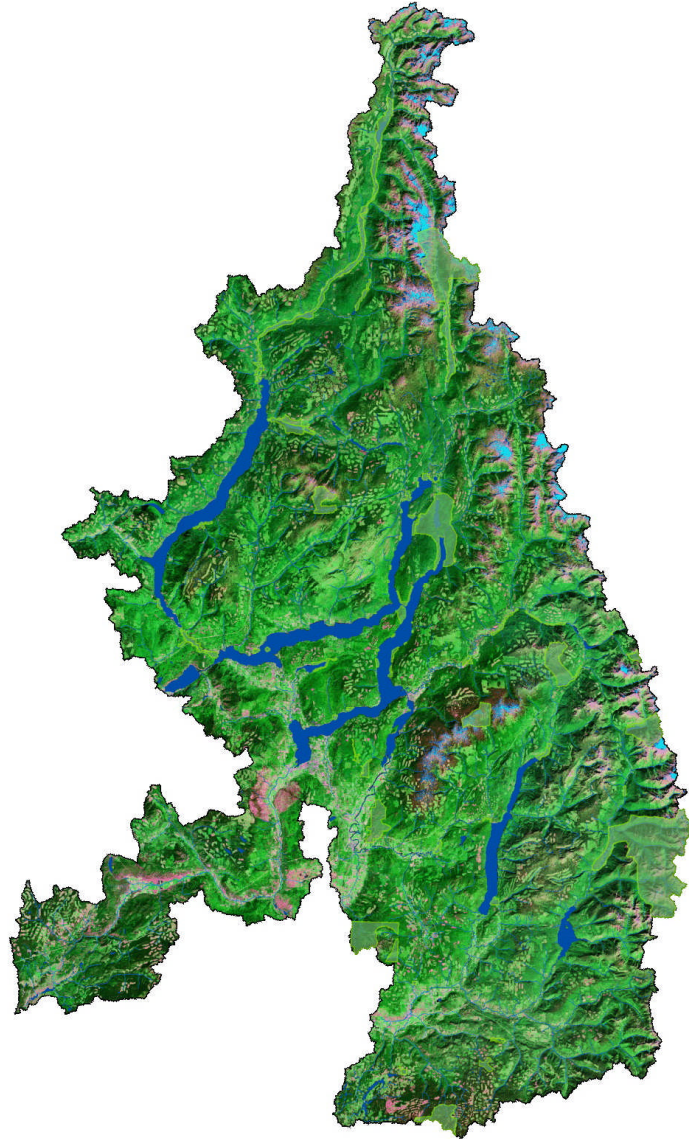


Shuswap Watershed Educational Handbook



Prepared for the
Shuswap Watershed Project

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Part I – User’s Guide

Purpose

The mission of the Shuswap Watershed Project is “working collaboratively to help improve understanding, appreciation, and protection of the Shuswap watershed”.

This handbook is designed to support the use of the Shuswap Watershed poster and website by teachers, students and researchers. Because much of the support material is available on the website www.shuswapwatershed.ca the handbook is also a guide to the use of the resources available on the website, and elsewhere on the internet. It is intended that this handbook be a living document that will evolve over time. While there are no plans to provide printed copies, at some point in time, a brochure may be developed to encourage use of the handbook and the website.

Symbols used in the Handbook

To ease quick use of the material, a number of symbols have been used in this guidebook to highlight different types of content.



Teacher’s manuals from other areas



Discussion / study questions



Project Ideas



Important point to note



Resources



Reference to the Watershed Poster

Background

The project was initiated by the development of the Shuswap Watershed poster by the *Shuswap Environmental Action Society (SEAS)*. The Shuswap Watershed Project is aimed at helping raise awareness about issues in the Shuswap Watershed; increasing public knowledge; and promoting both personal and group actions to protect and restore the Shuswap Watershed.

A number of governmental and nongovernmental agencies teamed up to produce a large colour poster of the Shuswap Watershed, the first such map ever produced for the watershed (portrayed on the cover of this handbook).

A focus group of about 20 educators from the Shuswap met and developed an outline of topics that they felt should be addressed in an educational guide to accompany the poster. The initial outline included a wide range of topics, including:

- Geological History
- Hydrology/Geography

- Watershed Values
- Watershed Habitats
- Fisheries
- Impacts from Development
- Climate Change

This guide and the accompanying website provide teachers, students, and other users with information about these topics.


The guide has several objectives:

- provide some basic background information
- provide lessons and activities to enhance student learning with project ideas and study questions
- provide linkages to the curriculum.



This guide is a work in progress. Some topics have more information than others. As resources are identified, updates to the guide will be posted. In addition, feedback is invited from teachers about ways in which the guide and the website can be improved to better meet needs.

The focus group of educators suggested that the emphasis should be on grades 4-12. This is a wide range of ages and as a consequence the material in some sections delves into topics quite

deeply, to provide challenge for older students.  Teachers of younger students will also find lesson plans; in addition, the material and discussion questions lead naturally into lessons. Users are free to modify and adapt lesson material to meet the needs of learners, what ever age or grade level.

The study activities for the Shuswap Watershed should not be perceived as an add-on or taking away from the regular curriculum. Indeed, they can *add life to the curriculum (and curriculum to your life)*! This area of study lends itself to **the integration of subject areas**. Learning Outcomes in Reading, Writing, Speaking, Math, Science, Social Studies, Fine Arts, and Physical Education can easily be covered, thus reducing time pressures teachers may feel to “cover” the curriculum.

Using the Handbook

Handbook Organization

Part II summarizes some of the key links on the website to help users understand watersheds, how they function, human impacts on watersheds, and specific concerns within the Shuswap watershed.

Part III gives ideas for student activities and project questions. There is no one “correct” way to enter the subject matter. Rather, teachers and learners are encouraged to follow their passions and interests as their explorations evolve.

Part IV focuses on “Action” projects and provides some tips and resources specifically for this type of project.

Part V provides links to resources on other websites.

Teaching Manuals from other Areas



Rather than “reinventing the wheel”, there are excellent resources already developed elsewhere. These are located on the website in the folder “Watershed Teaching Manuals”.

Part II - Contents


The structure of the guide and the website are loosely based on the book *Watersheds, A Practical Handbook for Healthy Water*, by Clive Dobson and Gregor Gilpin Beck, published by Firefly Books, Willowdale Ontario and Buffalo New York, 1999.

1. [What is a Watershed?](#)
2. [How Watersheds Work](#)
3. [Parts of a Watershed](#)
4. [Natural Changes within Watersheds](#)
5. [Impacts on Watersheds](#)
6. [Actions to Protect and Restore Watersheds](#)
7. [Shuswap Watershed Information and Reports](#)
8. [Watershed Teaching Manuals](#)
9. [General Information about Environmental Education](#)
10. [About the Shuswap Watershed Project](#)
11. [Curriculum Guides and Learning Resource Outcomes \(LROs\)](#)

1. What is a Watershed?

A watershed is an area that drains all precipitation received as a runoff or base flow (groundwater sources) into a particular river or set of rivers. (Source of definition: Atlas of Canada). Watersheds are also called drainage basins. Within a watershed, there are smaller watersheds; and, within these watersheds, there are still smaller ones. Watersheds are separated from each other by landforms, usually heights of land. The Monashee Mountains to the east form a height of land which separates the Shuswap drainage from the Columbia drainage to the east.


The Shuswap Watershed is a sub-drainage of a larger watershed – namely, the Fraser River.


Within the Shuswap Watershed are twelve smaller watersheds.  These are shown on the poster as “sub-drainages”, in twelve different colours, ranging from the Shuswap River drainage (the largest sub-drainage) to Wap Creek, the smallest. Areas in white on the sub-drainage map drain directly into Shuswap and Mara lakes via small creeks.

The upstream area of a watershed, where streams rise in the mountains, is called a “headwater”. As you move downhill and downstream, these small streams combine and form into rivers. There are six main rivers which empty into Shuswap Lake as well as numerous large and small creeks.


As well as surface water, watersheds include groundwater. The direction or nature of groundwater flows may differ from those on the surface.

A watershed includes both aquatic (to do with water) and terrestrial (to do with land) components.

 The Shuswap watershed has a diverse range of habitats within it, ranging from moist wet areas in the upper Seymour, upper Adams river, and upper Wap rivers to drier habitats in the headwaters of the Salmon River.

 Shuswap Lake empties into the South Thompson River at Chase where the waters of the Shuswap watershed merge with the waters of other watersheds to eventually enter the Fraser River and then on to the Pacific Ocean


Historically, both First Nations and European settlers depended on water for life; communities were located along the lakes and streams of the Shuswap watershed.

 The folder “[What is a watershed](#)” contains more background information on the water cycle, groundwater, and watersheds with some lesson ideas.

2. How Watersheds Work

Watersheds form a part of the planet’s system for recycling the matter of life – water, elements and minerals. The water cycle is one of these systems. Other systems include cycles for recycling carbon, and nutrients like nitrogen and phosphorus.

Watersheds and the natural areas within them perform a host of valuable ecological services, and provide humans – as well as the rest of living beings – with the necessities of life.

 The folder “[How Watersheds Work](#)” contains a sub-folder on “[Values of Natural Areas](#)” prepared by Ducks Unlimited, for a variety of different kinds of natural areas found within a watershed.


3. Parts of a Watershed

There are four principal components of the Shuswap Watershed: headwater streams; wetlands; rivers; and lakes and ponds. Information is organized on the website for each of these four [components](#).

Groundwater is an unseen yet extremely important component of watersheds and information is included in the [resources](#) for this section.

Estuaries, where rivers meet the sea, are a part of many watersheds but not the Shuswap, because the Shuswap watershed is a tributary watershed of the Fraser River. For information on the Fraser River estuary, refer to the Fraser River Estuary Management Plan:

http://www.bieapfrempp.org/main_frempp.html Note, however, that new nomenclature includes fresh water estuaries, which are key components of watersheds where rivers empty into lakes and are feeding areas for salmon, trout, other fish, and a whole host of other animals in the food web.

 The folder “[Parts of a Watershed](#)” contains background information (or links to background information) on wetlands, lakes, rivers and groundwater.

4. Natural Changes within Watersheds

While one of the focuses of the Shuswap Watershed Project is on changes and impacts caused by humans, watersheds naturally experience some changes as part of nature’s cycles. These include:

Geological change over time - <http://www.enderbymuseum.ca/thepast/geog/iceage.htm> - briefly mentions the glaciations of the Okanagan and Shuswap valleys during the last ice age. Also see <http://www.geoscapes.ca/pov/pdfs.html> for information focussed on the geological history of the Okanagan Valley.

Geomorphologic changes (processes of landform change caused by the action of water, ice and wind) –

For BC references: see Compendium of forest hydrology and geomorphology in British Columbia <http://www.forrex.org/program/water/compendium.asp> (can be downloaded in full or chapter by chapter)

River patterns; e.g. Adams river changing its delta over time – see Adams river [report](#)

Eutrophication – stages of a lake’s cycle – small lakes in watershed tending towards greater nutrients, siltation – e.g. Gardom, Skimikin. Shuswap is oligotrophic. Insert diagram of lakes. See http://www.wisconsinlakes.org/lake_states.htm

Flooding – e.g. high water in Shuswap Lake; Salmon River flooding

Biological changes (changes in plant communities over time)

Plant communities develop in response to conditions of climate, soil, and sunlight, tending towards a “dynamic equilibrium”. Disturbances like fire or landslides result in the process of natural succession. For example, in the southern interior, fire is a


disturbance that helps maintain grasslands and some species like lodgepole pine. For further information on natural cycles see:

http://www.env.gov.bc.ca/bcparks/consERVE/naturalcycles_part1.pdf and
www.env.gov.bc.ca/bcparks/consERVE/naturalcycles_part2.pdf


 These files are available on the website under “[Natural Changes in Watersheds](#)”.

Wildlife also can create changes in the landscape; a dramatic example is the change that beavers can make as they contribute to the establishment of wetlands and flooding


For some information on biological plant communities of the Shuswap Watershed see
http://archive.ilmb.gov.bc.ca/slrp/lrmp/kamloops/okanagan/plan/files/downloads/OK_profile.pdf and
<http://www.ilmb.gov.bc.ca/slrp/lrmp/kamloops/okanagan/plan/files/oslrmpfull.pdf>

 Both these files are available on the watershed website under “[Planning Reports – Ok-Shus LRMP](#)”.


5. Impacts on Watersheds: Key Threats to the Shuswap Watershed

 The Shuswap Watershed poster identifies a number of key threats to the watershed:

- Invasive species
- Resource use
- Foreshore development
- Pollution
- Recreational use
- Climate change


 The folder “[Impacts on Watersheds](#)” contains general information on many of these topics, with Shuswap specific information contained in the folder on “[Shuswap Watershed Info & Reports](#)”. For example, the folder “[Planning Reports](#)” contains considerable background information on Shuswap Lake, the Salmon River, foreshore mapping on Shuswap and Mara Lakes, and the Shuswap Lake Integrated Planning Process.

6. Actions to Protect and Restore Watersheds


 The [folder on actions](#) includes materials for actions at the level of individual, school, group, and policy or governance. Particularly useful resources for teachers in this section include the Canadian Wildlife Federation [action sheets](#), the [Streamkeepers Manual](#), the [CPAWS Teacher Action Guide](#), and the [SEEDS water challenge](#).

Also refer to other sections of this guidebook (such as [Ideas for Student Activities](#) in Part III), Part IV on Action projects, and resources in Part V.

7. Shuswap Watershed Information and Reports

 Resources relating to the Shuswap watershed include [planning reports](#) for Shuswap Lake and some of the rivers in the watershed, some [First Nations perspectives](#), a [stewardship report](#) on some species at risk in the Shuswap watershed, [fact sheets](#) on fish species, a [report](#) on climate change impacts in the Shuswap, and a [data file](#) with land areas for the drainage sub-basins in the watershed.

8. Watershed Teaching Manuals

 Relevant manuals for teachers in the Shuswap Watershed include [those](#) prepared to accompany the Okanagan Waterscape poster, and also [those](#) prepared to accompany the Bow River Basin waterscape poster. There are great lesson ideas in these manuals which can easily be adapted to the Shuswap watershed. The Wild BC [Leap into Action](#) manual has action project ideas for teachers, particularly aimed at Grades 4 to 8.

9. General Information about Environmental Education

This folder contains a variety of content, including:

- a [BC Ministry of Education curriculum for sustainability](#)
- an [interdisciplinary guide](#) for teachers on “environmental learning and experience”
- two [evaluations](#) of environmental education
- an [overview](#) of environmental education in Canada for grant makers
- a CPAWS guide called [Inventing the Future](#) – which outlines “Activities to help students learn about the future and sustainability in the Third Millennium”
- “[Films for Change](#)”, a pedagogical template to guide students and teachers committed to environmental leadership and to effecting change in their communities.

10. About the Shuswap Watershed Project

This folder contains two presentations:

- [Role of the Watershed Project](#): presents a perspective for teachers on how to embark on projects using the Watershed Project
- [Watershed Project Leader Talk](#): outlines the background for the Shuswap Watershed Project.

11. Curriculum Guides and Learning Resource Outcomes

This folder contains highlighted extracts from the [Ministry of Education Learning Resource Outcomes](#) for each grade. Highlights emphasize linkages between the curriculum LROs and the material and lessons on the Shuswap Watershed website.

Part III – Using the Watershed Poster and Website in Teaching

Other Watershed and Related Handbooks



There are a number of other handbooks, teaching guides and resources found on the internet. To save time for users, these materials have been included on the Shuswap Watershed website. Close to home, there are guides for the [Okanagan Waterscape Poster](#), [Bow River Waterscape Poster](#) in Alberta, “[Leap into Action](#)” (Wild BC), and a [BC Water Stewardship Handbook](#) for educators. A few [US watershed lesson plans](#) have been included, mostly from Boulder, Co, along with a US bibliography.

Starting Points

Look for your grade level in the Curriculum Guides folder for “[Prescribed Learning Outcomes B.C. Curriculum](#)” At each grade level, for the relevant subjects, the intended learning outcomes have been highlighted in yellow. Identify which learning outcomes can be achieved through activities and lessons developed around the Watershed Poster; often many intended learning outcomes can be attained in one lesson. Addressing environmental issues requires an integrated approach; for example, Social Studies, Science, Math, Language Arts, Fine Arts and Social Skills are all necessary to study the watershed and develop plans to protect or restore it.

Another starting point might be to ask the students what their interests are concerning the watershed and go from there. (And then look at the “[Prescribed Learning Outcomes B.C. Curriculum](#)” to confirm that the intended learning outcomes are being met.)

Yet another starting point might be to follow **your passions** and **interests** as an educator and go from there. Students really pick up on your commitment and are more likely to get involved.

Possible Strategies for Organizing a Watershed Study


Team projects: (jigsaw strategy) students choose an area to study, become experts, and then share their expertise with their class mates. For example, teams of students could each study a

topic area such as climate change impacts, development impacts, geography, water conservation, changes in water quality, or natural ecosystem changes in the Shuswap .

After appropriate time has been given for research and ideas synthesis, group presentations involving a wide variety of media could be made to the whole group. Encourage the students to be creative and use drama, art, dance, and multimedia to get the point across.

Individual projects: Students choose a topic that they are passionate about, or have some interest in or curiosity about. They then create a display, much like a Science Fair Project, to teach the other students, or develop and carry out an “Action project” to help the Shuswap Watershed.

Student presentations. As you know, one of the best ways to learn something is to teach it to others. For example:

- Choose your favourite animal or plant in the Shuswap Watershed, research it and present it to your classmates
- Choose your favourite recreational activity in the Shuswap Watershed, research it and present it to your classmates
-  Using the poster, choose one of the threats to the watershed and develop a plan to teach others about this threat and the best practices to alleviate the threat.
- Some of the resources on the DVD can be used as guides. For example the Stream Keepers manual or visit some of the suggested websites e.g. The Canadian Wildlife Federation web site is full of suggestions and projects. <http://www.cwf-fcf.org/en/what-we-do/issues/water/what-you-can-do/your-water-tips.html>

Catalyst questions. Yet another strategy is to pose some catalyst questions about the poster and the watershed and have students answer them. A number of potential discussion questions have been listed in the sections which follow.

- Brainstorm or list potential threats to the Shuswap Watershed. Reveal the threats outlined on the poster, the issues the students identified, and then work on problem solving to develop possible solutions.

To illustrate a watershed: Have students make a fist with the knuckles pointing upward. The knuckles represent the heights of land which are the watershed boundaries, the spaces between the fingers are tributaries running down towards the central “valley” at the bottom, which itself flows out to a river, lake or sea.

Ideas for Student Activities

This section is organized by topic, with suggested study questions and project ideas listed for each topic. Some web links have been listed in each section.



There are also many resources on the website in folders that link to each section of this guide, and on other sites listed in Part IV.

Geological History



Discussion / Study Questions

1. Geological forces. What are the major forces that have shaped the geology of the Shuswap Watershed? <http://geoscapes.ca/pov/okhistory5.html>
2. Geological time. What would the area have looked like where you are 15,000 years ago? 10,000? 5,000, 100? <http://geoscapes.ca/pov/okhistory4.html>
3. Future geology. What do you think it will look like 50 years from now? 100, 5,000, 10,000?
4. Landform change. What are the causes of disturbances to landforms now in the Shuswap Watershed?



Project Ideas

1. Hikes. Hike up the Enderby Cliffs, Mount Ida, or the Pillar at Pillar Lake, and imagine how these features were made.
2. Okanagan/Shuswap divide. Combine a trip up the Enderby Cliffs with a visit to the Columbia / Fraser watershed divide near Armstrong (a picnic area marks it on Highway 97A).
3. Relief maps. Make a relief map of the Shuswap Watershed, or the floor of Shuswap Lake.
4. Geological Time line. Make a time line showing the major forces that sculpted the landscape in each era starting with the Precambrian era. <http://geoscapes.ca/pov/okhistory4.html>
5. Illustrated glossary of terms. Make an illustrated glossary of the geological terms for various land forms and geological structures. Create a classroom display of these terms, using examples.
6. Watershed timeline. Make a Watershed timeline starting 15,000 years ago and project into the future 100 years. Indicate what you think the landscape would look like and which plants and animals you think would be predominant. Include when humans appeared on the scene.



Watershed Components and Changes over Time



Discussion / Study Questions

1. Functions of watershed components. For each component in the watershed: discuss where these occur in the watershed, the functions each perform, and how these components have changed or are changing over time.

Aquatic components

- a. Wetlands - species, functions – values of wetlands, loss of wetlands and how this affects the watershed.  Note that wetlands are mapped on the Watershed map: see the legend.
- b. Lakes – types of lakes (oligotrophic, mesotrophic, eutrophic) – examples of each from the Shuswap Watershed. Shuswap: oligotrophic; Gardom: mesotrophic.  Identify deltas where rivers enter Shuswap Lake.
- c. Riparian habitats – value of riparian areas, best management practices for riparian areas. See www.livingbywater.ca
- d. Rivers – Adams River; Seymour River, Anstey River, Eagle River, Shuswap River and the Salmon River

Terrestrial components

- e. Forest cover in the watershed and diversity of forest types. See <http://www.geog.ubc.ca/biodiversity/eflora/TerrestrialVegetation.html>
<http://www.for.gov.bc.ca/hfd/library/documents/treebook/biogeo/idfzone1.htm>
2. Ecological reserves. What are ecological reserves and why are they important? Research an ecological reserve in the Shuswap Watershed. See http://www.env.gov.bc.ca/bcparks/eco_reserve/mara_er.html
 3. Provincial Parks Where are there parks? What features do these parks protect? How were these parks created? (see www.seas.ca)



Project Ideas

1. Seton watch. Visit a wetland or streamside (or any favourite spot) and sit quietly for at least twenty minutes. Record all the sounds, smells, sights, and feelings you experience. (This is called a “Seton watch”, after Ernest Thomas Seton, a famous author, artist, naturalist who was able to sit in one place for many hours and observe.)
2. Journaling. Start a personal journal in which you express your life experiences and thoughts through sketches, words, and other symbols.
3. Photograph or Powerpoint presentation. Make a photograph album, or PowerPoint presentation, of all your favourite spots in the Shuswap Watershed.
4. Leave No Trace hike. Go on a *Leave No Trace* hike or camping trip. It will add to the fun of your experience and of those who come after you.
<http://www.env.gov.bc.ca/bcparks/explore/misc/notrace.html>


5. Clubs. Join a Naturalist Club or Environmental Group; there are several Young Naturalist Clubs in the Shuswap, and environmental groups are often interested in having young people join them.
6. Interviews with elders. Interview pioneers and / or First Nations elders about their memories of the watershed from when they were young. Ask them about what changes they've seen and what caused the changes.
7. Field trips. Organize a field trip to one or two areas of the watershed and discuss the role these places play in the watershed:
 - Salmon Arm foreshore
 - Wetland areas (e.g. swamps)
 - Turner Creek
 - Canoe Creek
 - Salmon River
 - Eagle River
 - Shuswap Falls and Wilsey Hydro-electric dam
 - South Canoe Reservoir
 - Wastewater Treatment plant
 - Water Treatment facility
 - Mara Meadows ecological reserve
 - Larch Hills
 - Kingfisher Interpretive Centre
 - Gardom Lake
 - Malakwa – Eagle River Nature Park
 - Enderby Cliffs
 - Columbia / Fraser divide near Armstrong
 - Silver Star Mountain
 - Salmon runs – Eagle River, Adams River, Scotch Creek
 - School parking lot
 - Rainbow Falls
 - Albas Falls
 - Seymour River Falls
 - Perry River canyon
 - Momich River and Lake forest fire area
8. Photo essay. Make a photo essay of your field trip
9. Documentary video. Make a documentary video about an issue you are passionate about the in the Shuswap watershed.
10. Geocaching. Contact the Shuswap Geoquest project and make a Geocache which would show the finder some highlights of the Shuswap Watershed. www.shuswapgeoquest.com/
11. Time capsule. Make a “Time Capsule” which shows the state of the Shuswap Watershed. Include photos, newspaper articles, reports, artefacts which someone would find interesting 20 or 50 years from now.
12. Sub-drainage study. Research and examine in more detail one of the sub-drainages. Identify the creeks in it; if some of the creeks are un-named, invent your own names that make sense for the area's geography and history.
13. Sub-drainage study and comparison. Compare a relatively wild sub-drainage like the Anstey with one that is much more developed like the Salmon River.

Riddle –What kind of a shed can you swim in, snowboard in, and canoe in?

Ecosystems




Discussion / Study Questions

1. Food webs and ecosystems. What are the essentials of life for a plant? An animal? Discuss food webs and ecosystems.
2. Biogeoclimatic zones. What are the Biogeoclimatic zones, or ecoregions, in the Shuswap Watershed? See <http://www.env.gov.bc.ca/ecology/ecoregions/>
3. Carrying capacity. What is meant by the term “carrying capacity” in natural systems? What might be the carrying capacity of the Shuswap Watershed? What might be some of the Limiting factors impacting the carry capacity of the Shuswap Watershed?
4. Precautionary principle. What is meant by the Precautionary Principle in relation to environmental risk management and ecosystems?
5. Ecosystem health. How would we measure the health of ecosystems in the Shuswap? See Watershed Report Card folder for samples of two report cards.
6. Impacts on ecosystem health. Brainstorm with the class which activities might be having the greatest ecological impact on the Shuswap watershed, and why: urban development, recreational development, recreation activity, transportation, agriculture, mining, forestry, Others?
7. Threatened ecosystems. Discuss whether there are any ecosystems threatened in the Shuswap watershed. See <http://www.env.gov.bc.ca/wld/list.htm> for a list of threatened ecosystems and brochures on each. Relevant ones for the southern interior include grasslands, wetlands and cottonwood riparian ecosystems.
8. Ecological footprint. Discuss the concept of “ecological footprint”. See <http://www.myfootprint.org/> . Calculate your personal ecological footprint: http://www.mec.ca/Main/content_text.jsp?FOLDER%3C%3Efolder_id=2534374302883396
1. Where in the watershed are you?  Use the Watershed Poster to locate where students live (with pins or sticky notes). They can also add more information to the poster that is relevant to the topic of discussion.



Project Ideas

1. Nature monitoring. Start a monitoring program to monitor some aspect of the watershed – streams, invertebrates, plants, ice on and ice off. See www.naturewatch.ca/. Also see the [Streamkeepers Manual](#) in the folder “[Actions to Protect and Restore Watersheds](#)” for ideas for stream monitoring, invertebrate monitoring, water quality testing.
2. Watershed report card. Carry out a class project of preparing a Watershed Report Card for the Shuswap Watershed, or a sub-drainage.
3. Ecological footprint. What could you do personally to reduce your ecological footprint?
4. Virtual and real watershed tours. Take a virtual tour of each of the drainages in the Shuswap Watershed, using Google Earth. Then take an actual trip up one of the drainages.
 - a. See if you can hike, bike, boat or ski from headwaters to a specific point.
 - b. Or, organize a relay where students followed the watercourses to get to know the watershed better.

- c. Take pictures and / or video of features which show watershed health, and features which may indicate problems.
5.  Watershed assessment. Using the Watershed Poster, estimate the percentage of the landscape devoted to the uses and functions listed following:
- Municipalities
 - Agriculture
 - Forested cut blocks
 - Wetlands
 - Lakes
 - Provincial Parks
- In the end we will conserve only what we love; we will love only what we understand; and we will understand only what we are taught (or learn about).*

Baba Dioum
6. Community Mapping Website. Visit the CSRD mapping sight on the Community Mapping Network (http://squamish2010.ca/mapguide2010/shuswap/main_fusion.php) and explore what information is available on the site. Look for information for a part of the watershed that interests you in relation to:
- Bird records
 - Sockeye spawning
 - Chinook salmon migration
 - Human development features – e.g. buoys in the lake
7. Environmental thresholds. Investigate the concept of “Environmental Thresholds”. What could be the example of an Environmental Threshold in the Shuswap watershed?
8. Play writing. Write a play about an aspect of the watershed with an environmental message
9. Story writing. Write a story which has an environmental theme. For example:
- Become a drop of water travelling from the head waters of one of the drainages to Chase.
 - Be an adult Chinook salmon travelling from Chase to Shuswap Falls
 - Be a Sockeye salmon fry leaving the Adams River and searching for food in Shuswap Lake.
 - Be a Grizzly bear up in one of the alpine regions of the Shuswap Watershed.
10. Cartoon. Make a cartoon or comic strip about some aspect of the Shuswap Watershed. See example regarding invasive species [Comic Strip.JPG](#) in the [background folder](#) for Invasive Species.
11. Songwriting. Compose a song and write the lyrics about the Shuswap Watershed. The song could tell a story, talk about the watershed’s values, describe a specific issue, or explore your feelings about the watershed. Begin by listening to the Songs for the Shuswap CD or hear the songs on the website

Hydrology



Discussion / Study Questions

- Shuswap drinking water. Where does our drinking water come from in the various communities of the Shuswap?




Use the Watershed Poster to diagram sources of drinking water for students in the class (each student could use pins or stickers to identify their water source). Discuss what treatment water receives prior to reaching our homes?. How is it distributed?

2. Drinking water in rural areas. How do rural residents in the class, in the Shuswap, get their water? Discuss ground water and surface water and how they are connected.
3. Water uses in the Shuswap. Discuss how water in the Shuswap watershed is used – agriculture, industry (what industries?), residential use, fish and wildlife, hydro-electricity generation, other uses....
4. Residential water use. How much water do we use in the average home in BC? How is it used? Which uses take the most? Discuss the pros and cons of lawns.
5. Water cycle and human impacts. Discuss the water cycle and ways that water can become contaminated. Include groundwater. Discuss ways that we interfere with the cycle when we urbanize our communities and create “impervious” roofs, roads, and parking lots. Brainstorm ways that we can reduce the amount of hard surfaces in our urban areas – parking lot infiltration, green roofs, retaining natural areas, reducing road widths. See for example: <http://www.crd.bc.ca/watersheds/protection/howtohelp/reduceimpervious.htm> (Capital Regional District in BC) and <http://www.riversides.org/rainguide/> (Toronto)
6. Recreational activities and water. Brainstorm favourite recreational activities (most if not all require water) without water there would be no Winter Olympics – or life on this planet for that matter.
7. Stream hydrology. Discuss stream hydrology, and concepts like stream order in the watershed, riffle, run, pool.
8. Dams on rivers. Discuss the impacts of damming rivers; discuss the impacts of the two BC Hydro dams on the Shuswap River. [\[add link to my column on the dams\]](#)



Project Ideas

1. Mathematical analysis of watershed. Review some of the standard ways of analysing watersheds – drainage area in relation to lakes, etc. Compare the Shuswap Watershed with other watersheds for which data are available.
2. Water audit. Do a water audit for your home or your school. Where is the most water being used? Where is it being wasted? Develop a plan to reduce water waste. See the folder on [water conservation](#) in “Individual Action” and the file [WaterSmartHomeAssessment.pdf](#)
3. Water use. Research information on water use in BC or Canada and prepare a way of graphing the information.
4. Water conservation campaign. Do a class project of developing and implementing a water conservation campaign for the Shuswap Watershed. Brainstorm ideas (posters, newspaper tip column, radio spots, TV spots, YouTube video, internet social networking, street theatre, etc.).
5. Continental water diversion. Investigate NAWAPA (an idea from early in the last century for intra-continental transfer of water from watersheds) – see <http://www.youtube.com/watch?v=ORRUJyt7AIo> Debate the pros and cons of this concept.

6. Stream table or watershed model. Make a stream table (see [Water Stewardship Manual](#), p 68) or an outdoor Watershed Model (see the [Water Stewardship Manual](#) p 74). Change some of the variables in the stream table or watershed model and observe what happens; e.g. change the slope of the box, flow rate or volume of water, add vegetation, or alter the landscape. Relate your observations to real life situations in the Shuswap Watershed – e.g. stream erosion, delta formations, glacial erosion.
7. Historic research. Research changes that have occurred in the watershed since the arrival of European settlers, by examining archives in museums, historical society records, old newspaper archives to find photographs and references to waterways in the past. Investigate community maps to discover “lost” creeks (i.e. culverted).
8. Topographic maps.  Compare topographic map sheets with the relief and other features that appear on the Watershed Poster.
9. Board game. Design a board game in which the players “travel” from headwaters to the outlet at Chase using non-motorized and / or motorized methods. Players could take on roles of different “beings” in the watershed – fish, mountain caribou, sockeye, trout, etc.
10. Water diversion. Research the proposal to divert Shuswap water to the Okanagan and the massive campaign to oppose the plan (Shuswap Thompson Research and Development Association)
11. Water diversions. Investigate existing water diversions from the Shuswap to the Okanagan, including those from Duteau and Fortune Creeks (see article in Geography)

Species in the Shuswap Watershed



Discussion / Study Questions

1. Native and non-native species; invasive species. Discuss concepts of native, non-native, invasive. (www.invasiveplantcouncilbc.ca) Identify native and invasive mammals, birds, fish, plants, invertebrates, amphibians, reptiles. Invasive species are the second biggest threat to loss of biodiversity, after habitat loss. The [resources section](#) contains games as well as lesson plan material.
2. Salmon study questions. What varieties of salmon are found in the watershed?
 - a. What is the life cycle for each species and what requirements do they have?
 - b. What role do salmon play in ecosystem health?
 - c. What was the impact of the Hell’s Gate slide in 1913?
 - d. What percentage of salmon use the shoreline for spawning and what are the spawning requirements they have?
 - e. What is meant by the statement that salmon are a keystone species?
 - f. What role do salmon play in the diets of humans in the Shuswap?
 - g. What role do salmon play in the culture of First Nations in the Shuswap?
 - h. What happened to the massive salmon run in the upper Adams River?
 - i. What happened to the once huge salmon run in the Salmon River?



Project Ideas

1. Classroom salmon. Raise salmon fry in the classroom and release these in a stream. Contact Neil Brookes, Kingfisher Interpretive Society (250-838-0004).
2. Salmon habitat mapping. Map all the rivers and creeks in the Shuswap that provide salmon habitat.
3. Poster. Design a poster about an aspect of salmon that interests you – e.g. the life history of the sockeye salmon, their cultural importance to First Nations, their significance in BC, protection of their habitat
4. Research report. Write a report about some aspect of salmon – e.g.
 - a. traditional First Nations fishing methods
 - b. why salmon are disappearing and the potential impacts of climate change
 - c. the effect of the Hell`s gate slide on the salmon populations (see Adams River folder within Shuswap Watershed Info folder) and discuss the potential for reintroducing the salmon populations affected
 - d. the effect of the former splash dam on Adams Lake (see Adams River folder within Shuswap Watershed Info folder)
 - e. Compare and contrast the life cycles of freshwater fish species with Pacific salmon species (see Fish and Fisheries folder within Shuswap Watershed Info folder)
5. Streamkeepers Activity. Undertake a Streamkeepers activity to help protect or restore salmon habitats in the Shuswap – see the [Streamkeepers Manual](#) in the Action folder. This could include a stream clean-up, replanting a shoreline riparian area, or carrying out a storm-drain marking program.
6. Public awareness campaign. Create a public awareness campaign regarding foreshore habitat
7. Invasive fish species. Explore the consequences of introduction of invasive fish species within lakes in the Shuswap watershed, and how this can be prevented in the future
 - a. Arrange for a guest speaker from Ministry of Environment (Kamloops) which managed the program to kill invasive fish in area lakes with rotenone
8. Invasive aquatic plants. Examine the distribution of invasive aquatic plants in the Shuswap watershed – e.g. Eurasian Water Milfoil, Yellow Flag Iris, Purple Loosestrife
9. Fishing guide. Prepare a guide for visitors to the Shuswap about fishing.
10. 100 km diet . Design a menu for breakfast, lunch and dinner in which all the ingredients come from less than 100 km away. Follow Canada`s Food Guide to include a balanced diet. Prepare a summer menu and a winter one.
11. Secwepemc diet. Research the diet of the Secwepemc First Nations pre-contact with European settlers. Be specific in terms of what kinds of game, fish, roots, berries and other plants they ate. Sources of information include books by Nancy Turner (*Food Plants of Interior First Peoples*) and Parish, Coupe and Lloyd (*Plants of the Southern Interior British Columbia*)(I will add my column about this topic to the geography section).

Governance



Discussion / Study Questions

1. Intergovernmental Responsibilities. Discuss the concept of intergovernmental splits of responsibilities for land, water and wildlife management in Canada and the provinces.



Project Ideas

1. Government responsibilities in the Shuswap Watershed. Create a chart which outlines the different levels of government and who controls what aspect of land, water and wildlife in the Shuswap watershed. Fill in whether they have an office located in the Shuswap watershed. A sample chart is included following to get you started.

Area of Concern	Level of government	Name of government agency	Location of nearest office
Water transportation			
Flood control			
Water licences			
Salmon			
Trout			
Building permits			
Forest management			
Geese			
Tourism			
First Nations lands			
Crown land			
Ducks			
Other...			

2. Government office tour. Arrange a tour to meet representatives of local government (e.g. the regional district, local village or city office), First Nations, provincial office (e.g. Ministry of Environment), or federal office (e.g. Department of Fisheries and Oceans).

Planning, Development and Growth




Discussion / Study Questions

1. Population forecasts. Discuss the challenges of forecasting future population for planning and development. What do forecasts say about the Shuswap watershed? See


http://www.interiorhealth.ca/uploadedFiles/Information/Reports/Population_Profiles/014%20TCS%20HSA%20P34.pdf and

<http://www.bcstats.gov.bc.ca/DATA/POP/pop/Project/P34BCIntro.pdf>

2. Carrying capacity and population. Discuss what should happen if the Shuswap Watershed is forecast to reach its population carrying capacity. Should people be “turned away”?
3. Industry. Discuss whether new industry should be encouraged to come to the Shuswap Watershed to help create more jobs. What kinds of industries should be attracted?
4. Watershed threats. Brainstorm potential threats to the Shuswap Watershed. Then,  reveal the threats as summarized on the Watershed poster. Compare the students’ ideas with the analysis on the poster. Discuss solutions, or use the discussion to lead into solution-oriented projects.
5. The Lorax. Watch the video of the Lorax by following the link below, or read the book by Dr. Seuss. <http://video.google.com/videoplay?docid=6650219631867189375#> Compare how they are the same) and contrast (how they are different) the issues of the watershed in which the Lorax lived with the issues in the Shuswap Watershed.
6. Consumer / industrial growth society. Discuss the role of economic growth in our society.
 - a. Does our economy need to keep growing in order for our society to be strong?
 - b. What would a no-growth economy look like?
 - c. Discuss the difference between “needs” and “wants”, and whether it’s important to distinguish between the two when making purchases.
 - d. Discuss the role of marketing, advertising, and peer pressure in contributing to “wants”. How are these part of the consumer industrial growth society?



Project Ideas

1. Action planning.  Research one of the key threats from the Shuswap Watershed Poster and develop an action plan to help address the threat.
2. Display. Make an informational display, much like a Science Fair Project, which informs people about an issue in the Shuswap Watershed that you care about. Make sure that the display is positive and solution-oriented; e.g. “I am for...”
3. Development process. Describe the process that you would need to go through in order to build a new house on a piece of land in your neighbourhood. What could you include in your house and the lot that it sits on to make your house as watershed-friendly as possible?
4. Shoreline planning. What are the rules and best practices for buoys, docks and shoreline protection? Summarize them. See <http://www.csr.bc.ca/siteengine/ActivePage.asp?PageID=254> and http://www.bclss.org/library/library/cat_view/102-reports-on-shoreline-management-guidelines-.html
5. Shoreline protection. Build a model or diorama of two shorelines – one which has been changed from its natural state by humans, and one which has been restored. See www.livingbywater.ca
6. Stream protection and forestry. Organize a field trip to an area of the watershed where active logging is underway. Invite representatives of the company to explain the operation and how logging and road building are being carried out to protect streams in the area.

7. Hypothetical sustainable community in the Shuswap. Design a new sustainable community for the Shuswap! Think about how the community will obtain the basic necessities of life (water, food, shelter, energy) as well as the social and cultural necessities of humans. How will waste be dealt with in the community (without exporting it elsewhere)?
8. Limiting Factors. Research the concept of “limiting factors” for natural systems. Using this information, what do you think will be the factors that limit human population growth in the Shuswap Watershed.
9. Bioregionalism. Write a report about this concept. How does it relate to watershed planning? (I have done a column on this too – will add it to Geography)
10. NIMBYism. Write a report explaining what is meant by the word “NIMBY”, and what are the pros and cons of this concept.
11. Debate an issue. Organize a formal debate concerning an issue of concern or threat. For example:
 - Resolved – “Houseboats are an essential part of the Shuswap’s tourism economy and should be allowed to discharge grey water into Mara and Shuswap Lakes.”
 - Resolved – “In rural areas like the Shuswap, people should be allowed to do what they want on their own lake front properties.”
 - Resolved – “In times of water shortage, the needs of water for agriculture are more important than the needs of fish in the streams.”
 - Resolved – “The wolf population should be reduced to allow for more large mammals (such as caribou) to flourish.”
 - Resolved – Incinerators or composting systems which process animal carcasses are a necessary function in an agricultural area and should be permitted in agricultural communities of the Shuswap watershed.
12. Triple bottom line economics. Research what is meant by this term, and to what extent business and government are using this concept in the Shuswap Watershed. Give examples.

Climate Change



Discussion / Study Questions

1. Climate and weather. What is the difference between climate and weather?
2. Causes of climate change. What are the primary causes of climate change?
3. Climate forecasts and impacts in the Shuswap. What are the forecasted projections for climate change in the Shuswap Watershed? What might be some of the impacts of these changes on the watershed – streams, forests, wildlife, trees and plants?
4. What is meant by adaptation? What adaptive measures should be considered to be prepared for local climate change impacts?



Project Ideas

1. Greenhouse gas reduction. What could you do personally to reduce your greenhouse gas emissions?

2. Home energy audit. Conduct an energy audit of your home or school and develop a plan to reduce energy consumption. See http://www.bchydro.com/guides_tips/green-your-home.html
3. Transportation diary. Keep a personal transportation diary for two weeks. Evaluate whether and where you can substitute alternate means of transport which produce fewer greenhouse gases (including human-powered transport).
4. Climate change adaptation measures. Prepare a chart that shows all potential watershed climate change impacts and list potential adaptation measures for each one.

Waste and Wastewater



Discussion / Study Questions

1. Where are the landfills in the Shuswap Watershed located? Where does the material come from? What is being done to protect groundwater underneath landfills in the Shuswap watershed?
2. How much solid waste does the average Canadian home produce in a week? In a year?
3. Discuss the statement “there is no away when it comes to our waste”.
4. How is sewage dealt with in the various communities in the Shuswap? What happens to sewage produced by homes in rural areas that are not linked to municipal sewers?



Project Ideas

1. Keep a log of all the garbage your family creates in a week; develop a plan to reduce it.
2. Research phosphates and nitrates and their effects when they are contained in wastewater. Find out whether the sewage treatment process in your community removes these from the wastewater.
3. Diagram the sewage treatment system in your community; if you are not connected to a sewer system, diagram the kind of wastewater treatment system that you have. (The most common one in rural areas is a septic system.)
4. Research the various types of septic systems in use and describe potential impacts if these systems fail.
5. Map and identify those areas of the Shuswap that are most at threat from failing septic systems

Part IV Action Projects

Types and Benefits of Environmental Action

At times, it may seem that there are so many environmental problems facing us that there may be no hope. In fact there are many projects students and the general public can undertake that **will** make a difference. Many of the project

*It is better to light one small candle
than to curse the darkness.*
Chinese proverb

ideas listed in Part III are oriented in this direction. In addition, the Shuswap Watershed website, and links in Part V, contain documents and links that will help students, teachers, and the general public to undertake positive, ethical, action projects.

The following table provides a typology of types of different environmental action.

Type of Environmental Action	Ease of Evaluating Benefits to the Environment
Persuasion: educating or lobbying other members of the public.	Benefits may never be demonstrable, and/or may not exist. The possibility exists that this persuasion may not in fact change anyone’s behaviour.
Consumerism: either changing one’s own consumer habits or encouraging others to do so.	Several measurement instruments can be used to identify changes in consumerism, and resources documenting the relationship between consumer habits and environmental impact are readily available
Political Action: action that is aimed at influencing a decision maker.	Decision-makers may never respond to pressure – or a pro-environmental decision they make may be due to other factors. Interviews of decision-makers can be helpful in determining this.
Ecomanagement: action to restore, remediate, or improve a natural area.	This is easily documented and measured using a “before and after” scenario. Funders who emphasize easy accountability, such as EcoAction, place high emphasis on activities of this sort.
Legal Action: action taken through legal avenues.	Action of this sort can be easily documented, through such things as judicial decisions.

Criteria for Action Projects in Environmental Education

Dr. Bill Hammond and Dr. Milt McClaren, who have both been active in Environmental Education for teachers in B.C., have developed a set of action principles (see following page) which are essential when undertaking action projects with students. Environmental/Economic issues **always** involve many points of view and angry, divisive feelings in the classroom and community may result. Education must **not** be about indoctrination or pushing a particular point of view. The basic rule of thumb for the classroom must be – **no child** should feel embarrassed or intimidated to express his or her point of view. Following the action principles will go a long way to avoid problems.

Criteria for Action Projects

It is very important that students have a say in action projects they choose to undertake. Here are a few criteria to guide students:

Take only positive actions: Be for something you propose, rather than against something someone else proposes.

Keep a balanced viewpoint – empathize: Treat every person you encounter as you wish to be treated, with respect and consideration

Do your homework: Study the issue and all its facets, dimensions, and viewpoints.

Avoid stereotyping: It is easy to lump individuals into a category or group. When you do so, you tend to minimize their contributions as a person. Role playing exercises can help to break down these barriers.

Eliminate scapegoating, accept responsibility: Don't blame your lack of success on something or someone else. Accept responsibility and move on.


Recycle: If at first you don't succeed – rethink and start again.

Be persistent: Environmental problems are some of the most complex issues of our time. Long-term commitment and the will to succeed are both necessary.

Source: Hammond, William (1997) "Educating for Action: A Framework for Thinking about the Place of Action in Environmental Education." *Green Teacher* Winter 1996-97. pp 6-14.




There have been many explorations of how to develop environmental literacy in students; some of the resources in the folder “General Info about Environmental Ed” speak to ways of strengthening effectiveness in environmental education. One tenet that stands amongst the literature is that the more students are involved, the greater the learning. Action projects are an important way of accomplishing this.

 The resources in the “[Action](#)” and “[Watershed Teaching Manuals](#)” folders will help teachers in planning and taking ethical action towards watershed protection.

- [Leap into Action.pdf](#) - an excellent, practical resource with lots of ideas for action that students can undertake. For example conducting an interview or writing a letter to their MLA.
 - [Guide to Action en.pdf](#) - This guide is informed by the experiences of youth leaders from around the world
 - [A Teacher's Guide to Community Environmental Action](#) - An informative guide to action by the Canadian Parks and Wilderness Society.
 - [Rubric for evaluation of Environmental Projects](#) - produced by Wild B.C.
 - [Stream Keepers Manual](#) – the full manual included on this website for convenience as a pdf file describes everything you need to take on a variety of action projects including:
 - Stream Habitat Surveys
 - Water Quality Survey
 - Stream invertebrate Survey
 - Storm Drain Marking
 - Stream Clean up
 - Streamside Planting
 - Streamside Fencing
 - Observe, Record, Report
 - Community Awareness
 - Juvenile Fish Trapping and Identification
 - Salmonid Spawner Survey
 - Creel Survey
 - Stream Channel Improvement
- For more information about the Pacific Stream Keepers federation <http://www.pskf.ca/>
- [Riparian planting.pdf](#) - Planting information DFO including appropriate riparian species and planting layout.

Part V - Teacher Resources

 This section lists resources from other websites that teachers may find helpful.

Atlas of Canada - Watersheds

Information on all Canada's watersheds, hydrology, maps.

<http://atlas.nrcan.gc.ca/site/english/maps/environment/hydrology/watershed/1>

Fisheries and Oceans Canada (DFO)

DFO Stream to Sea for Intermediate Grades

<http://www.pac.dfo-mpo.gc.ca/education/intermediate-intermediaire/index-eng.htm>

Canadian Wildlife Federation

Canadian Wildlife Federation:

<http://www.cwf-fcf.org/en/educate/programs/learning-about-watersheds/>

Teachers must sign in to access these materials: (teachers' guide and resource sheets)

From the website:

Inspire your students to explore their watershed and how it connects them to one of Canada's three oceans — the Arctic, the Pacific or the Atlantic — by celebrating the 2006 Oceans Day theme, "Watersheds ... your link to Canada's oceans ... explore the connection!" Help them discover that all living things, including people and wildlife, share the same water that flows from their neighbourhood to marine coasts and drains into an ocean. Better yet, introduce your students to the Discover Canada's Watersheds map contained in this kit and have them trace the flow of water from their school to the ocean. It doesn't matter how far you live from an ocean — you still have an effect on its health.

In this educational unit, you'll find a lesson plan for a display about watersheds, a watershed illustration, Canada's Watershed Map, and more. Your students will:

- investigate the watershed in which they live and how it is connected to an ocean;
- spread awareness about these connections through hands-on or electronic displays with other students;
- learn how we are all connected to an ocean;
- discover how to sustain our oceans and their communities through [the Blue School program](#); and celebrate their efforts to protect our oceans and marine wildlife by doing projects right in their schoolyard.

Zero Footprint.Net

http://kidsworld.zerofootprint.net/Overview_of_Environment_Canada_Sites_for_Teachers

From the website: A helpful collection of lesson plans, programs, and complementary resources for educators.

Please note that while the collection is for the most part Canada focused and designed for regional standards, most of the materials can be adapted across curricula.

[Primary School - Ages 5-8](#)

[Primary School - Ages 8-12](#)

[Secondary School - Ages 12-15](#)

[High School and Post-Secondary - Ages 15-18 and Adults](#)

[Speakers and Presentation Kits](#)

Environment Canada

<http://www.ec.gc.ca/education/default.asp?lang=En&n=D3D10112-1>

From the website: Find resources to help you bring the environment into your classroom or into the activities of your scout, naturalist or youth group.

[Get support](#) for your involvement.

[Take action](#) at school to reduce your ecological footprint!

Lesson plans and teacher guides for Nature and Wildlife, and Water, for various grade levels, both primary and secondary.

Statistics Canada

Human Activity and the Environment – Freshwater Supply and Demand in Canada.

Available as pdf file at: <http://www.statcan.gc.ca/pub/16-201-x/16-201-x2010000-eng.pdf>

This document offers a wealth of data and analysis on Canada's freshwater, broken down by region and drainage basin.

Environmental Protection Agency (USA)

Watersheds Website: <http://water.epa.gov/type/watersheds/index.cfm>

National Film Board

Footprints: Environment and the Way We Live

This Web site offers an engaging point of entry for secondary and postsecondary students into the complex interplay among society, culture and the environment. Carefully selected films from the NFB's vast collection, along with teacher guides and a wealth of supplementary material, focus on key issues and players in this field. Teachers will find detailed lesson plans and 191 short film clips to bring this exceptional site into the classroom. Visit

<http://www3.nfb.ca/footprints>

Shuswap Area Resources

www.csr.bc.ca – Columbia Shuswap Regional District

www.salmonarm.ca – City of Salmon Arm

www.sicamous.ca - District of Sicamous

www.enderby.com – City of Enderby

<http://www.fraserbasin.bc.ca/programs/shuswap.html> - Fraser Basin Council – Shuswap Lake

<http://www.shuswaplakewatch.com> – a privately run website with data on Shuswap Lake levels and other information

<http://www.shuswaptrails.com/> - Shuswap Trails Alliance

<http://www.shuswapnaturalists.org/> - Shuswap Naturalist Club

<http://www.shuswapnaturalists.org/ync.htm> - Shuswap Young Naturalists Club

<http://www.wa-ter.ca/> - Wetland Alliance

<http://www.seas.ca/> - Shuswap Environmental Action Society

Other resources

Organization Name	URL	Description of Web Site
Environmental Stewardship Division B.C. Ministry of Environment	http://www.env.gov.bc.ca/wld/aliensp/aliens_links.html	Great starting point to investigate invasive plants and animals in B.C., Canada, and the Pacific Northwest.
Ministry of Environment Fish and Wildlife Branch	http://www.env.gov.bc.ca/fw/	Provides links to Fishing Synopsis and Regulations.
Canadian Geographic	http://www.canadiangeographic.ca/kids/animal-facts/animals.asp	Information for kids regarding native animal species; search can be narrowed to BC
Department of Fisheries and Oceans	http://www.dfo-mpo.gc.ca/science/environmental-environnement/invasive_e.htm	Canada action plan, good start for National Programs
Environment Canada Eco Action	http://www.ec.gc.ca/ecoaction/gmsrc/search_results_e.cfm?action=details&id=252&start_row=21&all_records_details=region&region=nat	Possible funding source for action projects

Organization Name	URL	Description of Web Site
Freshwater Fisheries Society of B.C.	http://www.gofishbc.com/alienspecies.htm	Great site for information about fresh water fishing initiatives and fishing opportunities for kids. CD available
Stop Aquatic Hitch Hikers Program	http://www.protectyourwaters.net/prevention/prevention_generic.php	How to prevent accidental introductions of Aquatic Invasive Species.
Hinterland Who's Who	http://www.hww.ca/hww2.asp?id=220	Issues and topics invasive alien species in Canada
U.S. Geological Service	http://nas.er.usgs.gov/queries/factsheetlist.asp	Extensive catalogue of Non indigenous aquatic species fact sheets
Native fish.org	http://nativefish.org/Gallery/?PHPSESSID=e705c4270d165325bf5a7ab8341e4fd3	Extensive searchable Picture Gallery of Native Fish
U.S. Geological Service	http://nas.er.usgs.gov/links/fishlinks.asp	Links to a wide variety of fish links
Sea Grant University of Michigan	http://www.miseagrant.umich.edu/flow/U1/U1-L3.html Flow – Fisheries lessons on the Web. 5 lessons on Food Web 5 lessons on Water 5 lessons on Fish	Educational materials and kids website – Most Unwanted posters. Mainly great lakes issues but good ideas.
Environment Canada	http://www.speciesatrisk.gc.ca/search/speciesResults_e.cfm?lang=e&common=&op=1&latin=&taxid=0&stid=0&disid=0#Extinct	Searchable data base of species at risk includes plants and animals.
Wild B.C.	http://www.hctf.ca/wild.htm	Environmental Education in Action. Provides a large number of resources for environmental education in B.C. Access to workshops by trained facilitators all over B.C.
The Bullfrog Project U.Vic	http://web.uvic.ca/bullfrogs/	The Project is focused on public outreach, site monitoring and steward training to prevent Bullfrog range expansion. The Project is also researching methods to mitigate the impact of existing Bullfrog populations by restoring habitats to enable the co-existence of native frog populations
Habitattitude	http://www.habitattitude.net/news/	Sponsored by the Pet industry and US fish and wildlife giving information on responsible Aquarium operation and invasives
Aquatic Species on the move.	http://www.iisgcp.org/EXOTICSP/	Teach educators and their students about the ecological impacts of exotics and how these students and members their community can make environmentally responsible decisions to help prevent the spread and transport of exotic species.

Organization Name	URL	Description of Web Site
Sea Grant Nonindigenous Species Site U.S. wide	http://www.sgnis.org/	Links to professional articles
Department of Fisheries and Oceans	http://www.pac.dfo-mpo.gc.ca/recfish/Species/shellfishID_e.htm#AQUATIC_INVASIVE_SPECIES	Marine aquatic invasives
Department of Fisheries and Oceans	http://www-heb.pac.dfo-mpo.gc.ca/community/education/eduintro_e.htm	Lessons and links to help students become aquatic stewards. Lessons for primary intermediate and secondary students in French or English.
National Invasive Species Information Center U.S. Dept of Agriculture	http://www.invasivespeciesinfo.gov/resources	Searchable website with great links to a wide variety of topics
University of Minnesota Sea Grant Program	http://www.seagrant.umn.edu Very useful starting point for educational materials, in USA. Provides links to other Sea Grant Programs. Catalogue of many free and low cost educational materials.	Materials have been assembled from agencies nationwide by the University of Minnesota Sea Grant Program to assist K-12 teachers and nonformal educators in raising awareness and integrating AIS studies into their curriculums.
Cornell University	http://ei.cornell.edu/ecology/invspec/links.asp	Environmental Inquiry for High School Students- Authentic Scientific Research

Miscellaneous other links

Topic	Website
Grantmakers assessment of environmental education in Canada	http://www.walkingthetalk.bc.ca/files/EEBrief_Eng.pdf
Reference – films for change NFB	http://www.learnquebec.ca/export/sites/learn/en/content/curriculum/bal/documents/films_for_change.pdf
Evaluation of environmental education programs	http://www.sierraclub.ca/bc/programs/education/educators/resources/Measure_Success_of_EE_Final.pdf
	www.cmec.ca/international/UNESCO/Sustainable-2006-03.en.pdf
	http://www.pac.dfo-mpo.gc.ca/oceans/salishsea/default_e.htm
	www.cpawscalgary.org/education/network-environmentaleducation/capacity-building.html
Environment Canada Fresh water home	http://www.ec.gc.ca/water/e_main.html

Topic	Website
Environment Canada Fresh water links	http://www.ec.gc.ca/water/en/links.cfm?
Environment Canada Fresh water primers	http://www.ec.gc.ca/water/en/nature/prop/e_prop.htm
Watershed links (US focus)	http://www.adopt-a-watershed.org/index.php/watershed_links
Shuswap Lake data; facts	http://www.shuswaplakewatch.com/research/resfacts.html
Shuswap Lake flow data	http://www.shuswaplakewatch.com/research/runoff99p2.html
Shuswap Mapping project	http://www.csr.bc.ca/siteengine/activepage.asp?PageID=255
Shuswap Lake Integrated Planning Process	http://www.fraserbasin.bc.ca/programs/shuswap.html
Shoreline Care brochure	http://www.csr.bc.ca/development/DEVELOPMENT%20SERVICE/S/Shuswap%20Mapping%20Project/Shoreline%20Care.pdf
BC Lake Stewardship Society	http://www.bclss.org/
BCLSS - Connecting students to their watershed.	http://www.bclss.org/library/cat_view/63-recommended-reading.html
Watershed dictionary streams query – online BC Government data base of information on streams	http://a100.gov.bc.ca/pub/fidq/stream.do
Drinking water guidelines	http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/guide/index-eng.php
Owls, reptiles, amphibians - Shuswap	http://www.artemiswildlife.com/pubs/Shuswap%20Stewardship%20Manual.pdf
Fisheries inventory for BC water bodies	http://www.env.gov.bc.ca/fish/fiss/index.html
Sustainable approaches to water resources in BC	http://www.waterbucket.ca/
Shuswap watershed atlas – includes foreshore mapping	http://www.cmnb.ca/atlas_gallery/columbia-shuswap-regional-district-watershed-atlas and http://squamish2010.ca/mapguide2010/shuswap/main_fusion.php
Shoreline mapping article in Paper – posted on the Community Mapping Network site	http://www.cmnb.ca/files/atlas_files/SAObserver_article_20090715.pdf
Shoreline living information and best practices	www.livingbywater.ca
DFO posters and publications for teachers	http://www-heb.pac.dfo-mpo.gc.ca/community/pdf/00PubCatlg0507.pdf
Water conservation	http://www.livingwatersmart.ca/
Irrigation calculators	http://www.irrigationbc.com/
First Nations legends	http://www.okmainregion.net/index.php?menu=education&sub=uccprojects&page=education/ucc/balcers_Legends&file=education/ucc/downloads/balcers_Legends.doc

Topic	Website
Hydrology management tool for local government planning rainwater management and green development	www.waterbalance.ca
Animated groundwater explanation	http://www.leapingmedia.com/groundwater.htm
Native trees in BC – good description, easy to read	http://www.bcadventure.com/adventure/wilderness/forest/westred.htm
Recreational opportunities in BC	http://www.bcadventure.com/adventure/kayaking/index.html
	http://www.fraserbasin.bc.ca/programs/documents/Stewardship_Workshop/Atlas.pdf
Shuswap lake mapping project.	http://csrd.civicweb.net/FileStorage/6B4D9860366448B9B562201365FB524E-Shuswap_FIM_Mapsheet_Index.pdf
Ottawa – Gatineau Watershed Atlas – a sample watershed atlas from another watershed	http://www.ogwa-hydrog.ca/en/home

Appendix - Biographies

Kim Fulton

Kim Fulton (aka Dr. Fish) is a retired teacher/administrator from the B.C. public school system. He grew up recreating in the North Okanagan Shuswap area and spent his professional career there. He is keenly interested in helping protect, preserve, and restore the Shuswap Watershed. He has a Masters Degree in Education with an emphasis in environmental education. Some of the highlights of his career are listed below.

- Water Stewardship Project Coordinator
- Murray Newman Award Winner (for fresh water aquatic education in B.C. chosen by the Vancouver Aquarium)
- Minister of Environment Award Winner
- On line work as Dr. Fish answering questions from children
- Involved with Curriculum development including:
 - Gently Down the Stream
 - Treasures in the Trash
 - Networking the Fraser
 - Interior Telecommunications Project
 - Salmon Simulation Game
 - Water Stewardship Manual
 - Kokanee Resouce
 - Stream Keepers – Riparian Replanting Module, and Water Chemistry Module
 - Preventing the Spread of Invasive Species
- Sessional Instructor for the SFU Summer Institute in Environmental Education – Ten years – approximately 500 teachers Working with Milt McClaren and Bill Hammond outstanding mentors and environmental educators
- 25 Years Salmonids in the Classroom Teacher.
- 10 Years Science Teacher in 4-7 School
- 25 Years Project Wild Facilitator
- 27 Years Classroom Teacher and Library Resource Teacher
- 2 Years kindergarten teacher
- 15 Years Professional Development Chairperson for School District 21 – Armstrong/Spallumcheen
- 10 Years Administrator and Teacher elementary school
- Interpreter at Kingfisher Environmental Interpretive Center
- Past Director for Kingfisher Environmental Center

Sarah Weaver, B.A., M.A.

- Involved in environmental education in the Shuswap area for over 20 years as both consultant and educator.
- Co-founder of the national Living by Water Project (www.livingbywater.ca)
- Co-founder of two community-based environmental initiatives - Friends of Gardom Lake and Sustainable Shuswap
- Extensive experience in environmental education on water quality, riparian best practices, stormwater best practices, invasive plants, and best practices for land use planners.
- Principal author of the highly popular *On the Living Edge, Your Handbook for Waterfront Living*, which has sold over 20,000 copies in four regional editions
- Author of *Living Near Urban Lakes – Your Guide to Everyday Living in Urban Lake Communities*
- Trained as a geographer and land use planner
- Consultant to federal, provincial and local governments and environmental organizations in environmental best practices, participatory research, and communication and outreach
- Co-winner of the gold medallion in the Clean Water category of the Canadian Environment Awards program (2002); co-winner of the 10 year National River Conservation award (2004).

Jim Cooperman, B.A.

- Resident of the Shuswap area for 42 years. Education includes a bachelor's degree from the University of California at Berkeley and a teaching credential from Simon Fraser University.
- Work experience has varied from teaching and log building to construction, operating a small sawmill and environmental writing, editing and analysis. Volunteer efforts include amateur theatre, live music promotion, and researching and writing about local history including co-editing the local history journal, Shuswap Chronicles.
- Conservation work began in 1989, when he helped establish the Shuswap Environmental Action Society (SEAS). From 1990 until 2000, he worked provincially with the B.C. Environmental Network as the coordinator of the forest caucus and the editor of the B.C. Environmental Report.
- Other achievements include writing the chapter on Canada for *CLEARCUT, The Tragedy of Industrial Forestry*; authoring *Keeping the Special in Special Management Zones - A Citizen's Guide* published by BC Spaces for Nature; helping to organize the very successful Helping the Land Heal Conference held in Victoria in November, 1998; and writing numerous editorials that have been published in newspapers and journals throughout the province.
- Prepared detailed reviews of draft policy documents and papers, including the Forest Practices Code, Biodiversity Guidebook, Landscape Unit Manual, Old Growth Forest Inventory and the Guide to Writing Higher Level Plan Objectives.
- Participated in both the successful Kamloops Land and Resource Management Plan (LRMP) process and the Shuswap/Okanagan LRMP, thus helping to protect 220,000 hectares of southern interior Crown land in provincial parks.
- Now retired, Jim does volunteer work on local issues with SEAS, including Shuswap Lake water quality. Since April, 2005, he has been a volunteer columnist for the Shuswap Market. His column, *Shuswap Passion*, is on Shuswap geography. Jim initiated the Shuswap Watershed Project, including the poster and continues to work on its development.

