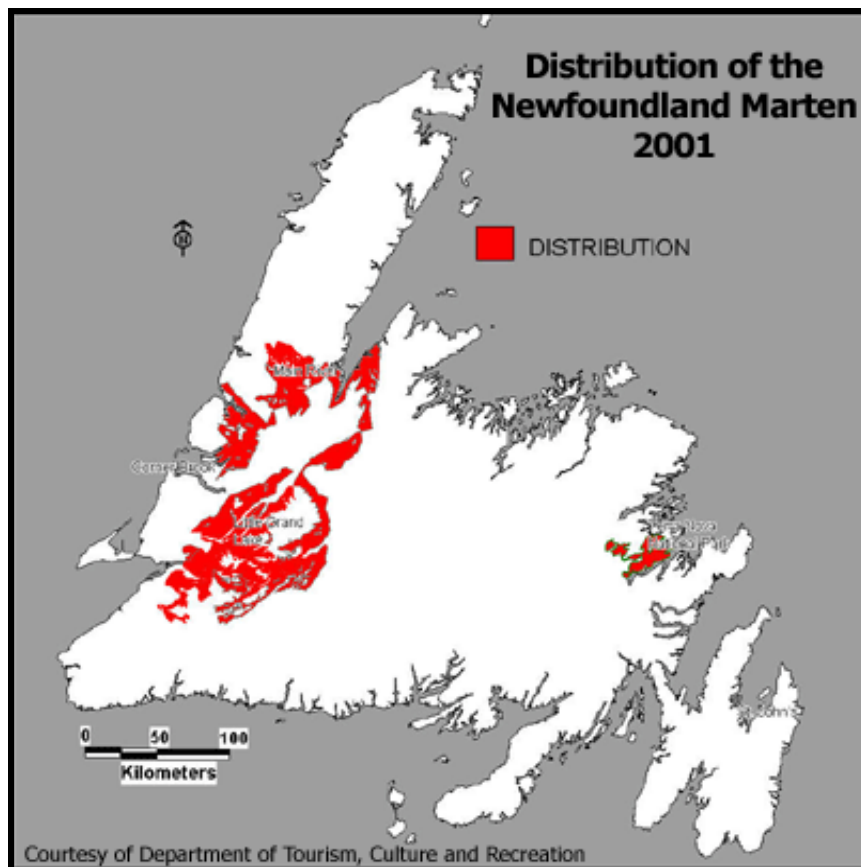
Integrated forest management has been introduced to address concerns like this and the Western Newfoundland Model Forest has been working on the marten's difficult situation. As part of their integrated forest management plan for sustainable development, The Western Newfoundland Model Forest created a Pine Marten Working Group. The Working Group is made up of eleven diverse *stakeholders*:

- ▶ Department of Forest Resources and Agrifoods
- ▶ Protected Areas Association
- ▶ Department of Mines and Energy
- ▶ Corner Brook Pulp and Paper
- ▶ Chamber of Mineral Resources
- ▶ Wilderness and Ecological Reserves Advisory Council
- ▶ Department of Culture, Tourism and Recreation
- ▶ Natural Resources Canada - Canada Forest Service
- ▶ Abitibi Consolidated
- ▶ Newfoundland and Labrador Trappers Association

This working group established a goal to set up a reserve that would protect habitat for the pine marten. After a twenty-four month process, the Pine Marten Working Group agreed on an area that involved an ecological reserve, two wildlife reserves and a crown land reserve. This area has 163,000 ha and meets the objectives of protecting pine habitat. On October 15, 1999 the Provincial Government held a press conference to announce the acceptance of the Pine Marten Working group reserve design.

Logging in Newfoundland and Labrador is usually done by clear-cutting, all that remains in the cutover are scattered birch trees and small stands of spruce and fir that are usually unsuitable for marten. Research in Newfoundland indicate that marten tend to stay away from habitats that have been logged for up to 23 years and as long as 40 years.

Within the Pine Marten Study Area of western Newfoundland, where marten are protected from snaring, there remain 41,000 *hectares* of mature and old forest (aged 60+ years). Of that, 2 - 10 % is dead as a result of a 1987 insect infestation. An additional 37,500 hectares have been harvested over the past 60 years, with 70% of that in the past 20 years. There is little forest in the age class of 20 - 60 years. This makes the forest type similar to areas formerly occupied by marten in Newfoundland, particularly on the west coast. However, the future plans for present forests indicates there will be habitat for only 100 marten within the west coast balsam fir ongoing in the Lloyd's River/Battle Pond areas, south of Little Grand Lake, also known to be used by marten.



Both pulp and paper companies (Abitibi Consolidated and Corner Brook Pulp and Paper Limited) have plans to continue logging within the distribution area of marten in western Newfoundland. No cutting has been permitted in the Little Grand Lake area since 1988. Depending on the commitments made by forest harvesters and the conditions imposed by the Minister of the Newfoundland and Labrador Department of Environment, harvesting may continue. As well, there has been no solution to the conflict between timber goals and habitat needs for marten. Timber harvesting by the Abitibi Consolidated is ongoing in the Lloyd's River/Battle Pond area, south of Little Grand Lake, also known to be used by marten.

Whether the efforts to save forest for marten survival are successful, remains to be seen. Current logging practices do not favor its survival. The fight to cut the old growth forests in the Main River area of White Bay on the island portion of the province is only making the marten's future more dim.

<b>Renewable:</b> Resources that can be replaced naturally in a short period of time.	<b>Nonrenewable:</b> Resources that cannot be replaced naturally in a short period of time.
<b>Natural Cycles:</b> Cycles in the environment that cycle energy and physical matter (e.g., Carbon Cycle).	<b>Integrated Resource Management:</b> Using a number of approaches to fulfill resource needs without affecting the needs of future generations.
<b>Clear-cutting:</b> Removing all the trees from a selected area.	<b>Forest Succession:</b> The natural progression of one plant type to another in a forest, usually from herbs to shrubs to trees.
<b>Home Range:</b> The amount of land a marten requires to find food, shelter and a mate.	<b>Denning:</b> A term referring to building a den and raising young.
<b>Stakeholders:</b> All the people or groups of people who have an interest or investment in a particular issue.	<b>Hectares:</b> An area of land that measures 10,000 square meters. One square kilometer equals 100 hectares.

### Analysis:

1. Define sustainable development.
2. Distinguish between renewable and nonrenewable resources.
3. Define integrated resource management and give an example.
4. What are the negative environmental consequences of clear-cutting?
5. What arguments are put forward in favor of clear-cutting?
6. What is the preferred habitat of the pine marten? Why is it disappearing?
7. What is the goal of the Newfoundland Pine Marten Recovery Team?



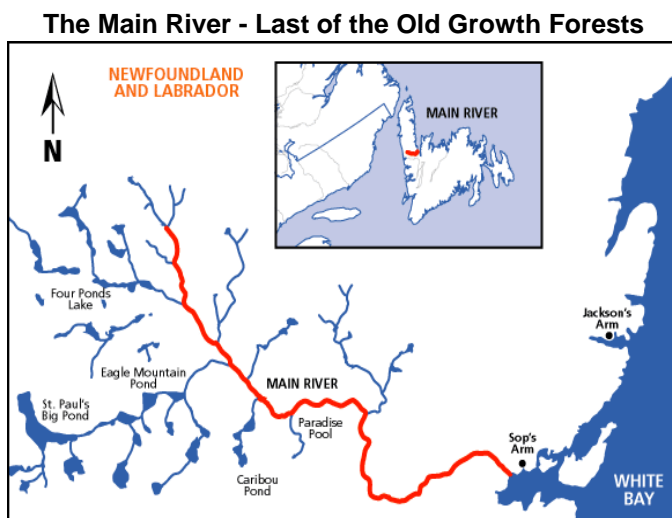


## Assignment 1, Part II

Instructions: Read the article, “*Sustainable Development*”, and write answers for the *Analysis* questions at the end.

### *Sustainable Development - Part II - Main River*

In the Fall of 2001, the Main River became the first river in Newfoundland to be designated as part of the Canadian Heritage Rivers System. The management of the Main entails a delicate balance between logging and keeping undisturbed habitat sufficient to maintain the natural values and recreational value for which the river was nominated to the system. A large area has been set aside as a provincial waterway park, providing legislative protection for the river corridor. Areas outside the proposed provincial park that fall within the view of people canoeing



on the river (the “viewshed”), will be designated as zones where special logging will not be visible from the river. Areas that are key or sensitive habitats for wildlife will be exempt from logging, and a **buffer** of 100m will be left along all major **tributaries** to ensure that aquatic habitat is not impaired.

When Main River was nominated in 1991, it was one of the few truly wild rivers on the island of Newfoundland.

The Main River has its **headwaters** in the heart of the Long Range Mountains on the

Great Northern Peninsula. It flows southeast from tundra-like barrens to the Atlantic Ocean where it empties into White Bay at Sop’s Arm. The river passes through an area of approximately 105 km<sup>2</sup>.

The main river is one of the last wild and scenic areas of the island of Newfoundland. It provides habitat for a variety of animals and plants. Farther down the Main, the forests are predominantly balsam fir and black spruce. The Newfoundland marten, native to the island and classified in 1986 as threatened, has been re-introduced to the area.

The river also contains one of the healthiest populations of Atlantic salmon in the province, with the gravel-cobble river bed and upper ponds excellent for salmon spawning.



As one of the last pieces of old growth Boreal forest in Newfoundland and Labrador to have remained untouched, the Main River has caught the attention of both logging companies and environmentalists alike. The Main River area at the base of the Great Northern Peninsula on the Island's west coast is part of the northern *boreal forest biome*, as is most of the province of Newfoundland and Labrador. Labrador also has *tundra biome* as part of its physical makeup. A biome is a large geographical area that has similar climate, soil, animals and plants. The main plants in the boreal forest are coniferous trees like Balsam fir, spruce and pine.

Balsam fir and spruce are also the main trees harvested for the pulp and paper industry in our province. These trees, in particular the spruce, are excellent for making newsprint because of their strong fiber. Unfortunately due to declining wood supplies on the island of Newfoundland, areas like Main River are now the target of the paper companies. The Corner Brook Pulp and Paper Company (CBPP) has the timber rights to the Main river *watershed*. Their plan is to cut the trees to make paper.

CBPP first proposed to start harvesting in the Main river area back in 1986 at which time they were required to prepare an *Environmental Impact Statement (EIS)*. For various reasons no cutting has taken place in this area to date, even though a number of roads have been built by the company to access wood from this area.

As of 2002, CBPP has issued a new environment Preview Report for the Main River that spans the years 2002 - 2006. In this plan, the company outlines its approach to wood harvesting in the Main river watershed. CBPP has adopted a policy of no clear-cutting in the entire Main River watershed. They do however intend to cut down trees.

The negative effects to cutting down trees are significant for this area. For example, there is a loss of potential *eco-tourism*, which is short for ecological tourism. This type of tourism depends on untouched wilderness that tourists find appealing. Tourists enjoy hiking, camping, canoeing and other outdoor activities that leave no lasting impact on the environment. These tourists tend to spend considerable sums of money while visiting nearby communities and this can be a significant boost to local economies. With the declaration of Main River as a Canadian Heritage river, its tourism potential will likely increase in the future.

Outside its tourism potential, Main River is also an important Atlantic salmon river where thousands of these fish return yearly to reproduce. Logging potentially decreases the effectiveness of stream beds as spawning grounds for fish. This is due to increased silt run off from the ground when trees are removed from a river's watershed. The silt tends to interfere with the fertilization and development of the fish eggs. This of course results in fewer salmon being produced. With the already low numbers of salmon returning yearly, still fewer being produced will not be a favorable outcome for the salmon populations.

With logging also comes a loss of biodiversity. When habitats are destroyed, animals have to find new homes or they die. Also, there comes a loss of native plant species specific to the conditions that exist prior to cutting. Many years will have to pass for these types of plants to return if at all.

Still other people from the Main River area will argue that the potential jobs for the local loggers are badly needed. Since the closure of the cod fishery, many people have had to leave the area, while others struggle to find employment. For those who have stayed, logging provided valuable income to meet the financial needs.

With so many groups adding their needs and wants to the Main river controversy, it seems its future is rather uncertain. Hopefully a balance of needs by all concerned can be reached such that the river ecosystem can be maintained without a high level of permanent disturbance. Conserving ancient boreal forest should be a priority for everyone involved, especially the organisms that call the Main River watershed home.

<b>Buffer:</b> A buffer zone is an area that serves as a protective barrier. During logging, buffer zones are left around ponds and streams.	<b>Tributaries:</b> Small streams and brooks that feed into a larger river. Tributaries are part of a river system.
<b>Headwaters:</b> This refers to the source of a river or stream; where it begins.	<b>Boreal Forest Biome:</b> The boreal forest is large forest system that stretches around the planet in the north that has coniferous trees as its main plant.
<b>Tundra Biome:</b> Another large area north of the boreal forest that has virtually no trees and is characterized by permanently frozen ground called permafrost.	<b>Watershed:</b> The total land area that drains into a river system.
<b>Environmental Impact Statement (EIS):</b> A study prepared to show all possible environmental impacts a project could have and all the possible courses of action the group or company will take to reduce or eliminate those risks.	<b>Eco-tourism:</b> Ecological tourism is the practice of touring natural habitats in a manner meant to minimize ecological impact.

### Analysis:

1. Where is the Main River located?
2. What is an Environmental Impact Statement?
3. Identify three negative effects of cutting down trees in the Main River area?
4. Identify a reason for favoring logging in the Main River area.



## Assignment 2 - Option I

### Climate Change and Global Warming

**Instructions:** Write answers for the following questions:

1. Define climate change and global warming.
2. Describe how human activities impact climate change/global warming.
3. Describe the impact of climate change on economic, social and environmental conditions.
4. Identify ways in which you as an individual might help solve the problem of global warming.
5. Identify ways that industry and government might help solve the problem of global warming.



## Assignment 2, Option II

**Instructions:** Write a research paper on the topic of climate change.  
In your paper, include:

- i) an explanation of what is meant by climate change and global warming;
- ii) the causes of global warming and how human activity has contributed to it;
- iii) how global warming has impacted economic, social and environmental conditions; and
- iv) suggestions about what individuals, industry and government can do about global warming.





## Assignment 2, Option III

**Instructions:** Write a research paper on a topic of your choice (on the approval of your instructor) related to climate change and how it affects a particular area.

Some suggestions for topics are:

- the effects of global warming on Greenland
- the possible effects of global warming on Newfoundland and Labrador