# INTRODUCTION

In the 1960s, Canadian Roger Tomlinson made a major contribution to cartography when he created the world's first geographic information system (GIS). Over the next 50 years, the GIS field has grown to become an essential part of today's world. GIS is used by all levels of government and also in business, education, health, natural resources and many other areas. Most people benefit from Roger Tomlinson's creation every day.

Long before Tomlinson began his work, the explorer David Thompson put map-making to good use when, around 1800, he mapped a significant portion of Canada.

The lessons that accompany this giant floor map highlight the importance of Tomlinson's GIS discovery, as well as other significant geospatial technologies. The lessons also show the value of Thompson's traditional maps and mapping skills.

The 10 curriculum-linked lesson plans will help you teach students essential topics such as map-reading skills while also helping them learn about the geography of Canada. These lessons will engage Canadian students with topical lessons on the Canadian Arctic, the Global Positioning System (GPS) and the importance of GIS in today's world.

This giant floor map and lessons will help educators engage, foster and promote geographic literacy and help develop the next generation of geographers in Canada.

You will see geospatial technologies referenced throughout the lessons. We encourage you to explore the options that are available to you in your school, school district or board.

Enjoy your time with the map; it is yours to explore.

# THE ACTIVITIES

In this guide, you will find 10 curriculum-linked activities designed for all Canadian students at the elementary and secondary levels.

## ACTIVITY 1: MAKING A MAP

Students will learn the essential map components, how to identify them and how to apply geographical thinking and concepts to explore the map.

## ACTIVITY 2: SCALING UP!

Students will learn the different types of scales used to calculate distance on the giant floor map.

## ACTIVITY 3: THINKING LIKE A GEOGRAPHER

Students will apply their geographical knowledge and skills to real-life issues and outline a variety of stories that can be shared on the giant floor map.

## ACTIVITY 4: CANADA QUIZ

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## ACTIVITY 5: CANADA: POPULATION

Students will learn about different types of population distributions, population density and migration push and pull factors in Canada.

## ACTIVITY 6: CANADIAN ECOZONES AND NATURAL RESOURCES

Students will explore Canada's ecozones and examine the effects that primary industries have on the environment. They will explore the relationship between the resources of Northern Canada and the densely populated regions of Southern Canada.

## ACTIVITY 7: THREATS TO THE CANADIAN ARCTIC

Students will explore the Canadian Arctic and discover the impact that climate change has had in this region by applying their knowledge of geospatial technology to investigate how to prevent further damage and monitor change.

## ACTIVITY 8: WHAT LIVES IN CANADA'S NORTH?

Students will apply their understanding of geographic information systems (GIS) and Global Positioning System (GPS) technology to explore Arctic wildlife and conservation efforts.

## ACTIVITY 9: GEOGRAPHIC INFORMATION SYSTEMS

Students will learn about geographic information systems (GIS), how it is used in our daily lives and apply their understanding to real-life occupations.

## ACTIVITY 10: GIS IN THE REAL WORLD

Students will learn how GIS works and work together to use GIS to solve problems using the giant floor map.

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**Whether you are a seasoned geography teacher or new to the subject, the following few pages will serve as a great introduction to the geographic concepts and technology in these lessons. You may want to review this overview with your students in advance of your time with the giant floor map.**

## LATITUDE AND LONGITUDE

**Latitude** and **longitude** make a coordinate system used around the world. The lines of latitude run west to east, lines of longitude run north to south.

The most familiar form of expressing latitude or longitude is in degrees, minutes and seconds, such as 45° 27' 32" N or 120° 23' 45" E. But most geographic information systems do not use latitude and longitude in the form of degrees, minutes and seconds; instead, they use latitude and longitude in decimal degree form, such as 52.568 N.

Decimal degrees can be understood better if you know how they are calculated by converting latitude and longitude in degree, minute, seconds using the following formula:

45° 27' 32" N

$$DD \text{ (Decimal degrees)} = \frac{45 + (27 \times 60 + 32)\ N}{3600}$$

$$DD = \frac{45 + (1620 + 32)\ N}{3600}$$

$$DD = \frac{45 + 1652\ N}{3600}$$

$$DD = 45 + 0.458\ N$$

$$DD = 45.458\ N$$

### CHECK FOR UNDERSTANDING

Convert these coordinates into decimal degrees:

12° 45' 27" S (answer: 12.7575 S)
98° 32' 42" E (answer: 98.545 E)

When using latitude and longitude, it is essential to differentiate the location of the coordinate by using north, south, east or west, such as 45° 27' 28" N or 89.257 W. Without a directional reference, a coordinate could be in one of four locations in the world. For example 45° 27' 28" could be north or south of the equator or east or west of the prime meridian.

GIS often does not use north, east, south or west; instead, it refers to coordinates as + or –. Positive values are given to latitudes north of the equator and longitudes east of the prime meridian. Negative values are given to latitudes south of the equator and longitudes west of the prime meridian. If + or – are used, latitude or longitude must also be specified. For example:

North of the equator = latitude 32.540
South of the equator = latitude –45.905

East of the prime meridian = longitude 154.395
West of the prime meridian = longitude –124.765

# GLOBAL POSITIONING SYSTEM (GPS)

The Global Positioning System — or GPS, as it is more commonly known — is an advanced technology created by the U.S. Military. GPS technology is now very common. You may have experience using this technology if you have used a GPS in your car or boat to find your way to a location, or more likely as an app on your smartphone. You may also have used GPS to find your favourite biking trail or to complete a geocache. Scientists use this technology for such things as studying climate change and tracking animal migrations. Companies use GPS to track their vehicles and to manage their resources such as hydro poles or fire hydrants. GPS can be a valuable tool to collect locational data or waypoints to download, make maps and complete analysis using a geographic information system (GIS).

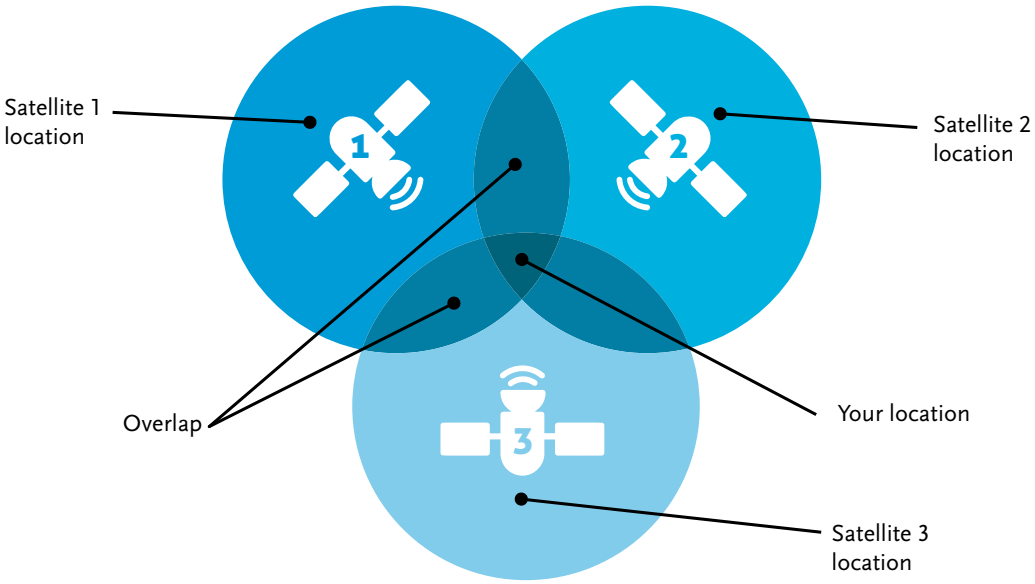
What many people do not know is that when they are using a GPS, they are actually using a GPS receiver. The GPS receiver collects signals from the GPS satellites in the Earth's atmosphere. There are about 30 active satellites working in the atmosphere at one time. These satellites orbit the Earth twice in 24 hours.

For a GPS receiver to know its location, the receiver needs to collect signals from a minimum of three satellites. The more satellites a receiver is collecting signals from, the more accurate the location on the Earth's surface will be. A top-of-the-line GPS receiver can find locations accurately to centimetres, while most GPS receivers are accurate to metres.

The location of the receiver on Earth is determined by how long the signal takes to go from a minimum of three satellites to the receiver. Sources of error can result from:

- the number and locations of the satellites in the atmosphere
- multipath errors, such as the signal bouncing off of an object like a building
- atmospheric interference

# HOW A GPS RECEIVER AND SATELLITE WORK



# GEOGRAPHIC INFORMATION SYSTEMS (GIS)

The first geographic information systems, or GIS, was created by a Canadian, Roger Tomlinson, in the 1960s. This geospatial technology is now used throughout the world thanks to:

- more advanced and affordable computers and software
- the availability of more formal GIS training
- easier to access and more affordable data
- advancements of related technologies such as the Global Positioning System (GPS) and remote sensing

A basic definition of GIS is hardware, software and data that stores, manages, analyzes and displays geographical data. To better understand GIS, it helps to break it down into five parts. All five parts are connected to make a GIS:

- **Hardware:** computer and other hardware needed to run the software
- **Software:** software program used to analyze and display geographical data
- **Data:** geographical data that is stored, managed, analyzed and displayed
- **User:** a person to run the hardware and software
- **Knowledge:** the skills and expertise that the user needs

# 1

# MAKING A MAP

**Learning objectives**

- Using the giant floor map, students will learn the essential components of a map and how to identify them.
- Students will explore the map of Canada and discover the different stories that maps can tell.

**Time required**

50 minutes

**Grades**

K-12

**Materials**

- Pylons (20)
- Teacher clue card (1)
- Hand-held legends (4)
- Theme cards (5)

**Set-up**

- Review the clues to familiarize yourself with all the essential components of the giant floor map.

## INTRODUCTION

Explain the definition and importance of maps to your students. From the earliest map drawn in the dirt with a stick, to those used by early explorers to discover new lands, to the modern digital maps used today, maps make our lives easier and tell important stories about the world we live in.

A map can be defined as a representation of the Earth drawn on a flat surface. It is important to realize that a map is the cartographer's (map-maker's) representation of the Earth. If everything on the Earth were included on the map, it would be too crowded and unusable. By selecting what is shown on a map, a cartographer allows the map to tell a story. Despite the massive size of this giant floor map, it shows only a small selection of human (roads, cities, etc.) and physical (mountains, lakes, rivers, etc.) features.

Have your students explore the giant floor map. Once everyone is back on the border, ask the following questions:

- Would this map be a good resource to plan a hiking trip through the nearest national park? Why or why not? What would make it more effective for this task?
- Would this map be a good tool for learning the capital cities of Canada? Explain why or why not.
- What symbol is used to represent a national park? What symbol is used to represent a capital city? Why do you think these symbols were selected by the cartographer?

Discuss how cartographers make maps readable by using symbols and colours. Have your students interpret the giant floor map by asking:

- Who can identify the oceans, lakes, rivers, highways and political boundaries on this map?
- What does a red line on the map represent?
- What does the dark blue colour in the oceans represent?
- How are capital cities represented?
- What other symbols do you see on the map, and what do they represent?

## DEVELOPMENT

For a map to be viewed as a good — or, cartographically sound — map, it must have a few specific features that all real maps share. Have students explore the map and identify which items they think are essential to all maps. Once they have found as many features as they can, tell them that the following items are essential to all maps:

**Title:** tells the reader what the map is about
**Legend:** identifies what the colour and symbols on the map represent
**Scale:** shows the amount of reduction from the real world to a map
**North arrow (direction):** shows the reader how the map is oriented so it can be interpreted in the real world
**Neatline (border):** shows where the map ends

# MAKING A MAP

The following four items enhance a map's ability to tell a story and are important to include:

**Cartographer's name:** who made the map
**Date:** when the map was printed
**Source:** where the data for the map came from
**Map window:** the map itself

Next, divide the class into four teams and assign each team a colour. Have the teams stand on their coloured compass next to the matching pylons. Read a detailed description from the teacher clue card, and then ask one student from each team to place their pylon on the map component you have described. Award a point to the first team to correctly identify the component. Once you have read all clues, calculate the points and declare a winning team.

## CONCLUSION

Explain to students that maps can be used for many different purposes. Have students discuss what the purpose of this map is and what a map such as this one is useful for. For example, looking at water systems is possible, but planning a walk to school is not. Be sure to direct students to look at the level of detail and the type of information included on this map.

Distribute a theme card to each group of students and have them spend five to 10 minutes determining what story they could tell with this map based on their theme card. Once all the groups are ready, have them present to the class.

## EXTEND YOUR GEOGRAPHIC THINKING

If possible, have your students stand on the map with a tablet or other device. Direct students to open different versions of online maps (Google, ArcGIS, etc.). Then, have each student zoom in or out on their selected map until it has a scale similar to the giant floor map. Have students evaluate the digital map to see if the necessary map components are included or not. Have the students compare their digital maps to the floor map. What information do the maps share? What is different?

If students have access to a geographic information system (GIS), challenge the students to recreate the giant floor map as closely as possible. Ensure students use every required map component and customize the map to make it the most impressive map possible.

**Links to the Canadian National Standards for Geography**

The World in Spatial Terms:

- Map elements
- Maps as representations of local and distant places
- Physical/political maps of the provinces, Canada and the world

# 2

# SCALING UP!

### Learning objectives

- Students will learn about the different types of map scales.
- Students will use a variety of scales to calculate distance using the giant floor map.

### Time required

50 minutes

### Grades

4-10

### Materials

- Tape measures (6)
- Chains (16)
- Scale cards (10)
- Whiteboard markers (10)

### Set-up

- Review the materials and locate the two types of scales on the map. Use the scales to calculate the distance from Ottawa to your school and record the number for later.

## INTRODUCTION

Locations can be relative or absolute. If you ask someone on the street in Winnipeg where Brandon, Manitoba, is, they may say that Brandon is two hours west of Winnipeg. Of course, "two hours west" is a relative way of giving a location, and is only accurate if someone is travelling at 100 kilometres per hour. If a person was cycling, the relative location of Brandon would be closer to 10 hours west of Winnipeg. In most cases, when geographers are working on a map, they are working with absolute locations and distances. This lesson looks at the different ways to explore distance on the giant floor map. An example of an absolute location is latitude and longitude coordinates. These are explained in the introduction at the beginning of this guide and looked at in-depth in Activity 8: What Lives in Canada's North?.

As explored in lesson one, scales are an essential part of any map. All cartographically sound maps must have at least one scale. Scales provide the map reader with a way to compare the map to the real world.

There are three types of scales that are used on maps:

- **Verbal scale, or direct statement scale:** This type of scale uses two different units. An example would be one centimetre = 1,000 kilometres. An easy way to remember this scale is that it "directly" tells you what the two units of the scale are.
- **Representative fraction:** This shows the scale in the form of a fraction. An example of this scale could be 1:50,000. Representative fraction scales don't have specific units but can refer to a standard unit of measurement such as centimetres or something less traditional such as the length of your hand.
- **Bar scale or graphic scale:** This is a line that has been divided into sections. These sections can then be transferred to the map.

Maps can be large scale or small scale. The size of a scale determines the amount of area shown, the level of detail, and how many symbols will be shown on the map.

| Type of Scale | Small | Large |
|---|---|---|
| Example of a Typical Scale | 1:500,000 | 1:50,000 |
| Area shown | more | less |
| Amount of symbols | more | less |
| Amount of Detail | less | more |

Check your students' understanding by asking:

Is this floor map a large- or small-scale map? How do you know?
This map is a small-scale map; it has a scale of 1:6,000,000. It can be determined that it is a small-scale map because this map shows a large area but has little detail and uses many symbols.

Would this be a good map to use to find your school?
Where is the scale located on this map?
What is the type of scale found on this map?
What is the representative fraction scale of this map?

# 2

# SCALING UP!

For many students, understanding large- and small-scale maps can be difficult. A good teaching strategy is to use money as a metaphor. The scale of this map is 1:6,000,000. Despite 6,000,000 being a large number, this map is actually a small-scale map. This is because the "value" of this map is actually equivalent to 1 divided by 6,000,000. To help students understand these concepts clearer ask them if they would like 1/10 of a million dollars or 1/2 of a million dollars.

## DEVELOPMENT

Using the tape measure, calculate the real-world distance (in kilometres) between Winnipeg and Ottawa. Use the example scale card as a guide. Remind students that while calculating the total distance, they cannot jump over large bodies of water. Students should locate major highways first and calculate the distance by laying their measuring tapes on the highways. They can also do it "as the crow flies" and measure the most direct route from Ottawa to Winnipeg. What is the difference in kilometres? Why is there a difference? And what use could the more direct route have?

Divide the class into groups, and have each group complete their scale card using their tape measures to calculate the total distance (in kilometres) between the two selected locations and another means of measuring distance such as chains, feet, hands or anything that won't damage the map.

Once groups have completed their scale card, have groups exchange cards and recalculate the distance. Now that students have worked with both types of scales, discuss the benefits or drawbacks of each.

## CONCLUSION

Give each group of students 10 minutes to create an "I Spy" quiz for their classmates. Have them use scale to describe the location of their "spy". One example would be "I spy a lake x kilometres away from La Ronge, Saskatchewan." Play as many rounds as you have time for.

## EXTEND YOUR GEOGRAPHICAL THINKING

To see how different level of scales affect a map's design, have students choose a location on the map and stand on it. Ask them to describe what they see from the giant floor map scale (Can they see their house? Streets in the neighborhood? Familiar small bodies of water?). Using a mobile device, have students open up a web map application such as Google Maps or ArcGIS Online and find the same location at a scale that is similar to the giant floor map. Now have the students zoom in a little bit at a time. Each time the students zoom in, have them describe what they can see and how it changed from the previous view. If they are able, have students find the scale at this level. Continue this process until they can see features such as a specific tree, small water body, their street, their house or their school.

Once all the students are looking at a large-scale map on their mobile device, have them place their device on the map. Now have students walk around the map and look at the various locations at a large scale.

**Links to the Canadian National Standards for Geography**

The World in Spatial Terms:

- Relative and absolute locations
- Map elements
- Locational technologies

# 3

# THINKING LIKE A GEOGRAPHER

### Learning objectives

- Students will apply their geographic knowledge and skills to real-life issues.
- Students will outline a variety of stories that can be shared on the giant floor map.

### Time required

50 minutes for preparation plus 50 minutes on the map

### Grades

K-12

### Materials

- All map materials

### Set-up

Book a computer lab or library time for research in advance of this activity. On the day of your map activity, give students access to all materials.

## INTRODUCTION

Geography is the study of Earth's physical and human systems and how they interact. From coast to coast to coast, Canada's geography is extraordinary and beautiful. The geography of Canada has played a crucial role in shaping the country we know today. Geographers see the world through a lens made of the six essential elements of geography. For more information about the essential elements of geography or to plan your next lesson using these elements of geography, visit cangeoeducation.ca/programs/geography-standards.

1. **The World in Spatial Terms:** Geographers study the spatial relationships among people, places and environments. Maps reveal the complex spatial interactions that touch the lives of all citizens.

   *Example: Almost every populated location in Canada is found near a water source. Can you find any towns or cities on the giant floor map that are not located near water?*

2. **Places and Regions:** The identities and lives of people are rooted in the places and regions they're from.

   *Example: Canada's diverse physical regions have significantly influenced the cultures and traditions of Canada's First Nations.*

3. **Physical Systems:** Physical processes shape the Earth's surface and interact with plant and animal life to create, sustain and modify the natural environment. Physical systems include things such as wind, ocean currents, plate tectonics, erosion, deposition and water.

   *Example: The influence of the warm waters of the Gulf Stream current brings moderate temperatures to Western Europe.*

4. **Human Systems:** The Earth's surface is shaped by human activities. The spatial organization of society is a mosaic of population movements, settlement patterns, economic activity, transportation, communication and political organizations.

   *Example: Different immigration and settlement patterns across Canada resulted in different rural settlement patterns: long, thin lots in southern Quebec versus square-mile sections in Western Canada.*

5. **Environment and Society:** The physical environment is modified by human activities. Early settlers cleared the land to plant crops and graze livestock. Today, air and water pollution and the management of solid waste and hazardous materials are a serious problem. The physical environment affects human activity as well. Soil types and water availability help to determine which crops will thrive. More dramatically, natural hazards (e.g., earthquakes, hurricanes and floods) have resulted in a substantial loss of life and property.

   *Example: Agriculture and urbanization has contributed to the eutrophication of Lake Winnipeg.*

6. **The Uses of Geography:** Understanding geographical content and how to use the tools and technology available for geographic study prepares people for life in modern society. Individuals, businesses and governments use geography and maps of all kinds on a daily basis. Geography students have a wide choice of interesting and rewarding career opportunities.

   *Example: GIS can be used to plan the least disruptive and most sustainable route for a pipeline in Canada.*

Discuss these essential elements with your class before the giant floor map arrives, and ensure that they are familiar with all six of them. Divide students into six groups, assign each an essential element, and instruct them to think of a story they want to tell on the map using the theme of their essential element. They will spend the remaining time of this class researching a data set that they can place on the map in your next class. Encourage your students to try to relate their data to other topics they are studying or to current events. Their new layers of information may include topics such as climate zones, vegetation regions, locations of wildlife, environmental disasters, significant physical features, significant human features, hometowns of hockey players, food production areas, locations of historical events or any other data that is geographical in nature.

## DEVELOPMENT

When the map arrives, have students look at all of the materials and decide how they are going to plot their data on the map. Have each group work to plot their data on the giant floor map.

Once all the new data layers have been added to the map, have each group explain what their essential element is, the topic they chose and how they decided to show it on the map.

## CONCLUSION

Once all students have presented, discuss the meanings of GIS and geospatial technology and how they can affect each essential element of geography. Have each group describe the importance of geographical skills by using the map. Ask students to explain how GIS helps us to understand the world around us. Take a photo of the information your class added to the map and share it with @CanGeoEDU.

## EXTEND YOUR GEOGRAPHICAL THINKING

Once students have completed this activity, have each group create an online version of their map, adding additional layers of information, photos and videos. Encourage them to expand their research and share it with the rest of the class.

**Links to the Canadian National Standards for Geography**

The World in Spatial Terms:

- Location and distribution of physical and human features

The Uses of Geography:

- Interaction of physical and human features and influence on current and future conditions
- Effects of physical and human geographic factors on major historic events

Environment and Society:

- Human modifications of the physical environment

# 4

# CANADA QUIZ

### Learning objectives

- Students will use their map-reading skills to locate different places in Canada.
- Students will discover the many ways to show and layer information on a map.

### Time required

50 minutes

### Grades

K-12

### Materials

- Reviewing the basics card (1)
- Game card (15)
- Pylons (20)
- Chains (16)

### Set-up

- Make all the map materials accessible to students, and review the questions to ensure they are grade appropriate.

## INTRODUCTION

For a map to tell a story that is easy to understand, cartographers carefully choose what they will include on the map. From colours and symbols to make the map easier to understand, to the necessary map components to help tell the story clearly and accurately, cartographers have a reason for everything that appears on the map.

Maps are important tools. They can help you navigate between two points, find your way if you are lost, learn about different places and much more. Ask your students to share how they have used maps in the past and how we may use maps in the future.

Explain to your class that there are many types of maps. For example, there are topographic maps, thematic maps, road maps, physical maps and many more. This map of Canada is a political map. Ask students to use information from the giant floor map to explain how they know this type of map is political. Discuss the types of information needed to turn this political map into a different type of map. Outline the difference between a political border and a natural border. Have your students show, or stand on, different types of borders on the map.

## DEVELOPMENT

Divide your class into four groups and have each stand in a corner with pylons matching the colour of their compass. Read the “Reviewing the Basics” card to get your students warmed up.

Read through the game questions and give one point to the team that correctly answers each question first. To correctly answer a question, a team member must place a pylon on the answer location and make it back to their team.

Keep track of the score and declare a winning team.

# CANADA QUIZ

## CONCLUSION

Once a winner has been declared, have students come up with questions of their own using things they know about Canada's geography.

## EXTEND YOUR GEOGRAPHICAL THINKING

Test your students' knowledge of Canada's physical features by asking them to stand on a place in Canada they would like to visit. Then have students do more research about the place in class and present their findings to the rest of the class.

**Links to the Canadian National Standards for Geography**

The World in Spatial Terms:

- Map elements
- Map, globe and atlas use
- Major places of the provinces, Canada and the world

# 5

# CANADA: POPULATION

**Learning objectives**

- Students will discover different types of population distributions.
- Students will look at population density in Canada.
- Students will learn about push and pull factors that affect migration.

**Time required**

50 minutes

**Grades**

4-12

**Materials**

- Coloured arrows (200)
- Community cards (20)
- Teacher information card (1)

**Set-up**

- Review the activity, the statistics and the locations associated with the community cards.

## INTRODUCTION

Canada is the second largest country in the world by surface area, but, with 35 million people, Canada ranks 37 in the world by population. The result of these two factors is that Canada, with a ratio of about four people per square kilometre, has a very low population density. Have your students use the scale to determine how large 100 square kilometres is and picture 400 people living there. Compare this space to your community and discuss how populated your hometown is.

Population distribution is the pattern of where people live. Have your students describe the population distribution of Canada and what factors may influence it. Focus on the differences between urban and rural communities and the percentage of Canada's population that live in each: about 81 per cent of Canadians live in urban areas, while 19 per cent live in rural areas, according to the 2011 census. Have your students define whether you live in an urban or a rural area.

To show Canada's population distribution, hand out the 20 community cards to students and have them place the cards on the city that they feel matches the information provided. Once all the cards are on the map, check student answers and correct any using the teacher information card. Discuss any patterns or trends that your students can see based on where the cards are, relating this back to your earlier discussion of urban and rural populations.

Discuss the fact that more than 75 per cent of Canadians live within 160 kilometres of Canada's border with the United States. Two major reasons for this pattern of distribution are the warmer climate of the south and the trade relationship that Canada has with the United States.

## DEVELOPMENT

Students will now determine push and pull factors that affect migration. A push factor is something that causes someone to want to leave an area, while a pull factor is something that draws people to an area. Brainstorm different push and pull factors within Canada. Factors can include educational opportunities, access to resources, job opportunities, access to recreational facilities, crime rates and more.

Next, have each student take two purple and two green arrows and sit on any place name on the map. Once everyone has settled, have students think about a push and pull factor that would be relevant in the area that they are sitting on. Have students, one at a time, share the push and pull factors of their part of Canada; have them place their purple arrows on the map to show push factors and green arrows to show pull factors. For example, if someone is sitting on Flin Flon, Manitoba, they might place one arrow pointing to where they are sitting as a result of having a strong sense of community and family close by. They might then place another arrow pointing to Toronto for educational opportunities and one to Fort McMurray, Alta., for job opportunities. Once they have placed their arrows on the map, each student will sit along the border of the map.

## CONCLUSION

After all students have placed their arrows on the map, discuss the patterns and trends. Did their push/pull factors reflect the current population trends in Canada? Why or why not? How may Canada's population distribution change in the future?

## EXTEND YOUR GEOGRAPHICAL THINKING

Push and pull factors are relevant not only within a country but also internationally. After the map has left, create an online map that shows current trends in Canadian immigration. Discuss how international issues such as the Syrian refugee crisis affect population growth and distribution in Canada.

**Links to the Canada National Standards for Geography**

Human Systems:

- Population distribution
- Patterns and processes of migration past and present
- Population characteristics of the provinces and Canada
- Human migration patterns

# 6

# CANADIAN ECOZONES AND NATURAL RESOURCES

**Learning objectives**

- Students will learn about the natural resources that exist in Canada's ecozones.
- Students will explore the relationship between the resources of Northern Canada and the densely populated regions of Southern Canada.
- Students will examine the effect primary industries have on the environment.
- Students will be able to identify point, line and polygon vector data on a map.

**Time required**

60-120 minutes

**Grades**

7-12

**Materials**

- Chains (16)
- Ecozone map cards (30)
- Teacher ecozone map card (1)

**Set-up**

- Review all of the materials and ensure you are familiar with the boundaries of Canada's ecozones.

## INTRODUCTION

Canada is a large country with a diverse physical geography. Canada is home to 18 terrestrial ecozones and 12 maritime ecozones. Each ecozone has a unique collection of landforms, soil, climate, vegetation and many other characteristics. The result of having such a diverse geography is that Canada has an array of valuable natural resources, which many Canadian industries depend on.

Ask your students to think about the different industries that rely on natural resources and have them explain their answers using the giant floor map as a guide. Have students stand on the part of the map where they think their example best fits.

Explain that harvesting natural resources can create jobs and help the local, provincial, territorial and national economies, but that resource extraction can also damage or alter the natural environment. Have students list some positive and negative consequences of the industries they described earlier. Locate your province or territory, and identify major industries that exist in it. Look at other provinces to see what they offer, and have students compare them to their own.

## DEVELOPMENT

A geographic information system (GIS) works with data that is layered over a base map (base maps can be a country, province, state, national park, etc.). The data can be points, lines or polygons and is usually layered from the largest layer to the smallest layer. This order of layering allows for all data to be visible on a map.

Points are geometric elements defined by a pair of x,y coordinates. Lines are shapes defined by a connected series of unique x,y coordinate pairs; lines may be straight or curved. Polygons are closed shapes defined by a connected sequence of x,y coordinate pairs, where the first and last coordinate pair are the same and all other pairs are unique. Have your students illustrate each of these elements on the map.

Check for understanding by asking:

> What layers can be found on the floor map? Can you classify each layer as point, line or polygon data?

Using the ecozone map as a reference, assign each student an ecozone to outline on the map using the coloured chains. Once all ecozones have been outlined, check for understanding by asking:

- What ecozone is your hometown in?
- If the ecozone of your provincial or territorial capital city is not the same, what ecozone is the capital city found in?
- Which ecozones have you visited? Describe the physical geography that you saw in each ecozone. Were any major primary industries noticeable during your travels?
- What are some of the issues surrounding resource extraction and primary industries in your local area?

Have students place pylons on the map where they believe resource extraction is hurting the environment. Allow time for students to explain why.

# CANADIAN ECOZONES AND NATURAL RESOURCES

## CONCLUSION

Check to see if students understand by asking them to highlight patterns and trends they see:

- In which areas of Canada are resources being extracted?
- Which ecozone is home to the most valuable deposits of natural resources?
- What kind of cities or towns are found near the resources? Are they big or small population centres?
- Who benefits the most from these resources and their related products? People in the North or people who live in cities close to the border?
- Do you believe there is any truth in the following statement? Discuss and fully explain your thoughts:

The majority of Canadians live in the southern part of the country. Many of Canada's natural resources are found north of the highly densely populated areas of Canada. The people of the south benefit more from the resources than the people of the north. The people of the north face more of the negative consequences of resource extraction than the people of the south.

Have students explain their answers using the map as evidence.

## EXTEND YOUR GEOGRAPHICAL THINKING

Have students research one of Canada's primary industries and create a story map about whether or not they would support this industry coming to their hometown.

**Links to the Canadian National Standards for Geography**

The World in Spatial Terms:
- Locational technology

Physical Systems:
- Ecozones

Human Systems:
- Types and patterns of economic activity

Environment and Society:
- Environmental issues

7

# THREATS TO THE CANADIAN ARCTIC

**Learning objectives**

- Students will explore the Canadian Arctic and discover how climate change has affected the region.
- Students will learn how geospatial technology can help to prevent further damage and help monitor change.

**Time required**

50 minutes

**Grades**

6-10

**Materials**

- Climate change cards (7)
- Solution cards (7)
- Teacher information card (1)
- Pylons (20)
- Chains (16)

**Set-up**

- Review all of the materials and ensure that all cards are present.

## INTRODUCTION

The Canadian Arctic is as remote as it is beautiful. The Arctic is sparsely populated and largely undeveloped. However, climate change poses a huge risk to this delicate area of Canada. Climate change is caused by greenhouse gases, such as carbon dioxide and methane, trapping heat in the Earth's atmosphere, in turn causing the Earth to warm. This warming has already resulted in rapid and dramatic changes to the Arctic ecosystem.

Have your students explore the Arctic region of the map, and ask them to place pylons in areas where they think climate change has had an effect. Discuss how communities living in the Arctic will be affected differently than communities in the south. Discuss why they placed pylons where they did.

## DEVELOPMENT

Explain that the class is going to be looking at specific examples of how climate change has affected Canada's Arctic. Divide them into seven groups and distribute a climate change card to each group. Instruct them to get any materials they would like to use to complete the task outlined on the card. In groups, students will add layers of information to the map, illustrating how climate change has affected the Canadian Arctic. Have all the groups explain what they've mapped and how climate change is illustrated through their example.

## CONCLUSION

Review the following key terms with your students:

- **Global positioning system:** a constellation of satellites and a receiver used to pinpoint locations on Earth
- **Geographic information systems:** hardware and software that store, analyze and display geographical data
- **Remote sensing:** the study of the Earth through photos and scanning from above the Earth's surface

Now, distribute the solution cards and have students match each to a problem that was mapped out in the development stage of the lesson.

Discuss other ways that Canadians can combat climate change and how GIS could help. Ask students how these solutions may evolve as climate change issues continue to grow. Discuss where climate change is being felt the most and compare that to Canada's population distribution. Review lesson five to look at population density.

## EXTEND YOUR GEOGRAPHIC THINKING

Most Canadians will not get a chance to visit the Arctic. However, the Arctic is a place in Canada that every Canadian should want to protect and preserve. Students can think nationally but act locally by creating and implementing a plan to make their school or home more environmentally friendly and reduce their greenhouse gas emissions. Use GIS to make a map that outlines changes that can be made in your local area.

**Links to the Canadian National Standards for Geography**

The World in Spatial Terms:

- Expanding locational technology

Places and Region:

- Critical issues and problems of places and regions
- Regional analysis of geographic issues and questions

Environment and Society:

- Effects of human modification to the physical environment

8

# WHAT LIVES IN CANADA'S NORTH?

**Learning objectives**

- Students will learn the difference between global GIS and GPS.
- Students will discover what GPS is and how it works.
- Students will explore Arctic wildlife and conservation efforts.

**Time required**

50 minutes

**Grades**

6-12

**Materials**

- Pylons (20)
- Wildlife cards (10)
- Teacher clue card from *Activity 1: Making a Map* (optional)

**Set-up**

- Review Teacher clue card from *Activity 1: Making a Map* to familiarize yourself with all essential components of the giant floor map. Read the overview in the teacher's guide to ensure you and your students understand how the Global Positioning System (GPS) works.

## INTRODUCTION

The Canadian North is a remote and spectacular region of the country. Despite the fact that it accounts for about 39 per cent of Canada's physical area, very few Canadians have been fortunate enough to travel to this part of Canada. This area is famous for its colourful tundra, dancing northern lights, the Northwest Passage, sparkling snow and ice, a pristine and delicate environment and, of course, the Inuit. Canada's Arctic is sparsely populated. In most areas, the winters are long, cold and dry, while summers are short and cool with slightly more precipitation than in winter. Vegetation that grows in the North includes bushes, grasses, mosses and lichens. Permafrost is common, preventing trees from taking root.

The Arctic can be defined by many features. One of the ways is to look at the treeline. The treeline is the name given to the point where trees no longer grow because of the conditions of the soil and the short summers. It isn't an exact line. Closer to the treeline, trees grow smaller and are more spaced out until eventually most types can't grow at all. Those that do survive grow shielded from the wind by rocks or hills and never grow very large. The treeline is not a straight line across Northern Canada. Where trees can grow is mainly influenced by climate but can also be influenced by elevation, soil, winds and animals.

Have students use chains and their knowledge of cardinal directions to work together to map out the treeline as a class. Read the following instructions aloud:

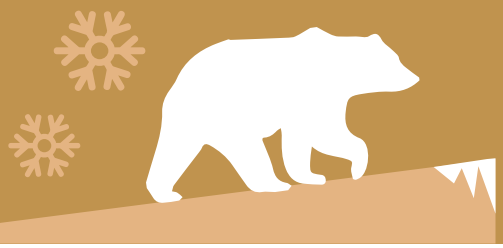
1. Start on the Firth River at the border between Alaska and Yukon.
2. Travel east, staying just slightly north of Great Bear Lake.
3. Travel northwest to Dubawnt Lake, continuing on to the northwest corner of James Bay.
4. Remain close to, but do not touch, Hudson Bay on the way.
5. Begin a new line at Inukjuak, Nunavut.
6. Follow the southern extent of Ungava Bay.
7. End just north of Nain, Newfoundland and Labrador.

Now that the treeline has been marked, have students discuss its position, and tell them that it has moved over the past several decades. What could cause such a large geographical feature to shift? Where do students think that treeline will be in 10 or 50 years?

## DEVELOPMENT

As a result of the Arctic being such a large portion of Canada and being so sparsely populated, GIS and GPS both help greatly when trying to learn more about this region. Students will use GPS data to discover where different animals live in the Arctic.

Before you discuss animals, ensure that your students understand GPS and how it works. Use the information provided in the teacher's guide if need be. Explain that researchers will often place GPS trackers on animals to trace their movements. Researchers are able to use the data they collect to find changes in patterns and to conserve animal habitats.



# WHAT LIVES IN CANADA'S NORTH?

Ask students to examine the map and list what kinds of animals they think live in Canada's North. Divide the class into 10 groups and distribute a wildlife card to each group. Explain that they will be using real data from tracked animals.

Have students place the cards on the map at the location given by the latitude and longitude coordinates on the cards. Explain that they should look at the first coordinate, the line of latitude, and find it on the map. Next, they will walk along their line of latitude until they find the right line of longitude. Once they have found both lines, have them place their card down on the map. Have all students place their cards in the correct location on the map.

## CONCLUSION

Have students read the cards they placed on the map. After examining the pictures of these Arctic animals and their range maps, discuss any patterns or trends they see with where the cards are placed. Do the animals have any common characteristics that allow them to survive in Canada's North? Compare these animals with those found in your neighbourhood and discuss any similarities or differences.

Visit some of the amazing websites that allow you to track animals using GPS, such as:

- polarbearsinternational.org/about-polar-bears/tracking/bear-tracker
- cwf-fcf.org/en/do-something/challenges-projects/gctr/the-race/
- birdscanada.org/volunteer/cmmn

## EXTEND YOUR GEOGRAPHICAL THINKING

Have students visit a local zoo or museum to learn more about these animals. If this is not available, have a resource officer or professor come in to the class to teach in detail about one or many of the organisms found in the Arctic.

**Links to the Canadian National Standards for Geography**

Physical Systems:

- Ecozones

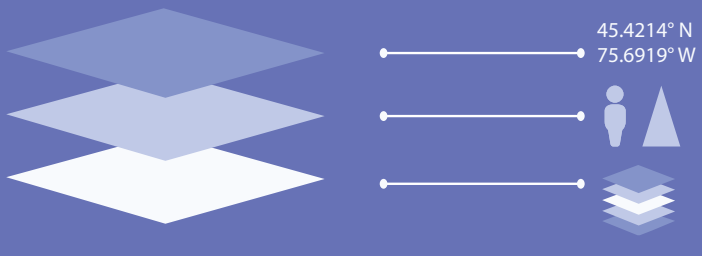
The World in Spatial Terms:

- Locational technology

Environment and Society:

- Human modifications of the physical environment
- Global effect of human modification of the physical environment

# 9




# GEOGRAPHIC INFORMATION SYSTEMS

### Learning objectives

- Students will be introduced to geographic information systems (GIS).
- Students will learn about real-life applications of GIS.
- Students will discover careers in GIS.

### Time required

50-100 minutes

### Grades

6-12

### Materials

- Career cards (7)
- Transparencies (7)
- Whiteboard markers (7)
- Chains (16)
- Pylons (20)

### Set-up

- Review the geography overview sheets from the teacher's guide with your students.

## INTRODUCTION

Start by checking your students' understanding of geographic information systems, or GIS. Remind them that the first one was created by a Canadian, Roger Tomlinson. GIS is a geospatial technology that is now used throughout the world. Another way we can understand GIS is to examine the three letters of GIS.

**G - Geographic:** This refers to the first of the two types of data that GIS uses. This first type of data is spatial in nature — the data seen on the map. Regardless of what is being mapped, all features on the map have a location. This location is usually in the form of latitude and longitude (degree, minute, seconds or in decimal degrees) or Universal Transverse Mercator (created by showing the Earth as a square grid). Have your students find the location of their hometown or a place they want to visit. Refer to the lines of latitude and longitude to find the coordinates of the place.

**I - Information:** This refers to the second type of data that GIS uses. This type of data is known as attribute data and is information about the spatial data. This data can be found in the attribute table. This data tells the user more about the features that are mapped out. Examples could be the elevation, population or mayor of a capital city. Have your students look at the size of dots that are used to represent cities on the map and determine what information is being shared through the symbols. Ask them to identify three other types of information that has been layered on the map.

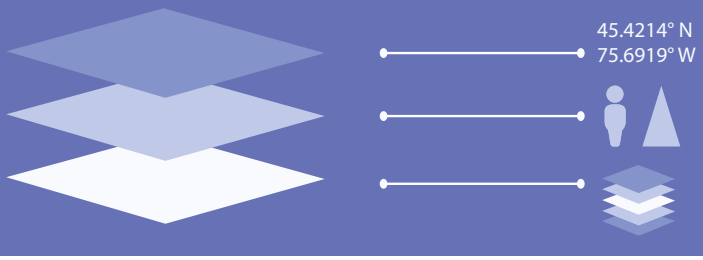
**S - System:** This refers to the link between the spatial data on the map and the attribute data found in the attribute table.

Ask your students to think about their own lives and identify connections they may have to GIS technology. Lead the discussion with the following questions:

- Does anyone have a parent or guardian who uses GIS at work?
- If so, where do they work and how do they use GIS?
- Has GIS played a role in your life before?
- Can you list other ways to use GIS?

Some areas where students may have experienced GIS technologies could include school division planning, where school buses pick them up, or provincial and territorial government highway condition maps. Their municipal government may also plan new subdivisions and utilities with the help of GIS.

Check for understanding: Have students create a data set of places in Canada they have visited. Once everyone has selected a place, have students become the data points on the map by standing these places. By doing this, they are layering their data set on the map. Repeat this activity but have students create a new data set of places they want to visit in Canada. Ask what patterns and trends they see.




# GEOGRAPHIC INFORMATION SYSTEMS

## DEVELOPMENT

To further explore the applications of GIS, divide students into seven groups, distribute a career card to each group, and give students time to explore the giant floor map using their card. Have all students go onto the map and then choose a location where they believe GIS is being used for the career card.

Distribute transparencies, markers and have students use the information provided on their career card to add a layer of data connected to their career by using the transparencies and any additional materials they may find useful. Ensure that students read all instructions before they begin to write on their transparency and encourage them to display the information on their transparencies in their own way. Remind students to be careful not to draw on the map.

## CONCLUSION

Allow time for each group to share their career, how their career uses GIS and what they layered on the map. Host a gallery walk and then discuss the many uses of GIS. Brainstorm additional applications that may exist and types of occupations that use it.

## EXTEND YOUR GEOGRAPHIC THINKING

To learn more about the GIS, do one or more of the following:

- Watch GeoSpatial Revolution (found at geospatialrevolution.psu.edu).
- Invite an industry user of GIS or a professor into the classroom to talk about GIS.
- Continue to explore careers in the GIS field. Create a display for your school to share the benefits of studying GIS
- Use this giant floor map or an online map to celebrate GIS day, the third Wednesday in November (November 16 in 2016).
- Have students research a job in the field of GIS and present this job to the class. Have students include the following:
    - title of the position
    - description of the job
    - education level required
    - salary
    - appeal of the job

**Links to the Canada National Standards for Geography**

The World in Spatial Terms:

- Location/allocation situations
- Expanding locational technology

# 10 GIS IN THE REAL WORLD

### Learning objectives

- Students will learn how GIS works.
- Students will solve problems by layering information on the giant floor map.
- Students will understand the diversity and importance of GIS.

### Time required

75 minutes

### Grades

7-12

### Materials

- Chains (16)
- Pylons (20)
- Definition cards (3)
- Teacher card for Intensive Livestock Site Selection (1)
- Intensive Livestock Operation criteria cards (4)
- Situation cards (2)

### Set-up

- Review the information provided in the teacher's guide to ensure you are comfortable with all the terms. If possible, use online tools to understand how each term (e.g., buffer, clip and erase) works in a digital format.

## INTRODUCTION

Geographic data in an electronic version of a map is shown in the form of either raster data or vector data.

Raster data looks similar to the pixels found in digital cameras or televisions. When you zoom in, it looks pixilated. The data cannot be manipulated.

Vector data is more commonly used on a GIS map. Vector data is shown as points, lines or polygons. Vector data is displayed by adding vertices (points where two or more straight lines meet) to a map at specific points. These vertices allow vector data to have definite boundaries and to be edited or added to. When you zoom in, the lines do not get blurred.

Give your students the following examples to assist with their understanding.

| Vector Data | Possible Examples on a Map |
|---|---|
| Points | Cities, wells, schools, animal sightings, etc. |
| Lines | Rivers, roads, railway tracks, gas lines, etc. |
| Polygons | Provinces, lakes, ecozones, countries, etc. |

Have students illustrate these three types of vector data on the map as they did in Activity 6: Canadian Ecozones and Natural Resources. Have all students go on the map as points. Then, have pairs of students illustrate lines on the map. Finally, have groups of four students illustrate what polygons are on the giant floor map.

Geographic information systems, or GIS, is a very useful technology used daily in countless ways. GIS is used in many fields, such as health, business, defence, education, real estate, natural resources and government. For more specific examples of how different professions use GIS, review Activity 3: Think Like a Geographer and Activity 9: Geographic Information Systems.

One use of GIS is to find a location for a specific purpose. Examples include planning a new school division, finding a suitable location for a new school, selecting the best location for a new ski resort, finding the safest and most appropriate location for a landfill site or choosing the best place for a new provincial park.

The process of using GIS to find a new location for a specific purpose is called site selection. To fulfill the required criteria of a site selection, you have to use vector geoprocessing such as buffer, clip and erase. Randomly distribute the definition cards for buffer, clip and erase to three students, and have each go to a different corner of the map, take turns reading their definition to the class and place their definition card on that corner.

The criteria required for a site selection can be broken down into inclusive or exclusive criteria.

Inclusive criteria are requirements that the new location must be located within.
For example:

- A new school must be 500 metres from the nearest bus stop, and
- A new school must be on land zoned recreation or green space.

For a site to be suitable, all the inclusive requirements must be fulfilled.

Exclusive criteria are requirements that must be avoided for a site to be considered suitable.
For example:

- A new school cannot be closer than 500 metres from a highway or freeway, and
- A new school cannot be closer than one kilometre from an existing school.

For a site to be suitable, all the exclusive criteria must be avoided.

## DEVELOPMENT

Now that students are familiar with the basic concepts used by GIS, they are going to address a situation and offer a solution using GIS.

As a whole class, work through the example using vector geoprocessing to complete a simplified site selection to find a new location for an intensive livestock operation (ILO) in Manitoba. Distribute the intensive livestock operation criteria cards to students. As they read their card aloud, have the class decide whether the criteria is a buffer, clip, or erase by standing in the appropriate corner where one of the definition cards was placed earlier. Follow steps 1 to 5 on the Teacher Card for Intensive Livestock Site Selection.

Next, divide the class into two groups and have them complete the two scenarios presented in the criteria cards in a similar way.

## CONCLUSION

Once everyone is finished, have each group explain how they came to their decision (ask them how their manual GIS helped in decision-making). Bring the attention back to your own community. As a class, discuss possible examples of how GIS can be used and how buffers, clips, erases can be used.

## EXTEND YOUR GEOGRAPHICAL THINKING

The task of completing a site selection without GIS software can be difficult. The final result may be inaccurate. Like most software, GIS software is designed to help us complete tasks faster, more accurately and more professionally than we could without software. Repeat this challenge using GIS and see the difference between the two processes and results.

**Links to the Canada National Standards for Geography**

The World in Spatial Terms:

- Location/allocation situations
- Expanding locational technology

The Uses of Geography:

- Local, regional, and world policies and problems with spatial dimensions