CLIMATE CHANGE
IN GRADE 11 AND 12 GEOGRAPHY
Acknowledgements

Based on Ontario EcoSchools: Climate Change in Grade 11 and 12 Geography, this resource has been slightly modified for use in TDSB schools.

The Government of Canada’s Climate Change Action Fund provided major funding for Ontario EcoSchools. Please see inside back cover for information on all of the partners involved in the development of the program.

TDSB EcoSchools: Climate Change in Grade 11 and 12 Geography

Developer: Leesa Blake, Toronto District School Board
Additional Material: Marlene Hume, Halton DSB; Kim Wallace, Halton DSB
Reviewers: Linda Barrett, Niagara DSB; Jon McGoey, London Catholic DSB; Lewis Molot, Faculty of Environmental Studies, York University
Adaptation: Catherine Mahler
Curriculum revisions (2005): Tina McPhee, Toronto DSB
Editor: Eleanor Dudar, Toronto DSB

© 2004 York University
Ontario schools, school boards, post-secondary institutions and government agencies may reproduce and adapt this publication in whole or in part for educational purposes without special permission from the copyright holder, as long as acknowledgement of the source is provided. No use of this publication may be made for resale or for any other commercial purposes whatsoever without prior permission in writing from York University. Please contact the Office of Research Administration 416-736-5055 for further information.

Every reasonable precaution has been taken to trace the owners of copyrighted material and to make due acknowledgement. Any omission will gladly be rectified in future printings.

Designer: Comet art + design
Printer: TDSB Printing Services
Grade 11 and 12 Geography and EcoSchools

*Climate Change in Grade 11 and 12 Geography* is one in the series of Ecological Literacy guides that make up the classroom component of EcoSchools. These guides offer teachers a new lens for seeing the environmental learning possibilities in the Ontario curriculum.

This resource is supported by *The Impacts of Climate Change*, a multimedia presentation that examines the impacts of climate change on the natural and human worlds. The multimedia presentation is available on CD; please see below for ordering information.

The TDSB EcoSchools resources support student learning and action that address climate change. Geography, with its highly integrated human and natural systems approach, is well positioned to foster understanding about climate change, its impacts and the possibilities for solutions.

To order print and CD versions of the EcoSchools resources including the multimedia presentations, please contact Library and Learning Resources, Tel: 416-397-2595; Fax: 416-395-8357; Email: curriculumdocs@tdsb.on.ca

To download PDF versions of all EcoSchools documents, go to [http://ecoschools.tdsb.on.ca](http://ecoschools.tdsb.on.ca)
1 Introduction to EcoSchools and the Five-Step Process

This concise guide provides an overview of the TDSB EcoSchools program and sets out a practical method for successful implementation: (1) establish an EcoTeam, (2) assess the school’s needs, (3) identify priorities and develop an action plan, (4) implement the action plan, and (5) monitor and evaluate progress.

2 Waste Minimization Guide

This guide outlines the 11 TDSB EcoSchools waste minimization standards. It provides the school’s EcoTeam with tips for assessing the school’s current waste minimization efforts, sample reviews and action plans and a set of tools for implementing improved waste minimization practices.

3 Energy Conservation Guide

Similar in format to the Waste Minimization Guide, this resource outlines the 10 TDSB EcoSchools energy conservation standards. It provides the school’s EcoTeam with tips for assessing the school’s current energy conservation efforts, sample reviews and action plans and a set of tools for implementing improved energy conservation practices.

4 Waste Minimization by Grade (1-8)

This resource is organized around “big ideas” about waste and waste minimization that are based on identified clusters of learning expectations in both Science and Technology and Social Studies and Geography. Using these ideas as a focus helps the teacher incorporate ecological thinking into existing curriculum. Annotated Internet resources offer background facts and student learning activities.

5 Energy Conservation by Grade (1-8)

Like Waste Minimization by Grade, this guide is organized around “big ideas” about energy and energy conservation that are based on identified clusters of learning expectations in both Science and Technology and Social Studies and Geography. Using these ideas as a focus helps the teacher incorporate ecological thinking into existing curriculum. Annotated Internet resources offer background facts and student learning activities.
Climate Change in Grade 11 and 12 Geography (Academic and Applied)*

This resource surveys 5 Geography courses (University, University/College, and Open). Overall and specific expectations for each course are accompanied by guiding ideas linking these expectations to different parts of the climate change story. Examples are provided for developing topics, and teaching and learning strategies recommended for developing topics, and teaching and learning strategies recommended for different student needs. Resources for planning class activities and assignments are listed. See #15 for supporting multimedia presentations.

Climate Change in Grade 10 Civics*

This unit introduces students to the concept of environmental citizenship through a series of well-supported activities where they analyze the accomplishments of environmental activists and organizations. A simple Public Policy Primer helps students see points at which they can influence issues. Students apply their knowledge in responding to the Government of Canada’s One-Tonne Challenge for reducing climate change gases. An Environmental Citizenship Portfolio containing each student’s class work and other materials sums up her/his understanding of environmental citizenship. See #15 for supporting multimedia presentations.

Climate Change in Grade 10 Science (Academic and Applied)*

This resource provides two possible culminating tasks: students are introduced to an actual problem and asked to propose solutions to either The Impact of Transportation Choices or Forest Management and Climate Change. Climate change related concepts have been identified in each strand. Charts link authorized texts and the Teacher Resource for each to relevant learning expectations. A student Checklist of Preparation, annotated Internet resources and evaluation rubrics are also provided. See #15 for supporting multimedia presentations.

Climate Change in Grade 11 and 12 Science*

This resource ranges over 8 different Science courses (University, University/College, College and Workplace), highlighting learning expectations that can be met using climate change issues as the examples. Focus questions help students connect the learning of facts and concepts in a meaningful way. The questions also suggest ways to adapt the existing curriculum to explore the data, evidence, interactions and technologies related to climate change issues. Lists of resources that suit the needs of the courses are included. See #15 for supporting multimedia presentations.

Climate Change in Grade 11 and 12 Geography*

This resource surveys 5 Geography courses (University, University/College, and Open). Overall and specific expectations for each course are accompanied by guiding ideas linking these expectations to different parts of the climate change story. Examples are provided for developing topics, and teaching and learning strategies recommended for different student needs. Resources for planning class activities and assignments are listed. See #15 for supporting multimedia presentations.

* These resources have been developed in partnership with the Ontario EcoSchools project.
**Schoolground Greening:**

*Designing for Shade and Energy Conservation*

Developed by Evergreen and the Toronto District School Board, this resource will help schools design for increased shade to protect students and staff from ultraviolet radiation (UVR) and to shade school buildings to save energy and make them more comfortable. Tips for involving the school community in the design process, surveying user needs, completing a site analysis, creating site plans and developing a fundraising strategy are included.

**Celebrating EcoSchools:**

*Festival Guide (Elementary)*

Developed in partnership with the City of Toronto, this collection of learning activities for elementary schools is designed for Earth Week or another EcoSchools celebration. While each activity can stand alone, the collection is especially designed for an entire school to engage in environmental learning adventures, focusing on the theme of human-environment connections.

**The 20/20 Planner**

Developed by Toronto Public Health, 20/20 *The Way to Clean Air* offers teachers a way to help students apply their learning about energy conservation at home. The planner is a “take-home” guide filled with simple tips and activity sheets that offer a range of actions that students and their families can undertake to reduce energy and vehicle use by 20% and respond to the Government of Canada’s One-Tonne Challenge.

**Certification Guide**

Developed by the Clean Air Partnership and the Toronto District School Board, the *Certification Guide* provides benchmarks and a scoring system for schools wishing to assess their environmental performance in a limited number of areas. The point system establishes Bronze, Silver and Gold levels of EcoSchools. Forms for schools wishing to apply for certification are included.

---

**Multimedia presentations:**

*Changing Climate, Changing Attitudes; The Impacts of Climate Change; The Science of Climate Change*

Three multimedia presentations have been designed to accompany the EcoSchools curriculum resources. *Changing Climate, Changing Attitudes* provides students and teachers with a general overview of global climate change and its impacts on Ontario society. *The Impacts of Climate Change* has been developed explicitly to complement the Grade 9 Geography course but can be used with all secondary students to examine the impacts of climate change on the natural and human worlds. *The Science of Climate Change*, while developed to support the Grade 10 Science course, is suitable for all secondary science students. These presentations include potential solutions and steps that citizens can take to help slow climate change.
Contents

Climate Change in Grade 11 and 12 Geography 3

Resource Overview 3

Understanding Climate Change: Basic Background 6

Major Elements of the Climate System 7

CGD3M – The Americas: Geographic Patterns and Issues, Grade 11 9

CGF3M – Physical Geography: Patterns, Processes, and Interactions, Grade 11 16

CGG3O – Regional Geography: Travel and Tourism, Grade 11 23

CGW4U – Canadian and World Issues: A Geographic Analysis, Grade 12 31

CGR4M – The Environment and Resource Management, Grade 12 39

Appendix 1 El Niño, La Niña and Climate Change 49

Appendix 2 Summary of the Kyoto Protocol 51

Appendix 3 Using the Internet: Search and Evaluation Tips 52
Ecological inquiry reveals our dependence on the healthy functioning of the Earth’s living systems which give us clean air, water, soil, food, and all the other resources we depend on. As our understanding of the inter-relatedness of all life increases, we can become literate in the ways to care for the Earth that consider the wellbeing of future generations. Ecological literacy allows us to understand the urgency of developing protective, sustainable, and restorative relationships with the natural systems that are affected by our daily activities.
Climate change is a complex subject requiring a multi-faceted analysis. Geography examines both the natural and human environments and how they interact as systems. This approach has helped geographers and other scientists understand causes and impacts of climate change and where to focus efforts in designing solutions.

Resource Overview

The purpose of this document is to identify places where teachers can address key ideas about climate change in a sampling of senior Geography courses. To guide inquiry, a set of focus questions is attached to a cluster of overall and specific expectations in five Geography courses in The Ontario Curriculum Grades 11 and 12: Canadian and World Studies (2005). A number of central ideas are repeated from course to course. Approach the depth and detail of the material as suitable to the needs of the students and the intent of the course.

Along with focus questions, specific examples or case studies are provided as a starting place for developing appropriate topics, accompanied by teaching suggestions. For each course, a number of resources are listed that include ideas for student activities. Others offer suggestions that can be incorporated into existing activities, assignments and tasks that are already being used within the course. Each course section concludes with common understandings in a climate change context that students are expected to develop and a list of web-based resources.

The chart on the next two pages outlines some connections between the study of geography and climate change issues in five senior Geography courses.

Whenever possible, materials from the Resources sections of each course have been archived on the TDSB Ecoschools website at http://ecoschools.tdsb.on.ca
<table>
<thead>
<tr>
<th>Course Focus Question</th>
<th>Teaching Suggestions/Student Activities</th>
<th>Information/data (charts, graphs, maps) required for climate change related student inquiry</th>
</tr>
</thead>
<tbody>
<tr>
<td>CGD3M The Americas: Geographic Patterns and Issues</td>
<td>How does climate change impact the natural and human systems within the environments of the Americas?</td>
<td>- Group students by country for an on-going inquiry approach to research several aspects of climate change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- CO₂ emission by country</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Severe weather trends (e.g., hurricanes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Economic statistics by country (e.g., tourism)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ocean currents (El Niño, La Niña)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Energy technologies by country</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Kyoto Protocol</td>
</tr>
<tr>
<td>CGF3M Physical Geography: Patterns, Processes and Interactions</td>
<td>What are historic climate patterns and trends and how do they compare to current trends and impacts on the physical environment?</td>
<td>- Graph a variety of climate data to analyse trends in climate and make future predictions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Assign students to expert groups representing different regions of the world to analyse the potential impact of the climate change predicted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Temperature change of the Earth over time (glaciation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ocean current</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Atmospheric and hydrologic content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Global vegetation patterns</td>
</tr>
<tr>
<td>CGG3O Travel and Tourism: A Regional Perspective</td>
<td>What is the true ecological cost of travel?</td>
<td>- Use a case study to model the exploration of environmental issues related to tourism for a specific destination and to examine how the issue is addressed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Have students apply the inquiry to a destination of her/his choice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Use comparison charts examining CO₂ generation caused by different forms of travel, and by countries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ecological Footprint (calculator and comparison data by country)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Carbon emission by mode of transportation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Case studies on impact of tourism</td>
</tr>
</tbody>
</table>
### Course Focus

#### Question

**CGW4U**  **Canadian and World Issues**

- What are the geopolitical implications of climate change?
- What will it take for nations of the world to participate in responding to the challenge of climate change?

**Teaching Suggestions/Student Activities**

- *Issues-based:* The topic of climate change could be addressed either through a food disparity issue (prediction based on trends) or through the issue of energy sources and availability.

- *Integration:* Within a culminating task — depending upon the format (issues by country or by theme) — encourage students to include the connection to climate change as part of the overall assignment and make predictions about its impact, as part of the inquiry.

**Information/data (charts, graphs, maps)**

- Carbon dioxide emission by country
- Cost of mitigating climate change
- NGOs that take action on climate change
- Multinational companies: who is where
- Type of government
- GNP by country
- Green technologies

---

**CGR4M**  **Environment and Resource Management**

- How do the consumer choices we make as individuals, or as a nation, have an impact on the environment?

**Teaching Suggestions/Student Activities**

- Students produce an environmental impact assessment of their current consumer choices (a school waste audit may also be undertaken).

- Extend the impact assessment to a cost-benefit analysis of larger scale activities such as forestry, farming practices, energy supply etc. (one could use a case study as an example).

- Develop action plans identifying how to make a difference (the cost-benefit analysis and action plan could be worked through by individual students or in groups).

**Information/data (charts, graphs, maps)**

- Kyoto Protocol
- NGOs that take action on climate change
- Green technology
- One-Tonne Challenge calculator
- Carbon dioxide calculator
- Ecological Footprint calculator

---

It is critical to remember that inquiry skills are inherent within the discipline; students should gather and analyse their own data. The list of annotated websites supplies students with readily current information to practice these skills. Atlases and video sources will also be important resources. Although each course has a specific set of resources listed, some of them may also be useful for other courses.
UNDERSTANDING CLIMATE CHANGE: BASIC BACKGROUND

Some key concepts recur throughout this resource. These are addressed in the Ontario Grade 9 Geography course, but may need to be reviewed before students undertake inquiry relating to climate change. In particular, a grasp of systems thinking and the concept of the Ecological Footprint is essential to understanding climate change and our connection to it.

A Systems Approach
The Focus Questions and Common Understandings invite a systems approach — put at its simplest, this is the notion that a change in one component results in a change in the system. Describing the world in this way allows us to understand the impact of human activity as a system or set of systems on natural systems, as well as the impact of natural systems on human systems.

www.ucar.edu/learn/
www.foe.co.uk/pubsinfo/infosyst/other_services.html
www.ucmp.berkeley.edu/glossary/gloss5/biome/

Ecological Footprint
This image powerfully represents the idea that humans have an impact on the Earth’s ecology. The Ecological Footprint offers a calculation that converts people’s consumption (human systems) into an equivalent of how much of the Earth’s land systems are required to sustain that consumption. The choices we make in our daily lives make a difference to the size of our footprint.

www.mec.ca/Apps/ecoCalc/ecoCalc.jsp
www.ecouncil.ac.cr/rio/focus/report/english/footprint/numbers.htm

Greenhouse Gases
Carbon dioxide (CO₂) is the major greenhouse gas (GHG) contributing to climate change. Many human systems use fossil fuels that, when burned, emit CO₂. Each person can calculate his/her own carbon dioxide emissions. Statistics are available to compare carbon emission sources and amounts by country.

http://earthtrends.wri.org
www.climatehotmap.org/index.html
www.natenergy.org.uk/convert.htm

Choice
Understanding the impacts of our actions is key to making choices that mitigate or slow climate change. We CAN do something: locally, nationally, globally. These issues are addressed in the Kyoto Protocol.

www.climatechange.gc.ca/onestonne/english
www.davidsuzuki.org/
www.climatechange.gc.ca/english/links
**MAJOR ELEMENTS OF THE CLIMATE SYSTEM**

![Diagram of the climate system](image)


---

**Global Warming or Climate Change?**

The terms global warming and climate change are often used interchangeably. What’s the difference? Scientists’ initial focus on the changing climate was the persistent temperature rise over several decades: hence “warming” was the feature that received major attention. The more comprehensive term “climate change” is more common now; it includes the global warming trend, but also refers to other climate change linked phenomena such as severe weather, melting polar ice caps, and high winds.

A special multimedia resource, *The Impacts of Climate Change*, has been developed to complement the Grade 9 Geography course. However, it will provide an engaging overview of the subject for Geography students in all senior grades as well. For ordering information, see page opposite inside front cover.
Tips on using Focus Questions

Teachers who prefer teacher-centred planning should plan lessons based on their interpretation of the Focus Questions. They will pre-plan their regular daily geography lessons with an eye first and foremost on the Ontario Geography document. However, when they need an example for in-class practice and assignments to illustrate a concept, they can use climate change examples. (Students interpret graphs to predict how climate change will have an impact on temperatures.) Teachers can leave specific climate change applications off their formal tests, or they can include the key ideas, which are included in the Common Understandings within a Climate Change Context of each course section in this document.

Teachers who prefer students to work more independently will likely introduce the Focus Question as a brainstorming activity and follow it up with a list of secondary questions. These secondary questions will be assigned either as classwork that everyone works on together, or as individual questions assigned as independent study and presentation (e.g., student posters, written assignments, oral presentations). Teachers can generate open-ended questions for formal assessment, or they can pool the collective research and have it form a required body of knowledge for formal tests. A good review of those ideas is found in the Common Understandings within the Climate Change Context sections.

These questions and the ideas they encompass provide a way to re-frame existing course curriculum through the lens of ecological sustainability. Changing the perspective on the content and skills of these selected courses makes a difference to the way students understand concepts and interpret information. Within a section of a unit, an entire unit, or the entire course, these questions can, literally, re-focus students’ understanding as they grapple with content and learn skills. These Focus Questions enhance the meaning of the expectations and support the development of the students’ critical thinking skills.

From TDSB EcoSchools: Climate Change in Grade 11 and 12 Science
See page opposite the inside front cover for ordering this resource and others in the EcoSchools series.
Overview
Students analyse the impact of climate change on various countries within the Americas from physical, economic and cultural perspectives. Comparisons of sources and quantities of greenhouse gas emissions by country lead to suggestions for future actions to address climate change.

SYSTEMS THINKING…
The world is a network of natural and human systems in constant interaction.

How does climate change have an impact on the natural and human systems within the environments of the Americas?

Curriculum Expectations
Please see page 13 for a list of the course curriculum expectations that can be linked to the Focus Questions below.

Focus Questions – Climate Change Connections
1. How do different nations and regions within the Americas contribute to CO₂ production? How are these nations and regions differently affected by the impact of climate change? What are the environmental, social and economic forces that affect the choices these nations have about limiting the CO₂ that they produce?

- Development patterns vary among nations of the Americas; different nations contribute to climate change in different ways. As climate change leads to changing environmental conditions, some nations are less able to adjust effectively and maintain or improve the standard of living.
- All nations contribute to the production of CO₂ (and other greenhouse gases) but some nations produce greater amounts, and so have a larger global impact.
- The consequences of climate change affect all people, but the poorer nations are often the most vulnerable to devastating climatic variations. This is seen when considering the impact of severe weather events, such as hurricanes, which can wipe out an annual crop and kill many people.
3. Who is responsible for making decisions about the production of GHGs? What are the kinds of decisions that can be made by specific nations or regions? Do countries have an obligation to support each other?

- Individuals, multinational corporations and governments can participate in international efforts to manage economic and environmental concerns. The Kyoto Protocol is such an effort.
- Different strategies are used to find energy sources that do not contribute further to climate change. Sharing energy-efficient technologies can help developing nations as they adapt to the constraints of agreements such as Kyoto. Different countries will have different solutions: some technologies will be more appropriate for one country than another (e.g. wind vs. solar energy).
- Examining a country’s emission standards, agricultural practices (e.g., fertilizers), forest industry practices, transportation infrastructure, energy sources, etc. will provide students with concrete data to inform their thinking.
- If conditions in Haiti become a case study, the role of aid from other nations could be considered. Local environmental degradation, such as deforestation, can lead to massive poverty and unsustainable populations that require external aid for basics such as food. One of the effects of climate change may be greater need for international relief, drawing on resources globally.

2. How do different nations and regions use resources and produce CO2? How do social and economic forces affect demographic changes? What is the impact of these forces on the environment and environmentally-sensitive practices?

- Economic forces (trade of resources or cash crops) can affect state decisions that have global consequences. Deforestation for harvesting timber or to produce more arable land for cash crops means that carbon sequestered in the forest is now released into the atmosphere. Using marginal land for agriculture requires massive use of fertilizers and pesticides produced through industrial processes that also contribute to GHG emissions. Such unsustainable practices reduce the long-term yield and can lead to desertification and problems with sources of potable water.

- Using marginal land for agriculture requires massive use of fertilizers and pesticides produced through industrial processes that also contribute to GHG emissions. Such unsustainable practices reduce the long-term yield and can lead to desertification and problems with sources of potable water.

- Economic forces (trade of resources or cash crops) can affect state decisions that have global consequences. Deforestation for harvesting timber or to produce more arable land for cash crops means that carbon sequestered in the forest is now released into the atmosphere.

- Using marginal land for agriculture requires massive use of fertilizers and pesticides produced through industrial processes that also contribute to GHG emissions. Such unsustainable practices reduce the long-term yield and can lead to desertification and problems with sources of potable water.
Common Understandings within a Climate Change Context

Ongoing human interaction with the environment may lead to significant environmental changes that then affect our ability to sustain the population. This can lead to human adaptation, new interactions and further unforeseen environmental changes. For example, the deforestation of Haiti has resulted in desertification, soil loss, diminished food production and the loss of potential tourist activity. Haiti has little ability to sustain its population or withstand the destructive force of hurricanes. On a larger scale, such environmental changes contribute to global climate change that has an impact on us all, limiting our ability to aid others.

The role of CO₂ gas is central in understanding climate change. An increase in CO₂ and other heat-trapping gases changes the composition of the atmosphere and affects the flow of energy out of the planet into space: more energy is retained and transferred into wind and water movement that affects wind and ocean current patterns. Identifying CO₂ sources and the global nature of this issue helps people to understand the need for international approaches that limit production and may help slow the rate of climate change on the planet.

Severe weather has always existed, but there are now more severe weather events. These changes in frequency and severity may be linked to increased energy and changing levels of CO₂ in the atmosphere. With improved satellite technology, temperature data can be collected (e.g. atmospheric and oceanic data) and trends can be tracked allowing for forewarning of conditions such as El Niño, La Niña or hurricane formation. The relationship between severe weather events and climate change is a complex one: see Appendix 1 on page 35 for more information.

Teaching Suggestions

These focus questions can be used in a number of ways. One suggestion is to use them to model and develop inquiry skills. Start as a class examining questions 1 and 2 for Canada. It will be important to illustrate the use of various representation forms (charts, graphs, maps) to present different kinds of data, including temperature, CO₂ sources, forested areas and population levels. See the website list and atlases for information.

Once a basic understanding is established, students can then apply the approach the other countries within the Americas. Question 3 could then be addressed as a class or within the expert focus groups.

Expert Focus Groups

First, examine the questions from a local perspective to model for the class the critical thinking needed to respond to the questions. Follow up by organizing students into small groups (3 to 5 students) responsible for ongoing research for a nation or region of nations. These expert focus groups can then revisit the same geographic place from many different perspectives, including physical geography, historical development, demographic patterns, climate, agricultural output and changing use of resources. Have students include CO₂ in their survey of the nation or region, both its sources and the areas that sequester and store carbon, as well as sites of severe weather events and environmental
degradation. This environmental perspective can provide students with an opportunity to consider climate change issues within the larger context of natural geographic systems and the impact of interacting social systems.

**Resources**

Wherever possible, materials from this Resources section have been archived on the TDSB EcoSchools website: [http://ecoschools.tdsb.on.ca](http://ecoschools.tdsb.on.ca)

<table>
<thead>
<tr>
<th>Topic</th>
<th>URL</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local and regional consequences of global warming</td>
<td><a href="http://www.climatehotmap.org/curriculum/index.html">www.climatehotmap.org/curriculum/index.html</a></td>
<td>Global Warming: Early Warning Signs — annotated world map</td>
</tr>
<tr>
<td>Local and regional consequences of global warming</td>
<td><a href="http://www.climatehotmap.org/">www.climatehotmap.org/</a></td>
<td>Grade 9–12 materials aligned with National Learning Standards for Science, Geography, Social Studies, Language Arts, Environmental Education and Technology; 4 activities: - Climate Change in my City - Oral History - Climate Change and Disease - Climate Change and Ecosystems</td>
</tr>
<tr>
<td>Carbon dioxide emissions</td>
<td><a href="http://earthtrends.wri.org">http://earthtrends.wri.org</a></td>
<td>Climate and atmosphere – includes data identifying carbon emissions by source for individual countries</td>
</tr>
<tr>
<td>Climate change issues and potential solutions</td>
<td><a href="http://www.panda.org/about_wwf/what_we_do/climate_change/index.cfm">www.panda.org/about_wwf/what_we_do/climate_change/index.cfm</a></td>
<td>An overview of climate change issues and solutions, with fact sheets on alternatives to fossil fuels.</td>
</tr>
<tr>
<td>El Niño and La Niña</td>
<td><a href="http://www.jpl.nasa.gov/earth/ocean_motion/el_nino_index.cfm">www.jpl.nasa.gov/earth/ocean_motion/el_nino_index.cfm</a></td>
<td>Temperature changes in the Pacific Ocean related to El Niño and La Niña events</td>
</tr>
</tbody>
</table>
Curriculum Expectations

Geographic Foundations: Space and Systems
- compare the diverse human systems and cultural realms of the Americas
- analyse the political, economic, and social factors that contribute to disparities in economic development within the Americas

Understanding Concepts
- describe the patterns of natural characteristics in the Americas
- describe the cultural realms and other major human patterns of the Americas
- explain the relationships among patterns of settlement, resource distribution, development, and migration in selected regions of the Americas
- describe trade patterns within and between selected economic regions of the Americas and analyse the factors that have shaped them

Developing and Practising Skills
- analyse the factors affecting the economic development of different regions in the Americas
- compare the standards of living of various groups selected countries or regions of the Americas

Learning Through Application
- analyse economic and quality-of-life data to identify patterns of socio-economic inequality within the Americas
- analyse development patterns in selected regions of the Americas and identify the benefits and disadvantages of development for each region chosen

Human-Environment Interactions
- analyse the causes and effects of human-environment interactions in various ecological zones of the Americas
- evaluate the environmental and economic consequences for the Americas of natural hazards and climatic variations
- analyse the linkages between population shifts and changes in physical and human environments in the Americas

Understanding Concepts
- describe the causes and effects of environmental degradation in specific areas of the Americas
- analyse the regional distribution of different types of natural disasters and climatic variations that affect the Americas and describe their consequences
- analyse the effects of rural-to-urban population shifts on mega-cities of the Americas

Developing and Practising Skills
- analyse the short-term and long-term social, environmental, and economic effects of natural hazards on selected regions in the Americas
- compare the ways in which selected groups of indigenous peoples in the in the Americas have responded to the challenges and opportunities of their environments
- analyse how human migrations have affected selected natural and human environments in the Americas
- predict the direction of future economic development in the Americas and its impact on the environment
Learning Through Application
• conduct a geographic inquiry that demonstrates how various regions in the Americas are affected by and deal with water scarcity
• describe the long-term local and global effects of the destruction of major forest regions in the Americas
• analyse how the production and transportation to market of selected resources affect natural ecosystems and human societies in the Americas

Global Connections
• evaluate the impact of the global economy on the environment and peoples of the Americas
• analyse how the nations of the Americas interact to promote or defend their political, economic, environmental, and social interests

Building Knowledge and Understanding
• describe how disparities between rich and poor nations in the Americas affect interactions between them
• describe various ways in which individuals, multinational corporations, and governments participate in the international relations of the countries of the Americas
• describe Canada’s responsibilities to the rest of the countries of the Americas
• explain how their geographic advantages and disadvantages affect the economic development of the nations of the Americas

Developing and Practising Skills
• evaluate the effects on Central and South America of world demand for the regions’ products and resources
• explain the economic, social, and environmental impact of the global economy on the people and environments of selected countries in the Americas, including Canada
• analyse economic data to determine the global ranking, as producers and users of resources, of the Americas as a group and of individual nations of the Americas

Learning Through Application
• analyse selected examples of relationships that have developed between regions in the Americas because of environmental problems, resource needs, and border conflicts

Understanding and Managing Change
• evaluate the effects of various political, economic, social, and technological changes on physical and human environments in the Americas
• evaluate various aid programs in the Americas and their impact

Building Knowledge and Understanding
• describe how population distribution in the Americas has changed over the past one hundred years as a result of changes in population growth, the economy, and technology

Learning Through Application
• compare the problems of living in a large city in North America to those of living in one in South America
• analyse a development project in the Americas to determine its effect on local environments and economies, including those of indigenous peoples
Methods of Geographic Inquiry and Communication

› use the methods and tools of geographic inquiry to locate, gather, evaluate, and organize information
› analyse and interpret data gathered through research and investigation, using a variety of methods and geotechnologies
› communicate the results of geographic inquiries, using appropriate terms and concepts and a variety of forms and techniques

Research
• develop and use appropriate questions to focus a geographic inquiry
• gather geographic information from primary sources and secondary sources to research a geographic topic or issue
• gather geographic information, using a variety of geographic tools and technologies
• evaluate the credibility of sources and the reliability and usefulness of information

Interpretation and Analysis
• distinguish among opinion, argument, and fact in research sources
• use a variety of geotechnologies to interpret, analyse, and synthesize information in connection with a geographic inquiry
• use graphic organizers to clarify and interpret geographic information
• use different types of maps to identify and interpret geographic relationships
• use appropriate statistical methods and categories of data in geographic analysis, observing accepted conventions
• develop possible solutions to geographic problems or issues, using appropriate forecasting, decision-making, and/or problem solving strategies
• explain the different points of view on a geographic issue that are, or might be, held by various stakeholders
• produce a variety of maps, diagrams, and charts, following accepted conventions, to illustrate geographic patterns and relationships
• provide appropriate and sufficient geographic evidence and well-reasoned arguments to support opinions and conclusions
• complete an independent inquiry that deals with a topic or issue concerning the Americas and that reflects the required elements of a geographic inquiry

Communication
• communicate the results of geographic inquiries, for different audiences and purposes, using a variety of forms and including geographic visual supports, both conventional and geotechnological
• use an accepted form of academic documentation to acknowledge all information sources, including electronic sources
• use appropriate terminology when communicating results of geographic inquiries
Overview
Using geological and atmospheric data, students will analyse historical and current patterns of climate and predict future climate trends and weather patterns. Physical, economic and social impacts of climate change in different regions of the world will be examined.

SYSTEMS THINKING…
The world can be viewed as networks of relationships among natural systems (as well as between human systems and natural systems) that constantly feed back to alter these dynamic relationships.

How do past and current climate patterns have an impact on the physical environment of the Earth?

Curriculum Expectations
Please see page 20 for a list of the course curriculum expectations that can be linked to the Focus Questions below.

Focus Questions – Climate Change Connections
1. What physical factors contribute to global climate patterns? How does energy flow between the atmosphere and the hydrosphere? How is energy change in the atmosphere related to climate change? How has climate changed over time?

- The physical nature of the Earth can be explained in terms of how energy interacts with natural systems (such as the atmosphere, the hydrosphere, the lithosphere and the biosphere) to produce global climate patterns.
- Extreme local weather, although part of the natural system, is becoming more frequent, which may be the result of changes in the flow of energy in the atmosphere of the Earth, and the global climate.
- Understanding these changes demands a review of geologic time scales as compared to human time scales. The historical understanding of changing climate patterns encompasses longer periods of time than is evident in the timescale in which we are measuring the current imbalance in the carbon cycle and the hydrological cycle.
Both local weather and global climate patterns are largely the result of the interactions of the atmosphere and hydrosphere. Prevailing winds and ocean currents resulting in specific weather patterns (too hot, severe weather) have contributed to changing demographic patterns and economic development by affecting the productivity of different regions, which in turn is linked to people’s prosperity.

Social systems interact with natural systems and begin to affect local environmental conditions. These interactions can eventually have a greater impact, changing systems beyond the local environment where they began. These changes affect wind and ocean current patterns that will result in dramatic changes for both developed and developing nations.

Technology today allows us to monitor several parameters of wind and ocean currents and the changes that occur. For example, Doppler radar allows us to track incoming storms; satellite imagery provides detail on moisture content in our atmosphere such as cloud cover; remote sensing provides detail on vegetation cover. Whereas in the past people made trade-offs to live in areas where there were obvious high risks (volcanoes have rich soil, shores can be flooded), in the future people may need to look beyond these obvious risks in assessing what the environmental risks will be. Students may reflect on how much faith we put in what technology tells us. How do we react to known risks, let alone considering those as yet unknown?

The economic feasibility of certain activities (forestry, agriculture, fishing) in present-day locations will decline, but predictions are not clear. An analysis of the impact of different activities (e.g., resource industries) and the impact of local behaviour on global change can provide case studies of how human activity can increase or decrease the magnitude and rate of climate change.

Common Understandings within a Climate Change Context

Both local weather and global climate patterns are largely the result of the interactions of the atmosphere and hydrosphere. Prevailing winds and ocean currents resulting in specific weather patterns (too hot, severe weather) have contributed to changing demographic patterns and economic development by affecting the productivity of different regions, which in turn is linked to people’s prosperity.

Understanding the interactions of the many factors that contribute to climate is difficult. Data that provide evidence of historical climate patterns and changes can help people today understand and predict the effect of changing the level of CO₂ in the atmosphere. Using data that show trends of change, students can identify possible future outcomes.

Current use of monitoring technology allows people to track sources of CO₂ emissions and identify carbon sinks — areas where carbon is being sequestered. This type of technology is useful for refining and altering models of climate change over time. Such technology could also be used as part of a system to monitor the effectiveness of action and to ensure compliance with CO₂ production limits. (Having such technical capacity raises other questions: e.g., “Would society allow an ‘environmental police service’ to detect the source of emitted gases?”)
Teaching Suggestions

Visual Representation of Data
There are many opportunities throughout this course where students could take data in different forms and create a visual representation. For example, students can take numbers from charts to form line graphs or bar charts, or to indicate variation on a map with several colours. Students should also be encouraged to gather their own data through field studies. (Check lab catalogues for the type of equipment available to collect specific data.)

Prediction
As different topics are approached within the course, students can predict how climate change will affect a specific region, then make larger global connections. An obvious opportunity comes in examining volcanic eruptions and linking them to different ice ages. Prediction can also be done at a very local level by examining micro-climates. For example, how does the construction/destruction of a hill make a difference to wind pattern, run-off, temperature, etc? How does the creation of a parking lot on a former agricultural field make a difference? (Joni Mitchell’s “Pave Paradise and Put Up a Parking Lot” may be used as an introduction. “Concrete Jungle” is another possibility.)

Specific Study of Climate Change
Within this course, it would be very appropriate to incorporate the issue of climate change as a part of the climate systems unit. As the basics of climate systems are covered (ocean currents, wind patterns, temperature fluctuations, etc.) the different components and their relationship to climate change could be assigned to individuals or students working in small groups. Assign each group of students a particular region of the world: have them research the impact of climate on their region, and then predict the changes to that region if climate change (e.g., overall temperature increases) continues at its present pace. Results of the physical changes could then be linked to the consequent impact on the people (human systems) in the region. A comparison chart such as the following could be set up to synthesize the details found within the groups:

<table>
<thead>
<tr>
<th>A. Nation/EcoZone</th>
<th>B. Current climate (temp. range)/veg/wildlife patterns</th>
<th>C. Current environment-related industry and settlement pattern</th>
<th>D. Predicted physical changes in the environment related to climate change</th>
<th>E. Predicted impacts and settlement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada/ prairie grasslands</td>
<td>Research according to the subheadings above; annotated maps would be appropriate here</td>
<td>Rich prairie soils have allowed the development of agriculture; people live in communities along rivers</td>
<td>Hot dry conditions eventually inhibit the soil’s ability to absorb rainfall and reduce grain yields; severe weather patterns include storms that produce heavy rainfall that is not absorbed by the soil, causing flooding.</td>
<td>Farmers change types of crops and soil amendments to accommodate the growing conditions; human communities will have to pay for municipal infrastructure that can accommodate the effects of severe weather. In extreme cases, the population may be forced to migrate if the land ceases to be productive.</td>
</tr>
</tbody>
</table>
## Resources

Wherever possible, materials from this Resources section have been archived on the TDSB EcoSchools website: [http://ecoschools.tdsb.on.ca](http://ecoschools.tdsb.on.ca)

<table>
<thead>
<tr>
<th>Topic</th>
<th>URL</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean currents and climate change</td>
<td><a href="http://www.whoi.edu/institutes/oeci/currenttopics/ct_abruptclimate.htm">www.whoi.edu/institutes/oeci/currenttopics/ct_abruptclimate.htm</a></td>
<td>Woods Hole Oceanographic Institute – oceans and climate change</td>
</tr>
<tr>
<td>Glaciation and climate change</td>
<td><a href="http://www.sln.org.uk/geography/enquiry/we35a.htm">www.sln.org.uk/geography/enquiry/we35a.htm</a></td>
<td>An assignment which addresses how climate change affects glaciation and vice versa (links for answers)</td>
</tr>
<tr>
<td>Ozone depletion and climate change</td>
<td><a href="http://www.ndsc.ncep.noaa.gov/climchng.html">www.ndsc.ncep.noaa.gov/climchng.html</a></td>
<td>An article outlining links between climate change and ozone depletion</td>
</tr>
<tr>
<td><em>Creating a Climate of Change</em></td>
<td><a href="http://www.curriculum.org/searchCSC.tcl">www.curriculum.org/searchCSC.tcl</a></td>
<td>Ordering information for Climate Change Kit from SEEDS Foundation (2002)</td>
</tr>
</tbody>
</table>
Curriculum Expectations

Geographic Foundations: Space and Systems
- analyse the sources and nature of energy flows through the lithosphere, atmosphere, hydrosphere, and biosphere
- explain the physical processes that create landforms, climate, soils, and vegetation.

Building Knowledge and Understanding
- explain how the earth’s orbit and tilt relate to the seasons and annual variations in climate
- identify the principal features of the lithosphere, atmosphere, hydrosphere, and biosphere
- identify the interconnections among natural systems within selected ecosystems
- describe the origins, distribution, and frequency of different kinds of storms

Developing and Practising Skills
- describe the flow of matter and energy through ecosystems and explain the relationship of these flows to landforms, climate, soils, and vegetation
- explain how climatic controls act upon the elements of the atmosphere to produce the climatic zones of the earth

Learning Through Application
- explain the concepts of heat balance and air circulation, using local examples
- analyse the effects of natural variations in climate on the structure and composition of the soils and vegetation of selected regions

Human-Environment Interactions
- evaluate the impact of natural systems on people and their activities
- evaluate the impact of human life on the environment
- explain the importance of stewardship and sustainability as guiding principles for human use of the physical environment

Building Knowledge and Understanding
- describe the trade-offs for humans living in areas that are subject to natural disruptions
- describe the effects of human activities
- describe the importance of using sustainable practices in resource-based industries

Developing and Practising Skills
- analyse how natural hazards affect human activities
- analyse ways in which human activities may increase or decrease the risks from natural hazards
- evaluate the impact on a selected region of human-caused changes in atmospheric conditions

Learning Through Application
- evaluate the impact of human activities on natural cycles
- analyse how selected human activities affect a local environment
- illustrate how the concept of sustainability is applied in a local environment
Global Connections
› explain the reasons for the global patterns of continents and oceans, landforms, climate, soils, and vegetation
› explain the importance of water to global systems
› analyse local, regional, and global issues related to physical geography

Building Knowledge and Understanding
• explain the role that oceans and ocean currents play in moderating climate

Developing and Practising Skills
• explain the relationships that link global patterns of landforms, climate, soils, and vegetation to each other
• describe the distribution of significant ocean currents and prevailing winds and their relationships to world vegetation and soil patterns

Learning Through Application
• compare global distribution patterns of climate, soils, and vegetation with patterns in a local bioregion
• analyse the effects of human activities on water resources
• summarize the geopolitical issues facing nations that share various physical regions
• analyse the effects that human activities and/or natural events in a region or country can have on another part of the world

Understanding and Managing Change
› analyse the causes and consequences of climate change
› explain how human uses of the earth, especially uses involving technology, cause changes over time in natural systems

Building Knowledge and Understanding
• describe the potential effects of climate change on the sustainability of resource based industries
• explain the relationship between natural variations in global climate and glacial movements
• identify the mechanisms of change within the lithosphere, atmosphere, hydrosphere, and biosphere

Developing and Practising Skills
• distinguish natural short-term variability from long-term trends in historical climate data
• explain the potential effects of long-term climate change on different parts of the world, including their local community
• explain the correlation between changes in population density, changes in human activities, and changes in the “ecological footprint” of our species

Learning Through Application
• describe the difficulties involved in predicting climate change
• analyse changes in the physical geography and land use in their local area over time to determine how these changes have affected the population and the environment
• evaluate the role of technology in changing relationships between humans and the environment
Methods of Geographic Inquiry
› use the methods and tools of geographic investigation and inquiry to locate, gather, evaluate, and organize information
› analyse and interpret data gathered through research and investigation, using a variety of methods and geotechnologies
› communicate the results of geographic inquiries and investigations, using appropriate terms and concepts and a variety of forms and techniques

Research and Investigation
• develop and use appropriate questions to focus a geographic inquiry or investigation
• gather geographic information from primary sources and secondary sources to research a geographic topic or issue
• use remote-sensing imagery, maps, the global positioning system, and geographic information systems to measure natural conditions

Interpretation and Analysis
• use a variety of geotechnologies to interpret, analyse, and synthesize information in connection with a geographic inquiry
• use different types of maps to interpret geographic relationships
• use appropriate statistical methods in geographic analysis, observing accepted conventions
• develop possible solutions to geographic problems or issues, using appropriate forecasting, decision-making, and/or problem solving strategies

Communication
• explain the limitations on our ability to make accurate predictions about physical phenomena
• explain the different points of view on a geographic issue that are, or might be, held by various stakeholders (e.g., individuals, business organizations, governments, special interest groups)
• produce a variety of maps, diagrams, and charts, following accepted conventions, to illustrate geographic patterns and relationships
• provide appropriate and sufficient geographic evidence and well-reasoned arguments to support opinions and conclusions
Overview
Students will attempt to calculate the true ecological cost of travel through an examination of energy and carbon costs of different forms of transportation and an assessment of the impact of tourism on travel destinations. Impact predictions will help guide suggested future tourism patterns, policies and behaviours.

SYSTEMS THINKING…
Examine the relationship between human actions and natural systems as they constantly affect each other. Some environments are more fragile than others, and technology may accelerate the impact that human actions have on natural systems.

What is the true ecological cost of travel?

Curriculum Expectations
Please see page 28 for a list of the course curriculum expectations that can be linked to the Focus Questions below.

Focus Questions – Climate Change Connections

1. What is your Ecological Footprint as you live today? What is the Ecological Footprint of different travel and destination choices? What is the carbon cost of different means of travel?

- We each create an Ecological Footprint that reflects our use of planetary resources. (This model of human interaction with the environment should be familiar to most students from previous courses.) Have students calculate their footprint as it is now, perhaps comparing it to what it was earlier. Students could also calculate their carbon output through the One-Tonne Challenge.

- At this point, the focus of attention is on the production of CO₂ gases that contribute to climate change. As students explore regions and consider tourism opportunities, the choices that people make with respect to transportation need to be considered. We use energy to travel, and some travel choices produce more CO₂ than others.

- Different modes of transportation produce different carbon emissions. Consider the various types of transportation (e.g., jet fuel vs. ship).
2. What factors draw tourists to specific regions? What are the consequences of tourist traffic?

- Often climate and environmental features attract tourists to a region, but human activity in the area can compromise these same attractive features. Travel, accommodation and entertainment infrastructure can sometimes diminish the appeal of the destination.

3. What might help to change people’s attitudes and expectations about comfort and convenience when they travel in areas where the systems – natural, human, or both – are fragile? What kind of policies could be put in place to address environmental degregation?

- Convenience and attitudes about what we expect to find when we travel to a particular destination are related to energy choices which in turn are usually related to climate changing greenhouse gases. Consider what people expect as they make decisions and choose to travel to a particular place.

- The human use of resources and its consequences can lead to unforeseen damage, such as high levels of ground level ozone or acid rain from vehicular emissions, or damage to living reefs by cruise ship waste and traffic. Highlight the idea of changes at both local and global ecosystem levels being in constant interaction, producing ripple effects (butterfly/chaos theory).

4. What are the energy options for different regions?

- Consider the quality and quantity of energy available and used in a number of destinations. Some regions use energy alternatives effectively.

- Research the energy options available to sustain tourism in different regions. (For example, does one country have more access to a particular energy alternative than another does? What are the best choices given the physical and social resources of the country?) World maps that provide energy sources (wind potential or solar kilojoules along with hydro and oil and gas potential) will help here.
5. What are the current trends in travel and tourism? How will climate change affect future possibilities for tourism for specific destinations?

- Regional variation in climate and resources often determines the energy choices available for a nation or region. Some fuels produce a high concentration of pollutants, and some energy generation methods produce high levels of CO₂, which can affect the global carbon and energy balances more than other methods.

- As Earth’s atmosphere captures more heat, the energy is distributed in the atmosphere and hydrosphere differently, creating climatic shifts. These climatic shifts will affect the environmental features of many regions, and so change the nature of tourism in these regions.

- Have students consider the likely impact of climate change as they examine the physical features of a region and current settlement patterns along with the tourist attractions. For example, if a tourist site is known for its beaches, and the beaches are likely to flood, or if a site is known for a particular species of plant or animal and the environmental conditions change, it could mean not only the loss of the tourist site but the loss of a species as well. (This is an opportunity to revisit the idea of the importance of maintaining biodiversity: fraying the web of life makes many living organisms — including humans! — more vulnerable.)

Common Understandings within a Climate Change Context

Energy and resource use are key components in understanding how human activity creates changes to the environment of a particular destination. Issues surrounding transportation provide a way to understand the impact of our actions. Seeing transportation and energy choices in terms of CO₂ production and infrastructure (e.g., roads or airports) can illustrate the impact on the local environment (e.g., pollution, habitat destruction), and help students understand how tourism can contribute to climate change.

The activity of one person may have limited impact on the local environment, but tourism can increase the population dramatically, creating significant impacts on the environment. Collective activity can degrade environmental conditions, leading to massive natural losses within a complex system. Such stress can increase the fragility of the region or country so that it is less able to withstand the forces of severe weather events. This fragility can lead to further environmental degradation, so that this destination is no longer attractive for tourism. The people who rely on this source of income often have limited options.
Teaching Suggestions
The topic of climate change in this course may be addressed through a case study approach and/or individual/group inquiry comparison. It is important for students to be able to relate what they are learning to their own Ecological Footprint. Taking on the Government of Canada’s One-Tonne Challenge is a positive action that underlines the importance of individual and collective action.

Case Study
Using a single case study throughout the course to address issues can provide students with a model of how to inquire about a different region or a question that they wish to pursue. The country of Nepal is suggested as a single case study with many rich complexities. If several case studies are used, the idea that some environments are more fragile than others can be emphasized, e.g. the Galapagos, the Arctic or Antarctic environments compared to that of Kenya. (Link back to complexity of webs and chains.)

Comparisons
Identifying contrasts can make some ideas very clear. Comparing the impact of tourist traffic in remote regions to densely traveled areas can provide students with opportunities to ask more questions for further research. How much CO₂ is generated per person? Are there efficiencies in heavily travelled destinations that are compromised in remote destinations?

Resources
Wherever possible, materials from this Resources section have been archived on the TDSB EcoSchools website: http://ecoschools.tdsb.on.ca

<table>
<thead>
<tr>
<th>Topic</th>
<th>URL</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecological Footprint</td>
<td><a href="http://www.mec.ca/Apps/ecoCalc/ecoCalc.jsp">www.mec.ca/Apps/ecoCalc/ecoCalc.jsp</a></td>
<td>Calculate your own Ecological Footprint</td>
</tr>
<tr>
<td>Ecological Footprint of Nations</td>
<td><a href="http://www.ecouncil.ac.cr/rio/focus/report/english/footprint/numbers.htm">www.ecouncil.ac.cr/rio/focus/report/english/footprint/numbers.htm</a></td>
<td>Listing of Ecological Footprints for countries of the world</td>
</tr>
<tr>
<td>World hotspots for climate change and consequences</td>
<td><a href="http://www.climatehotmap.org/index.html">www.climatehotmap.org/index.html</a></td>
<td>Annotated world map</td>
</tr>
<tr>
<td>One-Tonne Challenge</td>
<td><a href="http://www.climatechange.gc.ca/onetonne/english">www.climatechange.gc.ca/onetonne/english</a></td>
<td>Calculate your own level of carbon emissions and determine where you can reduce your carbon emissions</td>
</tr>
<tr>
<td>Carbon dioxide calculator</td>
<td><a href="http://www.natenergy.org.uk/convert.htm">www.natenergy.org.uk/convert.htm</a></td>
<td>National Energy Foundation — energy to carbon dioxide converter</td>
</tr>
</tbody>
</table>
### Resources cont’d

<table>
<thead>
<tr>
<th>Topic</th>
<th>URL</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse gas mitigating technologies</td>
<td><a href="http://www.greentie.org/links/">www.greentie.org/links/</a></td>
<td>Green technology – links to organizations specializing in greenhouse gas mitigating technologies</td>
</tr>
<tr>
<td>Climate change and tourism</td>
<td><a href="http://www.world-tourism.org/sustainable/climate/brochure.htm">www.world-tourism.org/sustainable/climate/brochure.htm</a></td>
<td>First International Conference on Climate Change and Tourism – recommendations on practices</td>
</tr>
<tr>
<td>Impact of climate change on tourism and aviation emissions on climate change</td>
<td><a href="http://www.eldis.org/csr/cliamechangeandtourism.htm">www.eldis.org/csr/cliamechangeandtourism.htm</a></td>
<td>Corporate social responsibility – potential impacts of climate change on the tourism industry and aviation emissions impact on climate change</td>
</tr>
<tr>
<td>Consequences of climate change on tourism</td>
<td><a href="http://www.wwf-uk.org/news/n_0000000309.asp">www.wwf-uk.org/news/n_0000000309.asp</a></td>
<td>World Wildlife Fund</td>
</tr>
<tr>
<td>Caribbean coastal degradation</td>
<td><a href="http://www.irf.org/irtourdg.html">www.irf.org/irtourdg.html</a></td>
<td>General overview of issues regarding tourism in the Caribbean</td>
</tr>
<tr>
<td>Tiamo Resort</td>
<td><a href="http://www.andros-bahamas.com/">www.andros-bahamas.com/</a></td>
<td>Resort in Bahamas suitable for case study</td>
</tr>
<tr>
<td>Report on ecotourism in Nepal. Funded by the Asian Development Bank</td>
<td><a href="http://www.adb.org/Documents/Environment/NEP/Memo70-01.pdf">www.adb.org/Documents/Environment/NEP/Memo70-01.pdf</a></td>
<td>This is intensive, but parts could be used as a case study or an example of what students may consider in their study.</td>
</tr>
<tr>
<td>A freelance writer’s overview of the history of ecotourism in Nepal.</td>
<td><a href="http://www.panos.org.np/resources/publications/tough_terrain/chap5.htm">www.panos.org.np/resources/publications/tough_terrain/chap5.htm</a></td>
<td>This is a summarized version of the issues related to tourism in Nepal. Good for student overview of a case study.</td>
</tr>
</tbody>
</table>
Curriculum Expectations

Geographic Foundations: Space and Systems
- evaluate the influence of human systems on patterns of travel and tourism and, conversely, the influence of travel and tourism on human systems
- analyse how factors such as movements of people and regional characteristics influence travel and tourism patterns

Building Knowledge and Understanding
- explain how natural features and human criteria are used to define regions

Developing and Practising Skills
- determine the reasons for patterns of tourist travel within selected regions
- analyse the effects of human systems on travel and tourism
- explain how tourism-related development can have a significant effect on human systems

Learning Through Application
- analyse the major natural, cultural, economic, and political characteristics of selected tourist regions
- identify natural and human features that attract tourists to their local region

Human-Environment Interactions
- explain how environmental factors affect patterns of travel and tourism
- analyse the impact of different types of travel and tourism on the natural environment
- evaluate the effectiveness of programs and initiatives designed to manage and protect the resources on which tourism is based

Building Knowledge and Understanding
- identify the natural resources on which tourism is based and justify the need for sustainable development

Developing and Practising Skills
- compare the positive and negative effects of tourism on people and the environment in selected sites or regions
- analyse specific examples of how tourist activities can threaten fragile environments or species

Learning Through Application
- produce a set of criteria or “code of behaviour” for tourists travelling in fragile environments
- describe UNESCO’s role and the challenges it faces in protecting significant natural and cultural heritage sites
- assess the need for sustainable development and protection of the resources on which tourism is based in selected sites or regions
- predict and explain the likely impact of a natural or human-caused disaster on travel and tourism in a selected region
Global Connections
  › describe global patterns of travel and tourism
  and the factors that influence them
  › explain the social, environmental, cultural,
    economic, and political effects of travel and
    tourism on various destination regions
  › compare the characteristics of selected tourist
    regions of the world

Building Knowledge and Understanding

Developing and Practising Skills
  • describe the social, environmental, cultural,
    economic, and political effects of travel and
    tourism associated with international events
  • analyse the causes and effects of economic
    disparities between selected world tourism
    regions

Learning Through Application
  • evaluate the natural and human attributes
    that contribute to the success of selected
    globally significant tourist attractions
  • explain the relationship between the
    development of travel and tourism in a
    developing country and the country’s level
    of economic growth

Understanding and Managing Change
  › analyse the social, environmental, cultural,
    economic, and political effects of tourism-
    related development on a community or region
  › evaluate the impact on travel and tourism of the
    plans, policies, and initiatives of governments,
    businesses, and other organizations

Building Knowledge and Understanding
  • identify recent trends in travel and tourism
    and their effects on natural systems and the
    environment
  • identify the economic, cultural, political, and
    environmental components of selected issues
    related to travel and tourism
  • explain how various factors contribute to
    the growth or decline of tourism around
    the world
  • explain issues that arise when planning
    for tourism development within a region

Developing and Practising Skills
  • show how changes in technology or in its uses
    alter travel and tourism patterns analyse the
    effects of political, economic, cultural, and
    environmental motivators and barriers on
    travel and tourism patterns

Learning Through Application
  • analyse the effects of an increase in tourism on
    the natural and human systems of a selected
    region
  • predict the future of tourism for a selected
    region or destination
Methods of Geographic Inquiry and Communication

- use the methods and tools of geographic inquiry to locate, gather, evaluate, and organize information
- analyse and interpret data gathered through research and investigation, using a variety of methods and geotechnologies
- communicate the results of geographic inquiries, using appropriate terms and concepts and a variety of forms and techniques

Research

- develop and use appropriate questions to focus a geographic inquiry on a topic or issue in travel and tourism
- gather geographic information from primary sources and secondary sources to research a topic or issue related to travel, tourism, or regional geography
- gather geographic information, using a variety of geographic tools and technologies
- evaluate the credibility of sources and the reliability and usefulness of information
- identify the educational requirements, job descriptions, current opportunities, and future prospects for selected careers related to the travel and tourism industry

Interpretation and Analysis

- distinguish among opinion, argument, and fact in research sources
- use a variety of geotechnologies to interpret, analyse, and synthesize information related to travel, tourism, and regional geography
- use different types of maps, graphs, organizers, and diagrams to clarify and interpret geographic information and relationships
- use appropriate statistical methods in the analysis of travel and tourism patterns, observing accepted conventions
- develop possible solutions to problems or issues related to travel, tourism, or regional geography, using appropriate forecasting, decision-making, and/or problem-solving strategies
- explain the different points of view on an issue related to travel and tourism that are, or might be, held by various stakeholders
- produce a variety of maps, graphs, diagrams, and charts, following accepted conventions, to illustrate patterns and relationships related to travel, tourism, and regional geography
- provide appropriate and sufficient evidence and well-reasoned arguments to support opinions and conclusions

Communication

- communicate the results of geographic inquiries, for different audiences and purposes, using a variety of forms and including geographic visual supports, both conventional and geotechnological
- use an accepted form of academic documentation to acknowledge all information sources, including electronic sources
- use appropriate terminology when communicating results of geographic inquiries.
Many global issues can be connected to climate change. For example, urbanization involves land use for transportation and housing and means loss of natural space; natural resource issues can be related to energy production or consumer products; food production is linked to agricultural practices which may include use of energy-intensive fertilizers.

Breaking these large issues into more explicit questions such as the following will help reveal the climate change connections:

- How do different land use choices affect climate change? (biomes have different characteristics: some have a greater capacity to act as a sink for CO₂ than others; we should look at the need for increasing CO₂ sinks)

- What are the climate change linked consequences that can result as farmland is swallowed up by sprawling cities?
2. What are the connections between climate change and the main food choices of a country?

› The cost of many of the foods we eat includes subsidized water use for California fruits and vegetables that are then transported by vehicles on subsidized roadways.

› Some methods of agricultural production result in more CO₂ than others, e.g., farms that are monocultures will use more fertilizer than farms that grow diverse crops; larger more extensive equipment is required on monoculture farms.

› Bali’s experience with rice varieties provides a case study for examining how different people and groups of people have different perspectives (engineers different from farmers), the role of culture (engineered farming failed while rituals with the direction of priests maintained high productivity), how people see resources differently (maximize use of water for self, and ignore the impact on others), the importance of biodiversity (monoculture led to devastating pests), the impact of IMF policy, the interaction of social systems and natural systems. To support the wonder rice, people had to spend money on fertilizers and pesticides that are petroleum based: their production is connected to climate-changing CO₂ emissions. (See David Suzuki and Holly Dressel, Good News for a Change, Chapter 5.)

3. What resources do countries use as their source of energy production?

› It is important to recognize that some countries may have coal or oil to burn readily at hand (e.g. China), while others are moving towards using other sources, (e.g., Hawaii and its Ocean Thermal Energy Conversion). Ideas touched upon toward the end of this section will question the power of some countries to encourage (force) other countries into using sources which may be more expensive, or not viable within the economic or political structure.

4. How will the impact of climate change physically affect biomes around the world?

› For different biomes, generic trends can be extrapolated. Some regions become drier, deserts expand, loss of coastlines, vegetation loss through fire increase, species loss through inability to change, etc.

5. How will the impact of climate change affect nations economically and demographically?

› Examine economies tied to a natural resource (fishing, forestry, agriculture) and also link the impact to the question above relating to the biome (or biomes) in which the nation exists. Consider living conditions (for both humans and animals), the temperature range, and basic needs (e.g., water source).

› Consider the existing settlement patterns and predict what changes may occur as the climate changes: what areas will people (and animals) have to migrate from?
6. How autonomous are nations with respect to climate change?

- Through an examination of the Kyoto Protocol, students can gather information on nations willing to sign or not and their rationale. The environmental conditions set out within various trade agreements also provides information on emission control standards.

7. What is the impact of a particular policy of a transnational corporation?

- Nike is a transnational corporation that has shown some leadership by eliminating PVCs from shoe construction and using organic cotton for its cotton needs. The issues of subcontracting and developing company policy that limits the exploitation by subcontractors can also be explored. (See David Suzuki and Holly Dressel, *Good News for a Change*, Chapter 1.)

8. How do international trade agreements affect climate change?

- Examine how a country’s natural resources are affected by various trade agreements (e.g., NAFTA, softwood lumber, water diversion). These in turn can have an impact on climate. Emission standards should also be examined (e.g., Mexico, US and Canadian comparisons).

9. What role do non-governmental organizations (NGOs) play in developing or implementing policy? How do the policies of businesses, governments and organizations affect everyday life? Are there unexpected links to climate change? (The EcoSchools *Climate Change in Grade 10 Civics* resource has a useful section on the role of policy. Go to [http://ecoschools.tdsb.on.ca](http://ecoschools.tdsb.on.ca) to view this resource.)

- Have students explore the ramifications of a particular NGO’s policy decision: e.g., Partnership for Pesticide Bylaws focussed its efforts on the City of Toronto to ban the non-essential use of pesticides on lawns and gardens. In May 2003, Toronto adopted a bylaw to restrict the use of lawn pesticides. Reduced pesticide use can lead to greater insect biodiversity and reduce toxic chemical runoff.

  The decision to restrict pesticide use in Toronto means that people, their pets and other animals are less likely to be exposed to toxic chemicals when outdoors. It also affects the livelihood of people working in that industry. The link to climate change is less obvious, but significant: pesticide production is an energy-intensive process and shipping these chemicals also requires energy. Whenever manufacturing or shipping involves energy produced by fossil fuels, greenhouse gases are emitted which contribute to climate change.

- BC natives have established a protocol for forestry that includes non-native interests. The productivity of the forest increases with the maintenance of a natural forest rather than choosing a clear-cut monoculture alternative. Growth of new trees in the forests helps to sequester CO₂. Fishing is sustained and provides additional non-forest income. This case study shows social, economic, cultural and political components as they affect the sustainability of a resource-based activity. (David Suzuki and Holly Dressel, *Good News for a Change*, Chapter 6.)
10. How will the impact of climate change affect nations socially, culturally and politically?

- Impending climate changes will create significant changes not only to the world economy, but also affect social structures and institutions, cultural survival and political autonomy. This is an issue that highlights the notion of interdependence among nations, showing that only the actions of nations working together can hope to mitigate climate change. (Ask which global issues are not related to climate change.)
- Where the changes are significant the environment will no longer sustain the population and people will require ongoing aid or become climate change refugees.
- A consideration of the impact of climate change from the many geographic perspectives (economic, social, cultural, political and environmental) highlights the costs of no action as opposed to the costs of action.

Common Understandings within a Climate Change Context

Climate change is a complex issue that has many layers of cause, impact and possible mitigation. Simple solutions are not always appropriate or effective. Robust natural systems are complex, such as a rainforest that is a polyculture with many species. The Bali rice farmers’ initiative shows that when social systems simplify a natural system with a monoculture, there are dramatic results. More than a simple sum of various parts, the properties of a polyculture are surprising and difficult to analyse.

Policy that provides solutions sensitive to local contexts is more likely to be useful, successful and lasting. The imposition of simplistic patterns generalized from one area to all areas can lead to greater degradation of the environment, political destabilization, cultural losses, reduced prosperity and lessened ability to sustain ongoing development of the population.

Solutions to climate change problems require action from many quarters, from the individual to small and large businesses to governments at all levels. This is a heartening message: it means that every person has the opportunity to make a contribution through personal action.

Teaching Suggestions

Focus Questions

The Focus Questions can be addressed in a number of ways throughout a world issues course. For example, they could be studied as the articulation of environmental issues in themselves. Another approach could be to revisit particular questions as different global issues are studied throughout the course. For example, what impact does climate change have as a factor when studying population patterns and urban development, resource/energy use or food disparities?

No matter how they are used, the nature of the questions necessitates basic background work through inquiry and the application of critical thinking skills to enable students to understand the implications of what they are learning.
Culminating Task
Climate change could also be a part of a culminating task where students have been given sufficient opportunities to explore relevant issues and develop the skills for independent research and analysis. Climate change can be assigned as an issue that requires students to actively integrate the many perspectives, problems and potential solutions available.

As part of the final 30% course task, students could choose a developing nation that might apply for aid. As part of their proposal for aid support, the applicant would factor in the many likely impacts of climate change.

Resources
Wherever possible, materials from this Resources section have been archived on the TDSB EcoSchools website: [http://ecoschools.tdsb.on.ca](http://ecoschools.tdsb.on.ca)

<table>
<thead>
<tr>
<th>Topic</th>
<th>URL</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate Change — costs of mitigation</td>
<td><a href="http://www.spea.indiana.edu/richards/Welfare_Economics/">www.spea.indiana.edu/richards/Welfare_Economics/</a></td>
<td>Climate change: A welfare economics perspective – evaluation of climate change, benefits of climate change and costs of mitigation</td>
</tr>
<tr>
<td>Local and regional consequences of global warming</td>
<td><a href="http://www.climatehotmap.org/">www.climatehotmap.org/</a></td>
<td>Global Warming: Early Warning Signs – annotated world map</td>
</tr>
<tr>
<td>Non-governmental Organizations</td>
<td><a href="http://www.ngo.org/links/index.htm">www.ngo.org/links/index.htm</a></td>
<td>Links to NGOs by topic</td>
</tr>
<tr>
<td>Biomes of the world</td>
<td><a href="http://www.ucmp.berkeley.edu/glossary/gloss5/biome/">www.ucmp.berkeley.edu/glossary/gloss5/biome/</a></td>
<td>Identifies biomes of the world – location and characteristics</td>
</tr>
<tr>
<td>Canada’s action plans for dealing with climate change issues</td>
<td><a href="http://www.nccp.ca/NCCP/index_e.html">www.nccp.ca/NCCP/index_e.html</a></td>
<td>Canada’s National Climate Change Process</td>
</tr>
<tr>
<td>Canada: Impacts of climate change and future actions</td>
<td><a href="http://www.climatechange.gc.ca">www.climatechange.gc.ca</a></td>
<td>Identifies changes to Canada regarding climate change and actions that need to be taken – government and the individual</td>
</tr>
</tbody>
</table>

Curriculum Expectations

Geographic Foundations: Space and Systems
› explain how the earth’s natural and human systems are interconnected in multiple, complex ways
› compare the cultural, economic, and political aspirations of selected groups and the effects of their actions on local, national, and global geographic issues

Building Knowledge and Understanding
• describe the interdependence of ecology and economics
• explain how point of view influences an individual’s perceptions of a place
• identify ways in which countries and regions of the world are becoming increasingly interdependent
• identify the social, economic, cultural, political, or ecological components of selected geographic issues

Developing and Practising Skills
• evaluate the significance of a variety of movements to protect resources and environments

Learning Through Application
• describe the distribution of the world’s major biomes and compare the productivity and diversity of selected ecosystems
• analyse appropriate statistical indicators to assess the quality of life in a variety of developed and developing countries in different parts of the world
• analyse the causes of economic disparity in the local or regional community

Human-Environment Interactions
› analyse geographic issues that arise from the impact of human activities on the environment in different regions of the world
› evaluate approaches, policies, and principles relating to the protection and sustainability of the planet’s life-support systems

Building Knowledge and Understanding
• explain how human-induced changes in natural systems can diminish their capacity for supporting human activity
• explain why people perceive resource use and sustainable development differently at different times and in different places

Developing and Practising Skills
• analyse the impact on natural and human systems of selected human migrations
• analyse the impact on natural and human systems of past and current trends in agriculture
• analyse the impact on natural and human systems of some of the side-effects of urbanization and urban growth
• evaluate the economic, social, and ecological impact of current practices used in harvesting or extracting a selected resource
• evaluate the effectiveness of various policies and practices that are used to promote sustainable development in selected places and regions of the world
• analyse the effects on the environment of various trade policies or agreements

Learning Through Application
• evaluate the short-term and long-term economic, social, and environmental effects of efforts to increase the productivity of a selected natural environment
• assess how selected municipal, provincial, and federal government policies contribute to sustainable resource development in Canada
• produce a case study of a specific situation in which resource development has contributed to the disruption of an ecosystem

Global Connections
› analyse the influences that increase the interdependence of countries around the world
› analyse instances of international cooperation and conflict and explain the factors that contributed to each
› evaluate the social, economic, and environmental impact of the strategies for sustainable development implemented by a variety of individuals, organizations, and institutions

Building Knowledge and Understanding
• identify current global sustainability issues and environmental threats
• explain how inequities in the distribution of resources and boundary disputes contribute to uprisings and conflicts
• explain how economies and environments in some places can be affected by decisions made in other places
• describe the contributions of individuals who have been influential in addressing global issues and evaluate the impact of their work

Developing and Practising Skills
• analyse the economic and environmental effects of colonialism and neocolonialism on selected countries
• analyse geopolitical relationships between selected countries and regions
• analyse the evolving global geopolitical role of a selected region or country and evaluate how its actions contribute to international cooperation or conflict

Learning Through Application
• evaluate the performance of a selected transnational corporation with respect to the promotion of environmental sustainability and human rights
• analyse problems of hunger and poverty in selected countries and explain how certain practices may aggravate the problems
• explain the relevance to their own lives of the work on poverty, disease, and the environment done by governmental and nongovernmental organizations

Understanding and Managing Change
› analyse trends and predict changes in the human use of the earth and its resources
› evaluate the cultural, economic, and environmental impact of changing technology
› evaluate the effectiveness of short-term and long-term solutions to geographic problems and issues at the local, national, and global level

Building Knowledge and Understanding
• explain how local participation in the development process can help build sustainable communities

Developing and Practising Skills
• predict future global demographic changes and their economic, environmental, and social implications
• analyse trends related to the consumption of selected resources to determine the sustainability of the resources
• evaluate the role played by non-governmental organizations and local community initiatives in different parts of the world in promoting sustainable development and responsible resource management
Learning Through Application
• identify local awareness levels and viewpoints relating to a current geographic issue
• evaluate the perspectives and arguments of various stakeholders on a current issue
• assess the environmental and economic impact of a selected case of environmental deregulation in Canada
• evaluate the effectiveness of an international agreement (e.g., Kyoto Protocol, Convention on Biological Diversity, Montreal Protocol, Convention on the Law of the Sea) that has been designed to address global issues or protect the global commons (e.g., air, fresh water, oceans, biodiversity)

Methods of Geographic Inquiry and Communication
› use the methods and tools of geographic inquiry to locate, gather, evaluate and organize informations
› analyse and interpret data gathered through research and investigation, using a variety of methods and geotechnologies
› communicate the results of geographic inquiries, using appropriate terms and concepts and a variety of forms and techniques

Research
• develop and use appropriate questions to focus a geographic inquiry
• gather geographic information from primary sources and secondary sources to research a geographic topic or issue
• gather geographic information, using a variety of geographic tools and technologies
• evaluate the credibility of sources and the reliability and usefulness of information

Interpretation and Analysis
• distinguish among opinion, argument, and fact in research sources
• use a variety of geotechnologies to interpret, analyse, and synthesize information in connection with a geographic inquiry
• use different kinds of maps and images to identify, interpret, and analyse geographic relationships, including those that involve the consequences of human activities or environmental phenomena
• use appropriate statistical analysis techniques in geographic analysis, observing accepted conventions
• develop possible solutions to geographic problems or issues, using appropriate forecasting, decision-making, and/or problem solving strategies
• explain why it is difficult to make accurate predictions relating to human use of the earth and its resources, and why some predictions are more (or less) accurate than others
• explain the different points of view on a geographic issue that are, or might be, held by various stakeholders
• produce a variety of maps, diagrams, and charts, following accepted conventions, to illustrate local or global patterns and relationships
• draw conclusions or make judgments or predictions on the basis of reasoned analysis and supporting evidence
• complete an independent inquiry into a selected local, national, or global issue that reflects the required elements of a geographic inquiry

Communication
• communicate the results of geographic inquiries, for different audiences and purposes, using a variety of forms and including geographic visual supports, both conventional and geotechnological
• use an accepted form of academic documentation) to acknowledge all information sources, including electronic sources
• use appropriate terminology when communicating results of geographic inquiries
CGR4M – THE ENVIRONMENT AND RESOURCE MANAGEMENT, GRADE 12, UNIVERSITY/COLLEGE PREPARATION

Overview
Students will analyse how consumer choices affect the sustainability of natural resources from both personal and global perspectives. Actions by individuals and special interest organizations as well as government policies will be assessed in terms of their effectiveness. An action plan to reduce greenhouse gases from a resource-based perspective will be developed.

SYSTEMS THINKING…
Humans are dependent upon the natural world, but the natural world is not dependent upon humans for its existence. Human systems have impacts on the rates of energy flow, matter cycling and relationships in the web of life. These changes to natural systems feed back to create change in human systems.

How do the consumer choices we make, as individuals or as a nation, have an impact on the environment?

Curriculum Expectations
Please see page 46 for a list of the course curriculum expectations that can be linked to the Focus Questions below.

Focus Questions – Climate Change Connections

1. How do our roles as consumers of resources link us to climate change?

 Like everyone else, students are consumers. Some may have little understanding of how the consumer choices we make are linked to many different interconnected systems on the planet. Some of these systems are natural systems (choosing organic cotton instead of cotton grown with pesticides), while others are social systems (manufacturing that involves labour standards and working conditions). Different driving forces lead us in different directions: reduced production costs may mean more emissions; reduction in emissions may mean fewer items produced or lower profits.

 By completing an Ecological Footprint analysis and taking the One-Tonne Challenge, students can start to make the connection to the idea that the choices they make do in some way have an impact on the Earth. A school waste audit may also be undertaken. Such an activity may help develop an understanding of the complexity of what is meant by “human impact.” While examining the many parts of human systems (e.g., transportation, shelter, food, etc.) students can see that they make many choices every day. They can begin to identify what as consumers they might do differently to mitigate or slow climate change. (This perspective is recommended as follow up with the remaining questions.)
2. How do consumer choices relate to the hydrologic, carbon/oxygen, and energy flow models?
   a) What are these models?
   b) How does the production of a consumer item have an impact on the system model?
   c) How can this lead to further changes in global climate?

- Students should be familiar with the hydrologic cycle, the carbon cycle and the flow of energy from the sun through the systems of the Earth. These fundamental concepts then provide a context for building models of the carbon budget and the global energy balance. Models consider the natural systems of the carbon cycle and energy flow, but also inscribe the idea that if there is a disturbance, there are also consequences.

- By tracing the production of a consumer item (e.g., clothing or food), students can trace the impact on natural systems through the models. Examples may include a newspaper, CD, T-shirt, cup of coffee, banana, etc. Look for ways to help students make connections between extracting and processing the raw material (resource) to manufacturing and distributing the product (heat and greenhouse gas emissions) and how it alters the natural environment.

- John C. Ryan and Allan Thein Durning’s little book, *Stuff: The Secret Lives of Everyday Things*, is an excellent resource packed with facts about the cost of every stage of production of nine common household items. The idea of the impact of multiples is important: while one person’s choices may seem inconsequential, the accumulation of many millions of choices can have major consequences. Every individual’s action can make a difference, but it is also important to look at how to get a lot of people thinking in these terms — and then taking action.

- Small changes in the amount of CO₂ in the atmosphere can lead to significant warming trends that affect the way energy flows globally. These models help students also consider the future impact of further imbalance, and examine moderate or more aggressive mitigation strategies for slowing climate change.

3. What are the long-term physical costs of continued climate change? What impact will this have on the economics of consumer products?

- A general inquiry into the environmental impacts of climate change on the physical environment needs to be undertaken (which areas of the world will become drier, which will see increased flooding, etc.).

- Then ask students to make a connection back to the impact on the resource used in a particular consumer product, the future availability of the resource and the general economic cost. (For example, bananas or wheat may not be able to grow in their current locations under the conditions resulting from climate change. This in turn may cause a decrease in availability and consequently an increase in cost. People relying on these products will have their livelihood threatened.) Tracing back to origins will lead to the notion that in a highly interconnected set of systems, one change results in a whole chain of consequences. (While it is not strictly true that “everything is connected,” this powerful idea is a healthy antidote to a fragmented world view.)
4. How do consumer choices affect environmental conditions and the sustainable use of natural resources? What changes can be made to consumer products to make them more climate-friendly?

By retracing the processing of a product, steps may be identified where the product can be made not just more climate-friendly, but more environmentally friendly as a whole. Examine how the hydrological and carbon cycles and energy flow disruptions can be minimized:

a) through methods used for the extraction of the resource needed to make an item;

b) through the process of production;

c) in transporting of the item to the consumer.

Examples: In retracing the production of bananas in a plantation, examine how the actual growing process could be altered to increase the amount of forest left as a possible carbon sink while still allowing the grower to make a living; or whether pesticide sprays could be eliminated or reduced to promote healthier air and soil for people as well as plants.

In tracing back to the origins of a T-shirt, examine the cultivation process of the cotton (agricultural practices) as well as all the stages of manufacturing, distributing and marketing the T-shirt. Is the cotton grown organically or with pesticides? Is it dyed? How is it packaged? How far is it shipped from its place of manufacture?

Note: These examples have been simplified to suggest areas to explore. It is important to have a thorough understanding of the processing of a particular item in order to be able to make solid suggestions for minimizing greenhouse gas production and overall environmental impacts.

Stuff: The Secret Lives of Everyday Things traces back to the origins the harvesting, extracting, manufacturing, shipping and distribution of nine “everyday” commodities to explore their environmental impacts. Data is mostly American, but in a global economy has relevance for Canadian readers. See Resources section.

5. What are some examples of ways that human actions can move toward more sustainable use of resources and offer solutions to help slow climate change?

- Suggest the idea of introducing “new thinking” — e.g., true cost-accounting of an item from resource extraction to resource recovery — not just a cradle-to-grave analysis, but cradle-to-cradle. Are we willing to pay the economic price? (For example, the material needed to make a car, the cost of either recovering the resources or dealing appropriately with the waste once the car has reached the end of its life. A move in this direction may make public transport far more feasible! Or, it may provide the impetus to redesign today’s car. A hybrid or solar car may become the preferred choice.) Do we think society would be ready to make these choices? Are students (and teachers!) as individuals ready to make these choices?

- Invite students to determine the ‘truer’ cost of an item by estimating the use of resources needed to make the consumer product and deliver it to market. For example, government subsidies may minimize the cost of irrigation...
and/or transportation, making produce from distant locations affordable. Students can compare the environmental and real costs of California broccoli compared to locally grown broccoli.

- Land use planning decisions: Urbanization in southern Ontario is increasing at a cost both to agricultural land and to the environment. Are we willing to make planning decisions that will result in the reduction of greenhouse gases by keeping more land used for local food production, thus reducing the need for long-distance transport? Or set aside some green space that can act as carbon sinks?

- Consumers can make environmentally conscious choices. It is important to realize not only that each individual can ‘make a difference,’ but also that individual choices add up — we do make a difference as an aggregate:
  - if we all chose not to put our fruit and vegetables in plastic bags at the grocery store, there would be a reduced demand for plastic;
  - take public transit instead of using the car;
  - carpool on a daily basis: less gas burned, fewer CO₂ emissions (a small action for one, but perhaps a huge impact for a society);
  - supplement heating our houses with solar energy (additional up front cost, but long term gain).

6. What are the roles of individuals, NGOs and governments in developing policies and actions for a more sustainable use of resources? What needs to happen to shift individuals, municipalities, industries and nations in the direction of more conserving attitudes and behaviours?

- Exploring the tradeoffs between profits and sustainability helps students understand the complexity of our decisions. This exercise can be used as a way of introducing the role of governments, individuals or NGOs in the development of policies or strategies that limit the environmental impact of human resource use.

- Canada has ratified the Kyoto Protocol and now has climate change policies that students can identify and investigate. Identify the sorts of changes in people’s attitudes and thinking that are needed. (Probe the popular idea that money and new technologies can solve every problem. Brainstorm where taxes should increase, decrease.)

**Common Understandings within a Climate Change Context**

Students should understand that exploring the issue of climate change is a way to study and understand the interactions of numerous components of natural and human systems. Climate change as an issue can provide both a context and an application for learning about the complexity of global systems. From an exploration of their individual behaviour as consumers to an examination of the global economy, students can see their own connections to/impacts on natural systems through the lens of climate change. Climate change also provides a vivid example of the unpredictable nature of change.

Encourage students to connect both economic and social change — changes in human systems — to the changes in the climate system. CO₂ and other GHG emissions are linked to our patterns of consumption,
land use patterns (urban landscapes), industrialization (include practices). These interconnections can help students to understand that these systems need to be changed — and begin to explore how they can be changed — as part of the action to slow the rate of climate change. Case studies that involve reducing CO₂ emissions, sequestering more carbon and reducing energy use provide models for sustainable choices.

By considering personal action and the actions of people they know, students can extend these choices to posit global trends. As consumers, we can act to make 'greener' choices, and as citizens we can advocate for changes in policy that will help Canada meet its Kyoto Protocol objectives and ensure a more sustainable future.

**Teaching Suggestions**

*Environmental Impact Assessment*

Each person’s own impact assessment can be completed through using the tools of the Ecological Footprint and the One-Tonne Challenge. Students can find examples of existing assessment forms. Or they may choose to develop their own questionnaire to assess the environmental impact of food, clothing, transportation and waste management choices within their immediate school or community. This may also include the different industrial or commercial sites located within their area.

If students develop their own questionnaires, it is important that they understand natural systems. Otherwise, they will miss important questions that need to be asked because they have not understood the intricacies of the interconnections among these systems and how they affect, and are affected by, human systems. Review types of questions to ask (open-ended, rating scales, yes/no, etc.) and how to solicit accurate and reliable answers.

Waste audits are another source of assessment for a particular site. Contact the TDSB waste management specialist (416-395-4147) for information about conducting a school waste audit.

If students undertake an impact assessment near the beginning of the course, it can serve as a reference point throughout the course of study, serving as a common thread tying the many components together. This approach may lead to an action plan for their particular choice of assignment as a part of the final course assessment.

*Case Study*

Taking a particular product as a case study, students can analyse the specific impact that the product has on the environment through examining how it affects different parts of the natural system (hydrological and carbon cycles, energy flows). Possible topics for case studies include:

- production of paper including different forms of forest management and harvesting of forest resources;
- home and transportation energy generation choices;
- producing/consuming food (including a local perspective where possible) and farming practices such as sun-grown vs. shade-grown coffee, mixed farming practices vs. factory farm production;
- car production.
Present a Plan of Action

An action plan could be used as a learning strategy throughout the course, depending upon the units within it. For example, if the course is organized in terms of specific issues, an action plan may be appropriate for each issue. If the course is organized in terms of governing bodies, e.g., personal, local, national, global, then developing an action plan for each level could synthesize learning effectively.

Working individually or in groups, students can present research findings and analysis for a particular company, industry, personal behaviour, etc. and develop a plan of action that reduces the use of resources, identifies needs over wants, and reduces emission of GHGs for that particular sector. Such a plan should include:

- identification of the sources of greenhouse gases and the inter-connection of systems (human and natural) related to the issue;
- analysis of the impact on natural systems;
- actions (from different levels of government) required to reduce the use of resources and/or emissions;
- an assessment of how the action will make a difference.

The action plan can include diagrams, maps, graphs, charts and reports. It allows for a broad range of coverage dependent upon many factors such as student ability, time allotment, placement in the course, etc. Refer to the Environmental Impact Assessment section above to see how an action plan could be used as part of the final 30% evaluation for the course.

Resources

Wherever possible, materials from this Resources section have been archived on the TDSB EcoSchools website: http://ecoschools.tdsb.on.ca

<table>
<thead>
<tr>
<th>Topic</th>
<th>URL</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmosphere and climate change</td>
<td><a href="http://www.ucar.edu/learn/">www.ucar.edu/learn/</a></td>
<td>Cycles of the Earth and atmosphere – middle school resources for teachers</td>
</tr>
<tr>
<td>Climate change, energy efficiency and biodiversity issues</td>
<td><a href="http://www.foe.co.uk/pubsinfo/infosyst/other_services.html">www.foe.co.uk/pubsinfo/infosyst/other_services.html</a></td>
<td>Friends of the Earth – links to climate change, energy efficiency and biodiversity issues</td>
</tr>
<tr>
<td>Waste audit — Ecological Footprint</td>
<td><a href="http://www.wrwcanada.com/02wasteaudit.html">www.wrwcanada.com/02wasteaudit.html</a></td>
<td>This is a simplified version for students to calculate their use of the Earth’s resources.</td>
</tr>
<tr>
<td>Transportation cost benefit analysis</td>
<td><a href="http://www.vtpi.org/tdm/tdm66.htm">www.vtpi.org/tdm/tdm66.htm</a></td>
<td>A thorough report on transportation costs from greenhouse gas costs to health costs (US gov’t based)</td>
</tr>
</tbody>
</table>
### Resources cont’d

<table>
<thead>
<tr>
<th>Topic</th>
<th>URL</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada’s action plans for dealing with climate change issues</td>
<td><a href="http://www.nccp.ca/NCCP/index_e.html">www.nccp.ca/NCCP/index_e.html</a></td>
<td>Canada’s National Climate Change Process</td>
</tr>
<tr>
<td>Canada: Impacts of climate change and future actions</td>
<td><a href="http://www.climatechange.gc.ca">www.climatechange.gc.ca</a></td>
<td>Identifies changes to Canada regarding climate change and actions that need to be taken – government and the individual</td>
</tr>
<tr>
<td>The One-Tonne Challenge</td>
<td><a href="http://www.climatechange.gc.ca/onetonne/english/index.asp?pid=81">www.climatechange.gc.ca/onetonne/english/index.asp?pid=81</a></td>
<td>The Government of Canada’s site with information about how Canadians can reduce greenhouse gas emissions</td>
</tr>
<tr>
<td>Government of Canada Links Directory</td>
<td><a href="http://www.climatechange.gc.ca/english/links">www.climatechange.gc.ca/english/links</a></td>
<td>Comprehensive links to many web pages on climate change issues</td>
</tr>
<tr>
<td>Climate change and sustainability</td>
<td><a href="http://www.davidsuzuki.org/">www.davidsuzuki.org/</a></td>
<td>David Suzuki Foundation – links to climate change, forestry, ocean &amp; sustainability</td>
</tr>
</tbody>
</table>
Curriculum Expectations

Geographic Foundations: Space and Systems
› analyse how the earth’s major components – the lithosphere, atmosphere, hydrosphere, and biosphere – interact and are interdependent
› analyse how the distribution of ecosystems has been and continues to be influenced by natural conditions

Building Knowledge and Understanding
• describe selected relationships among the earth’s diverse natural systems
• describe the variety, complexity, and evolutionary characteristics of selected ecosystems

Developing and Practising Skills
• analyse how matter and energy flow through the lithosphere, atmosphere, hydrosphere, and biosphere
• analyse how various factors contribute to the fragility and/or resilience of selected ecosystems

Learning Through Application
• demonstrate how the earth is a self-sustaining system

Human-Environment Interactions
› explain significant short-term and long-term effects of human activity on the natural environment
› analyse and evaluate interrelationships among the environment, the economy, and society
› analyse patterns of resource availability and use

Building Knowledge and Understanding
• explain how human well-being and survival depend on complex linkages with other components of the biosphere

Developing and Practising Skills
• identify differences in the perceptions of nature and the views on environmental preservation of selected individuals and groups

Learning Through Application
• illustrate how human systems and natural systems interact within the local ecosystem
• evaluate the effects of fossil fuel use on urban and rural environments
• illustrate ways in which environmental degradation is related to human health concerns
• predict the social, economic, and environmental effects of the extraction and depletion of selected resources
• estimate personal and class "ecological footprints"

Global Connections
› analyse environmental and resource management issues and explain their global implications
› explain how population growth affects the sustainability of global ecosystems
› evaluate the effectiveness of the efforts of the international community to deal with environmental and resource management issues
Building Knowledge and Understanding
• explain how growth in population and economic activity around the world increases pressure on natural resources and natural systems
• explain the need for international cooperation in achieving the sustainable use of global resources

Developing and Practising Skills
• analyse how global resource consumption is related to environmental degradation
• evaluate the effectiveness of the efforts of individuals, groups, organizations, and agreements to implement solutions to global environmental concerns
• evaluate the effectiveness of Canada’s participation in selected international organizations and agreements that deal with global environmental concerns
• explain how human activity in one place may cause changes to the environment in another place
• analyse and assess selected viewpoints regarding a sustainability or resource management issue

Understanding and Managing Change
▶ evaluate the impact of economic, social, political, and technological change on natural and human systems
▶ explain the purpose of environmental laws and regulations at the local, provincial, and national levels and evaluate their effectiveness over time
▶ evaluate a variety of approaches to resolving environmental and resource management concerns on a local, regional, and national scale

Building Knowledge and Understanding
• explain how environmental policies can affect the economy
• explain the purpose and nature of environmental-impact assessments
• describe the rights and responsibilities of individuals with respect to protecting the environment for future generations
• analyse the environmental-protection activities of non-governmental organizations

Developing and Practising Skills
• evaluate the environmental implications of developments in selected areas of technology
• explain ways in which we can improve our protection of natural systems while continuing to meet human needs
• explain how selected environmental protection principles and initiatives could contribute to economic and environmental sustainability
• compare the economic and environmental implications of various waste management methods

Learning Through Application
• produce a plan to reduce personal and class “ecological footprints”
• evaluate the impact on both human and natural systems of a selected environmental or resource management problem
• analyse the environmental impact of a particular industry or human system and recommend practices to promote economic and environmental sustainability
Methods of Geographic Inquiry and Communication

- use the methods and tools of geographic inquiry to locate, gather, evaluate, and organize information about environmental and resource management issues and concerns
- analyse and interpret data gathered through research and investigation, using a variety of methods and geotechnologies
- communicate the results of inquiries, using appropriate terms and concepts and a variety of forms and techniques

Research

- develop and use appropriate questions to focus a geographic inquiry on an environmental or resource management issue
- gather geographic information from primary sources and secondary sources to research an environmental or resource management topic or issue
- gather geographic information, using a variety of geographic tools and technologies
- evaluate the credibility of sources and the reliability and usefulness of information

Interpretation and Analysis

- distinguish among opinion, argument, and fact in research sources
- analyse a variety of media forms to identify biases with respect to environmental and resource management issues
- use a variety of geographic tools and geotechnologies to interpret, analyse, and synthesize information related to environmental and resource management topics and issues
- use graphic organizers to clarify and interpret information related to environmental and resource management issues

Communication

- use appropriate statistical methods in geographic analysis, observing accepted conventions
- develop possible solutions to problems or issues related to the environment or resource management, using appropriate forecasting, decision-making, and/or problem-solving strategies
- explain the different points of view on an environmental or resource management issue that are, or might be, held by various stakeholders
- produce a variety of maps, sketches, photographs, diagrams, and charts, following appropriate conventions, to illustrate the results of inquiries on environmental and resource management topics and issues
- provide appropriate and sufficient geographic evidence and well-reasoned arguments to support opinions and conclusions
- complete an independent inquiry on a local, regional, national, or global environmental or resource management topic or issue that reflects the required elements of a geographic inquiry

- communicate the results of geographic inquiries, for different audiences and purposes, using a variety of forms and including geographic visual supports, both conventional and geotechnological
- use an accepted form of academic documentation to acknowledge all information sources, including electronic sources
- use appropriate terminology when communicating results of inquiries related to the environment and resource management
El Niño, La Niña and Climate Change

Many students confuse climate change with other climate phenomena such as El Niño and La Niña, which have received such lavish attention in the media. Of course there is a connection, but it’s not a simple one, and indeed points to an area where there is still much to learn. This appendix is supplied to help avoid a possible misconception.

Information is taken from the National Oceanic and Aeronautics Administration (NOAA) website. www.pmel.noaa.gov/tao/elnino/faq.html#warming

What is the relationship between greenhouse warming, El Niño/La Niña and climate prediction?

There is a lot of confusion in the public about the interrelations connecting climate phenomena such as El Niño, La Niña and greenhouse effect. Is it true that a warmer atmosphere is likely to produce stronger or more frequent El Niños?

We don’t know the answer to this question. It is certainly a plausible hypothesis that global warming may affect El Niño, since both phenomena involve large changes in the earth’s heat balance. However, computer climate models, one of the primary research tools for studies of global warming, are hampered by inadequate representation of many key physical processes (such as the effects of clouds on climate and the role of the ocean). Also, no computer model yet can reliably simulate BOTH El Niño AND greenhouse gas warming together. So, depending on which model you choose to believe, you can get different answers. For example, some scientists have speculated that a warmer atmosphere is likely to produce stronger or more frequent El Niños, based on trends observed over the past 25 years. However, some computer models indicate El Niños may actually be weaker in a warmer climate. This is a very complicated (but very important!) issue that will require further research to arrive at a convincing answer.

Both 1998 and 1997 had record-setting global mean temperatures and also El Niño. What influences what?

El Niño clearly influences globally averaged temperatures which go up a few tenths of a degree C a few months following the peak warming in the tropical Pacific. This is because the tropical Pacific loses large amounts of heat to the overlying atmosphere during El Niño. So some of the extreme warming observed in global temperatures in 1997-98 can be traced back to the occurrence of El Niño in the tropical Pacific. However, underlying the El Niño effect (which should diminish in the next year) is a long term global trend towards warmer temperatures. Two questions arise, for which we do not have answers at this point: 1) Exactly how much of the extreme rise in global temperatures during 1997-98
was due to the 1997-98 El Niño, versus the contribution from the underlying long term trend? and 2) Did the extreme El Niño occur in response to global warming trends? This second question ties into your first question above. In fact, how global warming projects onto natural modes of climate variability like El Niño, the Pacific Decadal Oscillation, and the North Atlantic Oscillation (all of which can have an affect on global air temperatures) is a very compelling research problem.

Could the problem of disentangling the many factors and dynamics at play in El Niño and global warming be compared to writing down the scores of many different tunes whilst they are played all at the same time. Might cacophony be a good image to describe circulation patterns?

That’s a nice analogy. However, it could be refined in the following way: when the scores are played together, they not only become entangled, but they may actually metamorphose into a slightly different tune, one for which no score existed at the start of the piece. That is to say, that El Niño, global warming, and other climate signals are actually physically altered by their interaction in ways you would not expect by considering them in isolation. Sorting out these complex interactions is in fact one of the major challenges of climate research today.1

For more information, see NOAA oceanographer Billy Kessler’s lively discussion in response to an Egyptian writer’s question, “Why can’t I find any information about links between El Niño and global warming?”

www.pmel.noaa.gov/~kessler/occasionally-asked-questions.html#q16

---

1 This comment points to why a systems thinking approach is invaluable — and essential — in understanding the complexity of climate change.
Summary of the Kyoto Protocol

Countries around the world have recognized that climate change affects us all. The volume of greenhouse gases produced by human activity, added to the gases occurring naturally in the atmosphere, has led to extreme weather events, temperature changes and the melting of the Arctic icecaps.

In December 1997, Canada and more than 160 other countries met in Kyoto, Japan, and agreed to targets to reduce greenhouse gas emissions. The agreement that set out those targets, and the options available to countries to achieve them, is known as the Kyoto Protocol. Canada’s target is to reduce its greenhouse gas (GHG) emissions to 6% below 1990 levels by the period between 2008 and 2012. The goal of Kyoto is to reduce the total emissions of industrialized countries to 5.2% below 1990 levels.

The Government of Canada and the provincial/territorial and municipal governments are working together to achieve reductions in greenhouse gases. Investment in new technologies will help business to operate in a more efficient way and Canadians will benefit by having a cleaner environment. The Kyoto Protocol allows the presence of carbon sinks to count toward a country’s commitment to reduce greenhouse gases. A “sink” is any process that removes greenhouse gases from the atmosphere. For example, forests form a carbon “sink” through the process of photosynthesis – trees and other plants take up carbon dioxide (CO₂) and break it down. The oxygen (O₂) is released and the carbon (C) becomes part of the tree.

The Kyoto Protocol allows countries to buy carbon credits from other countries. This means that countries that reduce their greenhouse gas emissions by more than is required under Kyoto can sell their unused carbon credits to countries that find it difficult or expensive to reduce emissions. This is called emissions-reduction trading. In other words, countries that have “overperformed” (met and exceeded their target for reduction) may sell their “unused right to pollute” to countries that have failed to meet their emissions reduction target. Canada believes that a solution that uses the market has a part to play in achieving an overall reduction of greenhouse gases globally.

It is important that countries that have signed the Kyoto Protocol comply with the rules. To that end, Canada is working to build an effective way to measure whether everyone is doing their part. This is a way of checking that countries obey the rules agreed upon, giving them strong incentives to take their commitments seriously.

Based in part on information found at www.climatechange.gc.ca.

1 While it may appear strange that one country can buy the right to pollute from another country, remember that the total emissions of participating countries selling and buying carbon “credits” are to reach the agreed upon targets between 2008 and 2012. Some believe that countries being able to pay others in order to keep polluting is wrong; others say that it is a way of encouraging those who can to make greater reductions while penalizing those who don’t.
Using the Internet: Search and Evaluation Tips

Searching Internet Sites
1. Select a number of key words for your topic.
2. Enter the key word in singular or plural form, or use the singular form followed by an asterisk in order to generate hits (e.g., biome*).
3. Use lower case text in your searches. The search finds documents containing the words regardless of case.
4. If your search finds too many pages, place quotation marks around any series of words (e.g., “carbon dioxide calculator*”).
5. If your search finds too few pages, enter fewer words or more general words.
6. Use more than one browser.
7. Bookmark your browser results page so that you can find it again.

Evaluating Internet Sites
Relevance: Does the information relate to your research topic and questions?
Currency: Is the information up-to-date? Look for dates that tell when the site was last updated or revised. This is especially important in researching a complex topic such as climate change, where the science is constantly evolving.

Accuracy: Is the information accurate? What kind of bias is evident? The best way to verify accuracy is to check information against facts presented in other sources. Is the material reasonable and balanced or simplistic or inflammatory?
Reliability: Is the author considered reputable, credible, or an expert? Has he or she published other works in the field? Is the publisher academic, special interest, or mass market? Is it independent or closely allied to a political party or pressure group?
Sponsor: Who is the sponsor of the site? A government, cultural organization, or educational site generally presents more reliable information than a commercial, political, or personal one.

Remember the following address tags when viewing new sites:

<table>
<thead>
<tr>
<th>Domain</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.gov</td>
<td>a government site</td>
</tr>
<tr>
<td>.edu</td>
<td>an educational site</td>
</tr>
<tr>
<td>.org</td>
<td>an organization or advocacy site</td>
</tr>
<tr>
<td>.com</td>
<td>a commercial or business site</td>
</tr>
<tr>
<td>.ca</td>
<td>a Canadian site</td>
</tr>
</tbody>
</table>
ONTARIO ECOSCHOOLS PROGRAM

Project Administrators
Richard Christie, Toronto District School Board
Lewis Molot, Faculty of Environmental Studies, York University

Project Manager
Eleanor Dudar, Toronto District School Board

Assistant Project Manager
Catherine Mahler

Steering Committee
Ron Ballentine, Halton DSB, Science Coordinators’ and Consultants’ Association of Ontario; Richard Christie, Toronto DSB; Judy Gould, Durham DSB; David Green, Toronto and Region Conservation Authority; Arlene Higgins-Wright, York Region DSB; Lewis Molot, York University; Pam Schwartzberg, Learning for A Sustainable Future

Advisory Committee
Ted Cheskey, Waterloo Region DSB; Xavier Fazio/Susan Paradiso, Halton Catholic DSB; Joanne Harris, Science Teachers’ Association of Ontario; Ethel Johnston/Kim Wallace, Ontario Association for Geography and Environmental Educators; Catherine Kurucz, Thames Valley DSB; Gina Micomonaco, York Catholic DSB; Anne Mitchell, Canadian Institute for Environmental Law and Policy; Marsha Yamamoto, Toronto DSB

Project Designer
Comet art + design

PROJECT PARTNERS
To find out how to become a certified bronze, silver or gold EcoSchool, visit the EcoSchools section of the TDSB’s public website - http://ecoschools.tdsb.on.ca