

WEATHERING THE CLIMATE

Grade 4-6



*Please share this kit with the other teachers in your group.

Thank you for booking FortWhyte Alive's Weathering the Climate program. **The goal of this program is to have students gain an appreciation for weather and climate, how they differ, and how they are changing.** Students will learn about sun and water, and how they drive the weather machine of Manitoba and Canada.

CURRICULUM LINKS

SLO: 4-1-04

SLO: 5-4-06, 07, 16

SLO: 6-3-16, 18

OBJECTIVES

Students will:

1. Describe weather and climate
2. Identify tools of weather and weather forecasting (prediction)
3. Understand climate and how it affects plants and animals, including humans
4. Recognize that both natural change and human actions can affect climate

VOCABULARY

Air pressure: the weight of the air over a given location. There are generally areas of high pressure or low pressure. Air pressure or barometric pressure is measured with a barometer.

Anemometer: instrument used for measuring the force of wind.

Atmosphere: the gaseous layer or envelope that surrounds the Earth. The gases are held in place by gravity.

Barometer: instrument used for measuring atmospheric or barometric pressure.

Climate: the prevailing trend of weather conditions. A long term assessment on weather and the statistical analysis of weather data.

Climate change: the term used to describe fluctuations in the Earth's climate over time.

Past climates have changed due to a number of natural phenomena, however, we are now experiencing an unprecedented rate of climate change due to human activity.

Forecast: an estimate or prediction about upcoming weather

Greenhouse effect: a natural process that traps heat in the atmosphere. Heat rays enter the Earth's atmosphere and become trapped, much like heat in a greenhouse. Without this natural phenomenon, the Earth would be -18°C year round and uninhabited.

Troposphere: the layer of the atmosphere that is closest to the Earth. The troposphere is the weather layer and the layer in which we live.

Stratosphere: the layer of the atmosphere above the troposphere. 90% of the gases in the atmosphere can be found within the troposphere and stratosphere.

Weather: state of the atmosphere at any given time. It is the day-to-day variation of the atmosphere and their effects on life and human activity.

Wind chill: the combined cooling effect of wind and temperature.

PRE-VISIT ACTIVITIES

1. Calculate Your Field Trip Carbon Balance

There are many reasons to plant a tree – beautifying your school yard, cooling your house, providing wildlife habitat. Now there's another reason. And it will affect people all over the planet. This year, plant a tree for climate change! Climate change is a serious environmental issue caused by our dependence on fossil fuels. We burn fossil fuels to heat our homes, power factories and run our cars and busses. The result of burning fossil fuels is the release of carbon dioxide into the atmosphere, causing our planet to heat up. Trees remove and store carbon dioxide from the atmosphere and create oxygen which enables us (and animals) to survive.

Carbon Sources: Finding the Culprits

The Earth's climate fluctuates over the course of thousands of years, however, this is the first time in the Earth's history where living things have caused the Earth's climate to become warmer.

The addition of extra greenhouse gases to the atmosphere traps more heat on Earth. Human activities – driving cars and heating homes - are increasing greenhouse gases at unprecedented rates. Carbon dioxide (CO₂) is an important greenhouse gas, one of the "heat-rebounders" in the atmosphere. CO₂ is also the product of fossil fuel combustion – it is spewing out the tailpipes of automobiles by the tonne – one of the many CARBON SOURCES. Since the Industrial Revolution, we have increased CO₂ in the atmosphere by 30% - this may not sound like a lot but it has already caused an increase in the average global temperature. Scientists are no longer saying "if" but "how warm?" and they agree that the consequences will be dramatic and costly.

The results for Manitoba are not just warmer temperatures - they include more extreme weather events, droughts, forest fires, dieback of the boreal forest, pest outbreaks (including mosquitoes); all of which will disable our economy. The impact of climate change is starting to be felt...right now.

Carbon Sinks: Trees to the Rescue!

How Many Trees?

How many trees do you need to plant to create a **FWC Field Trip Carbon Balance**?

How will you travel to Fort Whyte Centre? Choose a. or b.

- a. **Travel by Car** _____ cars x _____ km = _____ Total km.
 _____ Total km x 0.25 ÷ 9 = _____ trees!

Our School will plant _____ trees to create a Field Trip Carbon Balance. These trees will absorb all the carbon dioxide produced by our **cars** today, travelling from school to Fort Whyte and back.

b. **Travel by Bus** _____ km x 0.54 ÷ 9 = _____ trees!

Our School will plant _____ trees to create a Field Trip Carbon Balance. These trees will absorb all the carbon dioxide produced by our **bus** today, travelling from school to Fort Whyte and back.

2. The Weight of Air

Blow up two balloons the same size. (HINT: blow up the balloons as much as possible) Use a string and tie one balloon to each end of a metre stick. Tie another string to the mid point of the meter stick and hang the stick with the balloons balanced on each end. When it's balanced, use a pin to pop one of the balloons. What happens? The other balloon dips down right away. Why? Because the air in the inflated balloon has weight and is heavier than the one without air. This is how air masses move and "push each other around" to create a *front*. A *front* is the forward edge of an advancing mass of warm or cool air.

3. Air Pressure

Because air has weight it can exert pressure. Warm, moist air rises and is associated with low pressure areas. As this air rises, it cools and the water vapor in it condenses (this is how clouds are formed). Cool air sinks and compresses, causing high pressure, which results in clear conditions. To demonstrate the effect of air pressure, suck the air out of a plastic pop bottle. (HINT: it is easiest if you use small pop bottles) Why has the bottle collapsed? Because the air on the outside is pushing inwards. When you remove the air from the inside of the bottle, there is nothing left to balance the pressure of the air on the outside.

4. Make an anemometer

Attach a ping-pong ball to a piece of thread. Tie the other end of the thread to the center of a protractor. By holding the protractor parallel to the wind, you will be able to read the angle the ball is blown by the wind. Use the chart below to estimate the wind speed.

ANGLE	90°	85°	80°	75°	70°	65°	60°	55°	50°	45°	40°	35°	30°	25°	20°
WIND SPEED (km/hr)	0	9	13	16	19	22	24	26	29	32	34	38	42	46	52

5. Wind Chill Activities

Find out how long it takes for water to freeze. Take a container of water outside under different weather conditions. (HINT: start with the same quantity and temperature of water each time). Time how long it takes before the water freezes. Challenge the students to predict what will happen under different conditions.

Use two thermometers to see what the effect of shelter has on temperature. While inside, place one thermometer in a shoe box, and tape the other to the outside. Make sure both thermometers start at the same temperature. Take the container outside into the wind and measure the drop in temperature over time. Graph the results. Try the experiment in

different weather conditions, or try using different types of containers with more or less insulation.

6. Lightning on the Loose

It all starts with the build up of static electricity in a storm cloud. Lightning is caused by the friction of rapidly moving ice particles and rain in a thundercloud. As a result of these built up electrical charges you see a bolt of lightning streaking through the sky. To demonstrate how static electricity forms:

- Blow up two balloons and rub them on your sleeve. Then touch them together in a dark room. You should see sparks of static electricity.
- Run a comb through your hair and then put it into a bowl of puffed rice. Grains of rice will stick to the comb.
- Shuffle across a carpet in a dark room, then touch a doorknob or other metal object. You will see a spark jump from your finger to the metal object.

7. Making a Cloud

Important points to understand:

- Three things are necessary for cloud formation: cooling of air, water vapor, and condensation nuclei.
- Water vapor must have something to condense on in order to form droplets that compose clouds (the condensation nuclei).
- Many things can serve as condensation nuclei. The most common in nature are dust, pollen, salt and smoke.

You will need: 1 liter (or larger) clear glass jar with lid (large mouth jars work best), ice cubes, hot water, matches, aerosol spray (e.g. air freshener), black construction paper

1. Fill the jar with hot water. Let the water sit for a minute to warm up the jar. Using a stack of books, prop up the black construction paper behind the jar.
2. Pour out most of the hot water, but leave about 2 cm of water in the bottom.
3. Turn the lid upside down and fill with ice cubes.
4. Spray a very small amount of the aerosol spray in the jar.
5. Strike a match and drop the burning match into the jar. Immediately place the ice-filled lid on the jar such that the mouth of the jar is completely covered.
6. Observe and record what happens in the jar for three minutes.

Results: You will see a small amount of mist that will build up and form a small cloud near the top of the jar.

POST-VISIT ACTIVITIES

1. Global Warming Experiment

Purpose: To determine the effect of increased carbon dioxide in the environment.

You will need: Two plastic 2L pop bottles, soil, 2 thermometers, one 150 watt spot light, rubber tubing, plasticine, a CO₂ dispenser. (If you do not have access to a science lab with CO₂, you can use pressurized soda or whipping cream dispenser with cartridges)

What to do:

1. Cut the tops off the plastic bottles.
2. Place approximately 5cm of soil in each bottle.
3. Cut a small hole near the middle of each bottle, and insert the thermometers. Using the plasticine, be sure to seal all the holes.
4. Place the bottles equal distance from the light (heat source), ~ 25cm.
5. If you are using a soda/whipping cream dispenser, discharge one CO₂ cartridge into the dispenser. Using the rubber tubing, slowly release the CO₂ into one of the plastic bottles. Repeat such that two cartridges have been discharged into one bottle.
OR If you have access to a science lab with CO₂, connect the rubber tubing to the CO₂ and dispense into one bottle. Leave the other bottle with normal air as the control.
6. Record the temperature in each bottle.
7. Turn on the light. Observe and record the temperature every minute for 15-20 minutes.

Results: The air in the bottle with the extra CO₂ should get warmer than the control bottle. This demonstrates the "enhanced" greenhouse effect.

2. Weather Scavenger Hunt

Take your class on a weather scavenger hunt to see how many weather-related things they can find. Divide your class into teams and give each team a clue sheet (see last page of this document), a bag, a pencil, paper, and a clipboard. The students can put some of their "weather finds" into the bags. For clues they can't collect they should draw or describe what they see on their paper. Afterward, have each team show and explain what they found for each clue. Have them return any "finds" to where the items were found. If you wish, hand out weather-related prizes such as kites, mittens, sand pail & shovel, sunscreen, etc, depending on the season. Note: Before sending your group out, be sure to set some guidelines.

4. Climate and Critters

Collect some photos of animals that live in different climactic regions. Have students brainstorm how these animals are prepared for (or adapted to) the climate that they live in. Have students then brainstorm what will happen to these animals if their home climate warms. If it has fur, will its fur keep it too warm? If it lives in wetlands, will its home dry up? What will the animals do if these things happen to them?

Weather Scavenger Hunt Clues

1. Something bending toward the sun.
2. Something that may become part of a cloud.
3. Something that tells you the wind is blowing.
4. A bad place to seek shelter during a lightening storm.
5. Something that protects people from the rain.
6. Something that uses sunlight or wind to work.
7. A place where icicles might form.
8. A place where weather has damaged a building.
9. A good place to seek shelter during a tornado.
10. Something shaped by wind or water.
11. A place to go where it's cool.
12. A place where rain has moved the soil.
13. Something that would make water freeze.
14. Something that would make snow melt.
15. Something that absorbs sunlight.
16. Something that soaks up rain.
17. A good windbreak.
18. Something left by the rain.
19. Something the color of the sky.
20. Something the color of snow.
21. Something that would help you see in fog.
22. Something that moves snow.