

BC's Natural Environment

TEACHER'S AND PARENT'S GUIDE



LESSON PLANS FOR GRADES 5 TO 7

Climate Change

The Importance of Biodiversity

Human Impacts on the Environment

LESSON 1: CLIMATE CHANGE AND THE GREENHOUSE EFFECT

Learning Outcomes:

Define and explain the greenhouse effect.

Introduce the connection between human activity and greenhouse gas emissions.

Identify the main human activity sources of greenhouse gases.

Materials:

- Greenhouse effect student printable and teacher reference (pages 3-5)
- Greenhouse gas student printable and teacher reference (pages 6-7)
- Coloured pencils or markers (black, red, yellow, blue)

Key Vocabulary:

- Agriculture, atmosphere, carbon, carbon dioxide, climate change, deforestation, fertilizer, fossil fuels, greenhouse gases, greenhouse effect, infrared radiation, landfills, methane, nitrous oxide, solar radiation

Introduction:

1. Ask students if any of them know what climate change is. Write down their suggestions on the board, then provide them with the definition:
 - a. **Climate change:** long-term, significant changes in average weather patterns (not just temperature, but rainfall and snowfall, wind, and other types of weather). Climate change affects both the average conditions and the variability of weather (ex. extreme events).
2. Ask students if they know why climate change has been increasing over the past century. Write down their suggestions on the board, steering them towards the correct answer:
 - a. Over the past century, human activity has increased the amount of greenhouse gases being released into the atmosphere, contributing to an increase in the planet's temperature.
3. Complete activity with the students (see page 2).

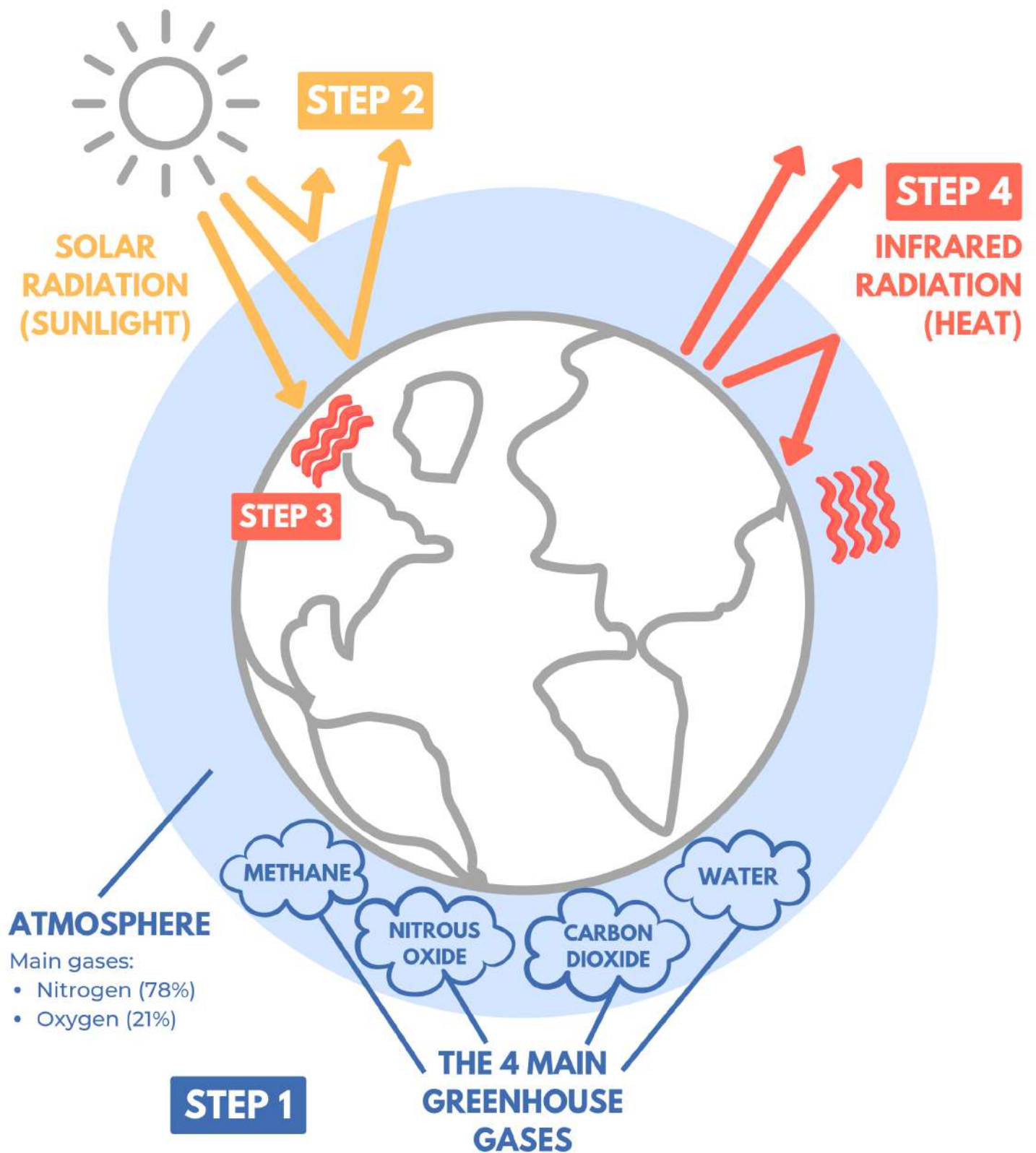
Conclusion:

Ask students if they think that greenhouse gases are good or bad. Lead the class into a discussion about how greenhouse gases are necessary to ensure that the planet does not become too cold to support life, but too many greenhouse gases in the atmosphere may result in the planet's temperature increasing at an alarming rate.

CLASS ACTIVITY – THE GREENHOUSE EFFECT, GREENHOUSE GAS EMISSIONS

1. Hand out greenhouse effect printable to students. Following each step from the printable teacher reference, draw the diagram on the board instruct the students to follow along. Provide definitions and explanations for each step. Students should end up with diagrams that look like the teacher reference, complete with definitions and illustrations.
2. Now that the students have a basic understanding of the greenhouse effect, turn their attention to the greenhouse gases at the bottom of the diagram. Explain to students that these are the main four greenhouse gases in the atmosphere.
3. Hand out the greenhouse gas worksheets to students. Following the order of the worksheet, ask students if they can identify each source of greenhouse gases. Once students have correctly guessed a source, explain to them how each source results in the release of greenhouse gases. Ask students to write down the name of each source and the corresponding explanation.

THE GREENHOUSE EFFECT (TEACHER REFERENCE)



THE GREENHOUSE EFFECT

(TEACHER REFERENCE)

STEP 1

Draw and label the atmosphere in blue, shading it in. Within the atmosphere write down the four main greenhouse gases in the atmosphere (carbon dioxide, methane, nitrous oxide, water)

Explanation: the atmosphere surrounds the earth. It contains a mixture of gases, including “greenhouse gases.”

STEP 2

Draw and label yellow solar radiation from sun, some of it bouncing off the atmosphere and the Earth, some of it directly hitting the Earth.

Explanation: during the day the sun emits solar energy towards the Earth. Some of it reflects off the atmosphere or off the surface of the Earth. Most of it is absorbed by the Earth's surface.

STEP 3

Draw red squiggly lines underneath the solar energy that did not reflect.

Explanation: the surface of the planet is warmed by the energy that was absorbed.

STEP 4

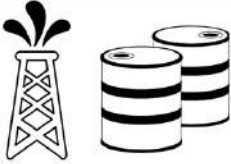

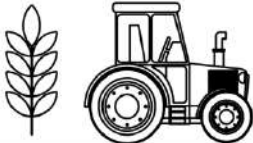



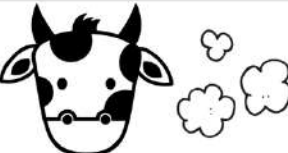

Draw and label red infrared radiation (heat energy) coming from the planet. Some of it goes straight through the atmosphere. Some of it bounces off the atmosphere back towards the planet. Draw red squiggly lines in the atmosphere near where the infrared radiation bounced back towards the planet.

Explanation: at night, the Earth's surface cools, which releases heat back into the atmosphere. Some of the heat passes through the atmosphere and goes into space. Some of the heat is absorbed by the GHG's in the atmosphere. The GHG's re-radiate the heat back towards the surface of the Earth, which warms it.



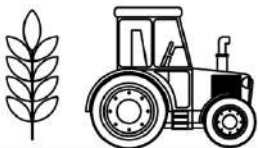



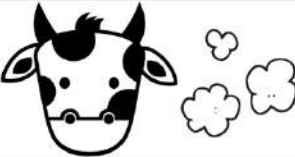

THE GREENHOUSE EFFECT



GREENHOUSE GAS EMISSIONS CAUSED BY HUMAN ACTIVITY (TEACHER REFERENCE)

CARBON DIOXIDE	
	FOSSIL FUEL USAGE (COAL, PETROLEUM, NATURAL GAS) <ul style="list-style-type: none"> Fossil fuels are made out of organic matter (containing carbon) from millions of years ago. When they are burned for energy, they release carbon dioxide.
	DEFORESTATION, LAND CLEARING FOR AGRICULTURE <ul style="list-style-type: none"> Trees contain carbon. When they are cut down to make room for farming, they release that carbon into the atmosphere. Forests also remove carbon dioxide from the atmosphere via photosynthesis. Deforestation reduces how much carbon dioxide can be removed by forests.
NITROUS OXIDE	
	FARMING - USE OF FERTILIZER <ul style="list-style-type: none"> Most fertilizers contain nitrogen. When this nitrogen comes in contact with a common type of bacteria, the bacteria use it to produce energy. This process creates nitrous oxide as a byproduct.
	FARMING - MANURE (ANIMAL WASTE) <ul style="list-style-type: none"> When animal manure is treated or disposed of, it creates the perfect conditions for bacteria that produces nitrous oxide.
	FOSSIL FUEL USAGE <ul style="list-style-type: none"> When fossil fuels are burned, the nitrogen contained in the fuel is released into the air as nitrous oxide.
METHANE	
	FOSSIL FUEL USAGE <ul style="list-style-type: none"> Methane is released when fossil fuels are extracted from the earth, refined, and transported. Some methane is produced when fossil fuels are burned.
	FARMING - FARM ANIMAL PRODUCTION OF METHANE <ul style="list-style-type: none"> Farm animals produce large amounts of methane when they digest food, which is released into the atmosphere by the animals.
	LANDFILLS AND WASTE <ul style="list-style-type: none"> Landfills contain lots of organic matter (ex. food waste), which produces methane as it decomposes.

GREENHOUSE GAS EMISSIONS CAUSED BY HUMAN ACTIVITY

SOURCES OF CARBON DIOXIDE	
	
	
SOURCES OF NITROUS OXIDE	
	
	
	
SOURCES OF METHANE	
	
	
	

LESSON 2: THE IMPORTANCE OF BIODIVERSITY

Learning Outcomes:

Review the concept of food chains and food webs.

Understand the concept of interconnectivity within an ecosystem.

Define biodiversity, learn about the benefits that biodiversity provides.

Materials:

- Whiteboard, whiteboard markers
- Biodiversity info sheet (page 10)

Key Vocabulary:

- Biodiversity, ecosystem, food chain, food web, microorganism, organism, photosynthesis

Lesson:

1. Ask students if they know what a food web is. Write down their definitions on the board, then provide them with the definition:
 - a. **Food web:** a system of food chains within an ecosystem.
2. Complete the following activity with the class:

ACTIVITY – INTERCONNECTED ECOSYSTEMS

1. Name a specific habitat and ask students to name organisms (plants, animals, insects, etc.) that live in that environment. Write these on the board, spread out in a word cloud.
2. Ask a volunteer to come up and draw arrows indicating a predator-prey relationship between organisms. If there are any organisms that remain unconnected at the end of this process, ask the class if they can think of anything other species that eats or is eaten by these organisms. By the end of the activity, there should be a complete food web on the whiteboard.
3. To represent an extinction, erase one of the organisms written on the board. Ask the students how they think this will affect the ecosystem. As they answer this question, circle the affected organisms and erase the arrows that connect them to the extinct organism. This activity demonstrates to students the principle that all organisms within an ecosystem are interconnected.

3. Explain to the class that a high level of biodiversity provides an ecosystem with a high many benefits. Ask the class if they know what the word biodiversity means. Write down their ideas on the board then provide them with the correct definition:
 - a. **Biodiversity:** the variety of all living things, including animals, plants and microorganisms)
4. Give students the biodiversity info sheet to provide a reference as to why biodiversity is important. Ask the students read through the sheet. Solidify students' understanding by asking the class which benefits are the most important (there is no right answer to this question).

THE BENEFITS OF BIODIVERSITY

biodiversity: the variety of all living things, including animals, plants, and microorganisms

Biodiversity provides resources

The greater the diversity of plants, animals, and microorganisms, the more resources that these organisms can provide to the ecosystem. For example, biodiverse ecosystems provide wood, biofuel, and other important plant resources.

Biodiversity protects and enhances the soil

Microorganisms and worms play an important role in creating and improving the quality of soil. Bacteria and fungi decompose organic material to create soil. Worms improve soil quality by providing nutrients from their waste and by mixing up the soil. Microorganisms help nutrients cycle through the soil.

Biodiversity cleans the water

The more species in a water environment, the better an ecosystem's ability to filter pollutants. Wetlands and forests play an important role in processing contaminants from water. Forests help the soil absorb more water, which reduces flooding and prevents erosion.

Biodiversity has social and cultural benefits

People with greater access to the natural environment have a lower prevalence of mental and physical disorders such as obesity and diabetes. Also, many cultures have traditions rooted in the use and appreciation of the local environment.

Biodiversity cleans the air

Oxygen is produced by plants through **photosynthesis** (the process they use to create energy for themselves). Plants also filter and absorb various pollutants from the air.

Biodiversity helps areas recover from natural disasters

If an ecosystem has a large number of species, it is more guaranteed that some species will maintain populations even if others fail. For example, if one reptile goes extinct, an ecosystem with ten other reptile species is more likely to adapt than an ecosystem with only one reptile.



LESSON 3: HUMAN IMPACTS ON THE ENVIRONMENT

Learning Outcomes:

Learn about common harmful activities that have a negative impact on the environment.

Understand that actions can be taken to reduce harm caused by human activity.

Materials:

- Whiteboard, whiteboard markers
- Internet access
- Human impact worksheet (pages 12-13)

Key Vocabulary:

- Agriculture, deforestation, eutrophication, dead zones, habitat fragmentation, invasive species, overharvesting, pollution, urbanization

Lesson:

1. Put the students into groups and assign each group with a human activity. Ask each group to research what this human activity is and the effect that this activity has on the environment.
2. After the groups have had enough time to research, ask a volunteer from each group to come up to the whiteboard and write down the definition of their human activity.
3. Hand out the human impact worksheets to the students and ask students to copy down the definitions written down on the board.
4. Starting with agriculture, ask the class if they can guess how this human activity may impact the environment. If students guess correctly, write the correct answer down on the board and ask them to copy it down onto their worksheet. Repeat this step with each of the activities listed on the worksheet.
5. Once the worksheet has been completed, ask the class if they can think of ways that humans can reduce the harm caused by these activities.



AGRICULTURE (FERTILIZER USE)



DEFORESTATION



DEFINITION:

DEFINITION:

EXPLANATION:

EXPLANATION:



INVASIVE SPECIES



OVERHARVESTING



DEFINITION:

DEFINITION:

EXPLANATION:

EXPLANATION:



POLLUTION



URBANIZATION



DEFINITION:

DEFINITION:

EXPLANATION:

EXPLANATION:



AGRICULTURE (FERTILIZER USE)



DEFINITION: the use of nitrogen-rich fertilizers in commercial farming

EFFECTS: fertilizer runoff into local bodies of water leads to **eutrophication** - excessive algae growth, which causes an increase in anaerobic bacteria, which consumes most of the oxygen in the water, which leads to **dead zones** (zones in water environments that do not contain enough oxygen to support most marine life).



DEFORESTATION



DEFINITION: clearing away wide areas of trees to harvest wood or to use the land

EFFECTS:

- habitat destruction
- **habitat fragmentation** - small fragments of habitat can only support small populations of species, and small populations of species are more vulnerable to extinction. If habitats are separated from each other, they are unlikely to be repopulated.



INVASIVE SPECIES



DEFINITION: introduced species that cause ecological harm in a new location

EFFECTS:

- invasive species rapidly outcompete native species and drive them to extinction, resulting in reduced biodiversity in the area



OVERHARVESTING



DEFINITION: harvesting a renewable resource to a harmful degree

EFFECTS:

- invasive species rapidly outcompete native species and drive them to extinction, resulting in reduced biodiversity in the area



POLLUTION



DEFINITION: the introduction into the environment of a substance that has harmful or poisonous effects

EFFECTS:

- pollutants travel upwards through the food web, increasing the concentration of pollutants in the tissues of species further up the food chain
- waterborne pollutants can have big effects on the reproduction of species in places downstream



URBANIZATION



DEFINITION: an increase in the population of people living in urban areas

EFFECTS:

- urbanization can cause habitat destruction and fragmentation in order to make space for expanding urban areas
- our increased reliance on farming (due to a growing population) exacerbates the environmental issues caused by agriculture