

Teacher's Guide to Environmental Science for the New BC Curriculum

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With the implementation of the New BC Curriculum, there will be an introduction of new coursework available to be taught, such as Environmental Science 11 and 12. Although it may be quite daunting to teach a brand new course, it is also an incredible opportunity because high school students will learn about their local environment and how humans interconnect with this environment. As I am quite passionate about the sciences, I wanted to provide a teaching resource for others who may feel a bit intimidated by the lack of prescribed curriculum to be taught for this course. My goal is to provide you with resources that are NOT worksheets, fill in the blanks, or bookwork activities. The New Curriculum is encouraging thinking over memorizing, and I hope to utilize activities that promote this idea. In this document, you will find some interactive activities, inquiry projects, and case studies that you may find useful for your own classroom, as well as some examples of vocabulary you may want to integrate into your lessons. At the very end of this document, you will find a detailed sample PowerPoint lesson and lesson plan for a day in Environmental Science 11. Although this booklet is intended specifically for the Environmental Science 11 curriculum, the materials and ideas may be adapted and used for any high school science classroom.

Summary of Big Ideas and Prescribed Content

- *Local Diversity*
 - Abiotic and edaphic factors
 - Biodiversity of ecosystems
 - Ecological roles of organisms
 - Inter and intraspecific interactions
- *Changes in Local Ecosystems*
 - Energy flow (i.e. food webs)
 - Matter cycles (i.e. water, carbon, nitrogen cycles)

- Population dynamics of organisms
- Landscape formations
- Changes and Equilibrium in ecosystems
- *Local Sustainability*
 - Characteristics of healthy ecosystems
 - How humans may be agents of change
 - First People's traditional ecological knowledge
 - Unsustainable vs. sustainable practices
- *Conservation and Restoration*
 - How environmental stressors (ie. climate change, disturbance, forest fire) may impact ecosystems
 - How do ecosystems restore themselves? How do humans help?
 - First Peoples concept of interconnectedness, and how interconnectedness applies to conservation and restoration
 - Engagement/involvement in global or local stewardship

Incorporating Indigenous Knowledge

Although the concept of incorporating Indigenous knowledge and the First People's Principles of Learning may appear overwhelming at first, it is a very uncomplicated process for the Environmental Science curriculum. Utilizing elders and their knowledge is a simple way to share an immense amount of Aboriginal knowledge about the local environment. In Prince George we reside on the unceded territory of the Lheidli T'enneh, and it is important to acknowledge the tremendous amount of wisdom that group has about our area. Try to be mindful that the sharing of some knowledge is sacred, and often it is best practice to utilize elders whenever possible instead of teaching material to your class that you may not be comfortable with teaching. One may also utilize school district resources regarding Indigenous education in the classroom; our district is quite fortunate to have these resources readily available for us, but other districts should have these sources available as well. Other ideas to incorporate knowledge of Indigenous people would be to incorporate case studies, where Aboriginal groups have been strongly opinionated about specific issues regarding the environment. An example of this would be the reintroduction of wolves into Yellowstone National Park.

Activities

Class Discussion (Bell Ringers):

Use these as means of formative assessment and to get your students thinking right as they walk through the door. Prompt students to follow instructions on the board and participate in a 'think, pair, and share' or group discussion based on the instructions or debate question provided. Use a visual timer to keep your students on track.

Examples:

- What do you already know about animal behavior? What do you want to know?
- What is climate change? How do you think it will affect British Columbia?
- What are GMOs? Do you think they are good or bad? Why?
- What does endangered mean? Can you think of any endangered animals in Canada? The world?
- OR – you could pick a random scenario that you've observed in the news. In the attached lesson plan, I used a story that I found about a Loon adopting a baby duck. I had students brainstorm reasons for the loon adopting the baby duck.

Case Studies:

Utilize case studies as often as possible in your classroom! They may be used as Bell Ringer activities, Inquiry projects, and classroom debate activities. Students are able to learn through formulating their own opinions based on research and news articles that they've collected, and they can utilize empathy, and an understanding of different perspectives on relevant issues going on in the world around them in the process.

Examples:

- The conservation of Caribou: should wolves be killed to prevent so many Caribou from dying?
 - There are a lot of opinion pieces from both First Nations and non First Nations groups, Conservation Officers, Biologists, and Parks Canada to use for this one
- Hunting laws: does hunting regulations help or hinder conservation? You could use this activity to bring up the concepts of harvesting/hunting in relation to population dynamics of different game species; a relevant topic in the media today is the legalization of hunting hibernating bears and the ethics surrounding it

- Forestry from around the world: you could have your classroom research how Canada organizes its Forestry sector and how it manages to efficiently produce wood products and ship them globally – how does it compare to other countries (i.e. Sweden or Japan)?

Try to pick a case study that is RELEVANT to your classroom and their needs. It could be something as simple as a news article from that week, and you could discuss that article in the classroom. The discussion could then turn into a future inquiry project for students.

Inquiry Projects: inquiry projects are great tools because knowledge through inquiry is not only required for the new curriculum, it gets your students excited, gives them choice, and they involve less marking for teachers! Lead your students through inquiry questions that you have chosen, or let students choose what they want to learn. Students will then teach themselves what they want to learn, and will present their knowledge through something tangible that can be evaluated by themselves, their peers, or their teacher.

Examples:

- What will happen to British Columbia as a consequence of climate change?
- How do humans interfere with ecosystems? (i.e. humans shooting wolves as a way to protect caribou)
- What is a wetland? What are they useful for? How might we build an artificial wetland?

Field Trips:

As learning through experience is a very important part of building student engagement, teaching students about local ecosystems and organizing field trips to those locations is an excellent strategy for your students to learn the curriculum. As there are various landscapes throughout British Columbia, feel free to pick and choose any habitat you feel is most important in your area to showcase. I am from Prince George, so I will provide some examples that I would showcase with my class for field trips.

- **Hudson's Bay Wetland:** once an air hangar spot for water planes, this location would be great to utilize for a cross curricular lesson with Social Studies. The wetland has been given new viewing areas, as well as signage for different wildlife you should expect to see. This

wetland is also right along Queensway Blvd. in downtown Prince George, so it would be ideal for learning about disturbance ecology and how humans have altered natural ecosystems.

- **UNBC Greenway Trails:** these trails were put in place to showcase the natural forests Prince George has to offer. There are several trail systems to follow, along with Shane Lake, a small man made lake. Classes could take water samples, go bird watching, research edge effects and fragmentation from the trail systems, as well as take ice samples or go ice fishing in the wintertime.
- **Norman Lake Bog:** a large area on the side of Norman Lake Road, this bog is home to a wide variety of plants adapted to live in acidic soils. This lecture would be excellent for incorporating Aboriginal knowledge through ethnobotany, as there are multiple plants such as bog cranberry, wild strawberry, and bog rosemary that are utilized by Indigenous people. One could invite an elder to attend the field trip or share their knowledge with the class after they collected plants from the bog.

WebQuests:

I am a big fan of WebQuest activities. They can be found online with a click of a button, and (even better) they are free! WebQuests can be used in one, or multiple blocks depending on the need for your students and the complexity of the activity. They involve an investigation question, provided online, or made up by the teacher, and then students research answers to the question or potential solutions too the problem. Demonstration for learning may be done through a write up, class notes, a poster/diorama, or a presentation. What I like most about these activities is that they are incredibly flexible for any curriculum. The level of assessment is then entirely up to the teacher!

Assessment Tools and Strategies

Remember that students do not necessary learn anything by taking a test or a quiz. Often students either don't bother to study and fail, or they study in a panic the night before the test and memorize

everything just to forget it when the test is over. Here are some ideas for assessment that could be utilized other than tests

Bell Ringer Discussions:

As said earlier, bell ringers are a method of formative assessment for teachers to observe the ongoing progress being made. Are students actively participating and engaging themselves in discussion? Are they improving and producing better quality discussion throughout the year? That is the goal of the New BC Curriculum: Individualized growth over time that can be improved upon daily.

Exit Slips:

Have your students summarize or highlight anything important that they learned during the lesson or activity on a small piece of paper or a Post-it note. Students then place their notes in a bucket or on the bulletin board, and the teacher is able to use those notes as feedback: did your class takeaway what you hoped to teach them? Did they feel lost? Do they have any other questions that could lead to future lessons or teachable moments? Exit slips provide the teacher with all of this information. If you want to know what your students understood from a lesson don't test them, ask them!

Inquiry Projects:

Allow your students to choose what they want to research for their final inquiry project. And then allocate a large portion of their grade towards their accomplishments and improvements made during the research for their inquiry project. Provide means of formative assessment along the way, and then allow the large chunk of summative assessment to come from an activity that students have chosen themselves.

Vocabulary Examples

Fitness: An animal's ability to reproduce and have many successful offspring. Only the strongest survive long enough to reproduce: **survival of the fittest!**

R Strategists: Animals that have a rapid life cycle and produce many offspring at a time. Little to no parental care or investment is made. Have a short life expectancy, and (usually) only reproduce once in their lifetime.

K Strategists: Animals that have a slow life cycle and produce few offspring at a time. High amounts of parental care are involved. Have a long life expectancy, and reproduce more than once in their lifetime.

	R Strategists	K Strategists
# Of offspring	many	few
Parental care	absent	present
Life expectancy	short	long
Example	Sockeye Salmon, Mosquito	Grizzly Bear, Human

Symbiosis: An interspecific relationship between 2 or more different species

Mutualism: Both organisms benefit in the interaction they have

Commensalism: Organism benefits, the other has no effect based on the relationship they have

Parasitism: Organism benefits at the harm of another organism

Amensalism: Organism is not affected while the other organism is harmed

Predation: Organism benefits by preying on another organism

Altruism: An act that increases one animal's fitness while decreasing the actor animal's fitness

	Class example	Class example
Mutualism	Bee pollinates flower for honey	Clownfish and Sea anemone
Commensalism	Remora fish hitches a ride on shark	Monarch butterfly takes in milkweed nectar that makes them poisonous
Parasitism	Cuckoo bird lays egg in robin's nest	Tapeworm
Amensalism	Sheep trampling on grass	Penicillium fungus that kills bacteria
Predation	Barn owl eats the mouse	Frog eats insects
Altruism	Monkey grooming another monkey	Minnow releasing fright substance

Monogamy: One male and one female form an exclusive mate pair for 1 or more mate seasons

Polygamy: One or both sexes form multiple mating pairs in one mating season

Polygyny: One male forms exclusive mating pairs with many females

Polyandry: One female forms exclusive mating pairs with many males

Mate Competition: Where males or females of one species attempt to outcompete with others to secure the best (the most fit, or the most attractive) mate

** Remember that the term fitness means the most successful at attracting mates

- Want fit mates in order to produce successful, attractive offspring

	Class example	Class example
Monogamy	Barn owls	Wolves
Polygyny	Red winged blackbird	Chickadees
Polyandry	Sandpipers	Black widow spider
Mate Competition	Deer use their antlers to fight as a way to impress females and attract a mate	Male birds with elaborate feathers display themselves to females as a way to attract a mate

Primary Producer: Organisms that make their own energy from sunlight (ie. photosynthesis)

Consumer: Organisms that consume either primary producers or other consumers for energy

Herbivore: Organism that eats plant materials

Carnivore: Organism that only eats other animals

Omnivore: Organism that eats both plant material and animals

Detrivore: Organisms that gain energy from consuming dead or decaying materials

Decomposer: Organisms that gain energy by breaking down dead or decaying materials.