

Human Activity and Air Quality

Note: This information has been designed for teachers. It could also be adapted for use by community groups.

1 KEY IDEAS

Students will:

- be aware that global decisions may have local impacts and local decisions may have global impacts
- recognize we are caretakers of the world's resources.

Students will begin to understand:

- what pollutants are in the air and where they come from
- how human activity influences local and global air quality and climate change
- how individuals can help address global climate change.

2 BACKGROUND

Global Climate Change

Global climate change is a range of disruptive alterations in regional climate systems around the planet.

The Atmosphere, Climate and Weather

The **atmosphere** is made up of various gases and water vapour in layers around the globe (see diagram below). These layers, along with the atmosphere's temperature, create a global climate ideally suited for life. **Climate** is the atmospheric conditions such as temperature, precipitation and wind that we expect over extended periods of time. **Weather** is the variations in atmospheric conditions that we experience day-to-day. Alterations to the balance of gases in the atmosphere can cause changes to global climates.

The Greenhouse Effect

The "greenhouse effect" is the natural insulating effect produced by gases in the troposphere which trap energy radiated by the earth. This energy heats the earth and maintains suitable moisture and temperature levels to support life. Without this natural effect, the average temperature of the earth's surface would be 33 C colder.

The Impact of Human Activity on the Greenhouse Effect

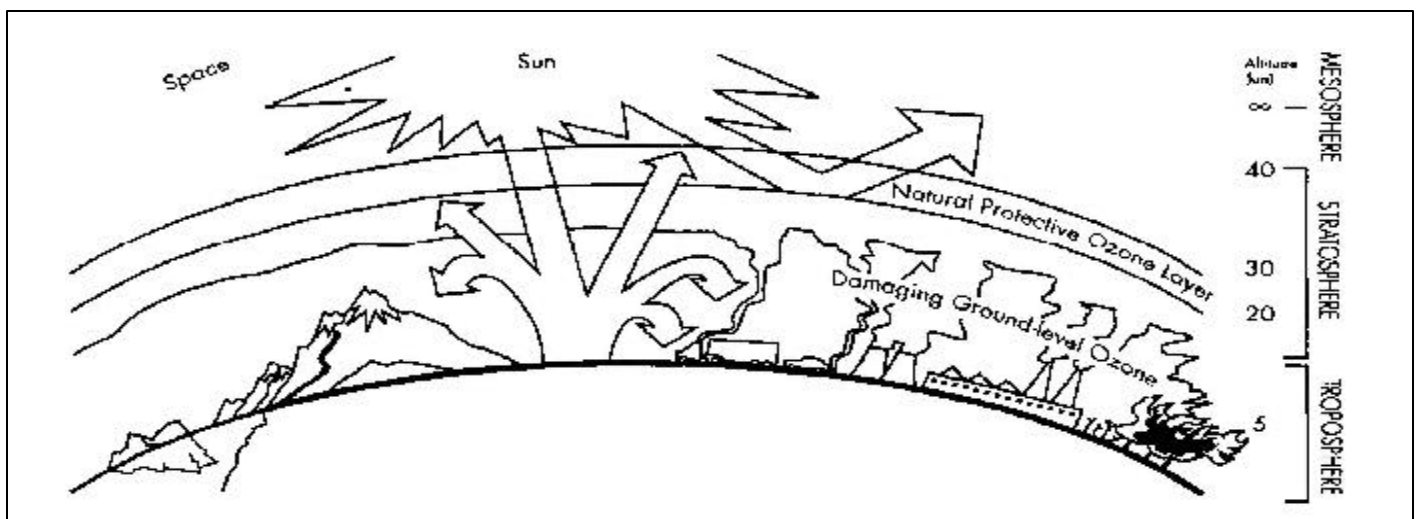
Human activities, such as burning fossil fuels, add more greenhouse gases (GHGs) to the atmosphere which prevents the escape

of radiated heat. This increases the natural greenhouse effect. GHGs include carbon dioxide and nitrous oxide (mainly from burning fossil fuels), methane (from transporting natural gas, exploring for oil and gas and solid waste decomposing in landfills), and perfluorocarbons (PFCs--from aluminium smelters).

Worldwide climates could be altered by the enhanced greenhouse effect, resulting in changes to local weather patterns. For B.C., this may mean more rain on the coast, less rain in the interior and flooding in the coastal areas.

Stratospheric Ozone Depletion

The ozone layer is a thin band of gas in the stratosphere. It filters out most of the sun's potentially harmful ultraviolet (UV) radiation. Chlorofluorocarbons (CFCs), halons and certain other ozone-depleting substances chemically break down molecules in the ozone layer. If the ozone layer is depleted (i.e., forming "ozone holes") then more UV reaches the earth's surface. High amounts of UV radiation could have serious impacts on plants, animals and human health. The conditions that cause high UV radiation levels also contribute to global warming. The main sources of CFCs are leaks from vehicles and building air conditioners, refrigerators, freezers and foam padding (i.e., cushions).



3 CONNECTIONS

Global and Local Issues are Connected

The pollutants that contribute to global air problems also cause local problems. By reducing these emission sources, we can help solve global and local problems:



Motor vehicles generate CO₂ emissions that cause local and regional air quality problems (smog and fine particulates) and also contribute to global climate change. To reduce motor vehicle use, consider work-at-home options, carpooling, using public transit, cycling or other alternatives.



Conserving energy can reduce the need for new power plants. Turn off electric appliances when not in use, select energy-efficient appliances and lightbulbs and insulate your home, hot water heater and pipes to reduce power demand. Solar power is a renewable source of energy that does not produce harmful emissions. More use of solar power instead of fossil fuels helps decrease the impact on the greenhouse effect and global climate change.



Trees absorb carbon dioxide and release oxygen. They also break down some pollutants and reduce dust. Planting deciduous trees next to buildings helps keep occupants cool in summer and warm in winter. This reduces demand for energy required to operate air conditioners and heating systems.

Support urban planning that limits sprawl and lowers dependence on motor vehicle use. Local transit routes are more likely to be built near high-density housing than detached homes. Promote development that gives preference to bicycle use, public transit and vehicle-free areas. Encourage home-based and near-home employment opportunities to reduce emissions created by driving to work.



Use alternatives to gasoline-powered garden tools. Use a rake instead of a leaf blower, and a push or electric lawnmower. A gasoline-powered lawnmower operating for one hour can produce emissions equivalent to those generated by a motor vehicle driven for half a day. Composting, rather than burning, is an efficient way to reduce yard waste and eliminate fine particulate pollution.

Organic waste buried in a landfill eventually decomposes forming dangerous methane gas. Municipal landfills contribute six per cent of the greenhouse gases in B.C. Reduce consumption, avoid overpackaging, reuse, recycle and compost. Less waste lowers the amount of methane gas produced, and extends the life of existing landfills, reducing the need for new facilities.



4 DEFINITIONS

Ground-level Ozone

Ground-level ozone is the major component of photochemical smog. It is not emitted directly, but is a product of photochemical reactions in the air between nitrogen oxides and volatile organic compounds. Leftover carbon compounds from burning fossil fuels mix with air to form volatile organic compounds.

Nitrogen Oxides

Nitrogen oxides are emitted largely from fossil fuel combustion. Most emissions of nitrogen oxides are transformed in ozone reactions, but some remain unchanged and are pollutants in their own right.

Carbon Monoxide

This colourless, odourless and tasteless gas is produced as a result of incomplete combustion of carbon-containing fuels like coal, wood and gasoline. Motor vehicle exhausts are major contributors to carbon monoxide levels.

Sulphur Dioxide

Sulphur dioxide is a corrosive gas formed primarily from the combustion of fossil fuels containing sulphur, and by power plants and factories that burn coal or oil for fuel.

Suspended Particulate

There are two types of particulates: naturally occurring and human-caused. Particulates contribute to the air pollution that we can see. On windless days, fine particulate matter is especially evident.

5 CURRICULUM LINKS

K1 Earth and Space Science: Weather and Seasons

K1, Grades 2-3 and 4 Social Studies: Environment, Interactions with Human and Natural Environment

Grade 2-3 Earth and Space Science: Sky Above Us

Grade 5 Earth and Space Science: Atmosphere and Weather

Grade 5 Social Studies: Environment, Effect of Lifestyles and Industry on the Environment

Grade 7 Social Studies: Environment, Impacts of Past Human Activities on Today's Environment

Grade 11 Social Studies: The Global Environment - Social and Economic Perspectives

6 LEARNING SKILLS

- reading for content, interpreting and applying scientific and geographic information
- understanding how people and natural systems interact
- thinking critically about human interactions with the physical environment
- presenting information
- involving citizens and the community.

7 ACTIVITIES

Where does air pollution come from?

Consider the following sources of pollution and guess what percentage of total air pollution each represents in the Lower Fraser Air Basin:

- Light duty vehicles (cars) _____ %
- Heavy duty vehicles (trucks) _____ %
- Trains, planes, ships, and off-road vehicles (other mobile sources) _____ %
- Industrial sources _____ %
- Area sources* _____ %

*Area sources are small sources distributed throughout the region. When put together, these sources have a significant impact on air quality. They include space heating (residential, institutional and commercial buildings) and agricultural activity (i.e., excessive use of fertilizers, manure waste).

*Answer:
58 per cent, 3 per cent, 14 per cent, 7 per cent, 18 per cent
Discuss your findings—were there any surprises?*



- What are some examples of other sources of each of the five major air pollutants in our region?
- What do you think are health concerns that have resulted from exposure to high levels of these pollutants?
- What do you think are some of the environmental concerns involving air pollution?
- What are some ways you can help improve air quality?

What difference does a degree make?

Making the connection between human activity, climate change and the impacts.

1. A member of your family says, "What's all this fuss about? Nothing happens that isn't supposed to happen naturally to the earth!" Is he right? What do you say to him?
2. You are creating a two-minute public education film that uses visuals to illustrate the concept of climate change. Discuss, as a creative production team, what images would capture the message. From your list, select the four most effective visuals. Prepare concept sketches of your choice and be prepared to present your ideas to the film director for approval.

Hint: Consider public perception and understanding of climate change.

Transportation Choices--Talk Me Into It!

We can choose from many different forms of transportation. This strategy game explores which form is most appropriate in various circumstances, and the environmental impacts our transportation choices have on air quality.

1. Divide into groups of four.
2. Get some small cards.
3. On each card, write one of the following words: **car, bike, walk, public transit.**
4. Turn the cards over and mix them up.
5. As a group, choose a scenario from the list below.
6. Each person selects a card.
7. In one minute, convince the others in your group that your form of transportation is the best for this scenario. Use descriptive language and stories to enhance your argument. Listen carefully to the other arguments--you might be able to use them in your presentation.
8. Exchange the cards and repeat the activity one or more times with a different scenario.

Scenarios

Trips from home to:

- an interview for a summer job (five kilometres)
- a rink for hockey practice (two kilometres)
- a shopping mall (three kilometres)
- a friend's house (20 kilometres)
- a grocery store to pick up a snack (half a kilometre)
- school (one kilometre)

Different forms of transportation have different impacts and implications. Look at the list below. How many of these came up in your arguments?

- cost
- convenience
- land use
- pollution
- personal health and well-being
- risk/safety
- speed/time
- traffic congestion
- efficiency
- noise
- status

Group Discussion

1. How realistic were your arguments?
2. In real life, would you have used the form of transportation you presented and defended? Why or why not?
3. What would motivate you to consider alternative forms of transportation?

For more information about air quality and climate change, point your Web browser to:

- **Greater Vancouver Regional District:** www.gvrd.bc.ca
- **B.C. Ministry of Environment, Lands and Parks:** www.gov.bc.ca/elp
- **Temperature Rising Poster:** www.climatechangecanada.org
- **Environment Canada:** www.ec.gc.ca