

be as secure as Vancouver's West Coast Energy Building, which is suspended on cables to absorb the swaying motion caused by an earthquake. The low-lying Fraser Delta, and other areas not built on **bedrock**, will be highly unstable. Their surface will turn to the consistency of porridge, a process known as "liquefaction."

Scientists studying the faults and plate movements off the British Columbia coast are convinced that the earthquake

will happen. The question they can't answer is: Where and when?

magma: molten rock material within the Earth from which igneous rock is formed through cooling

mantle: the interior part of the Earth that lies directly above the core

epicentre: the Earth's surface directly above the quake—the middle of the quake

tsunami: a great sea wave produced by an earthquake or by a volcanic eruption

seismic: to do with earthquakes

subduction zone: a long region with a trench through which a descending tectonic plate is assimilated into the earth's mantle

Richter scale: a measure of the power of earthquakes. Each step on the scale is ten times the previous one, so an earthquake that registers 7 is ten times greater than a 6 and one hundred times greater than a 5.

seismologist: someone who studies earthquakes

bedrock: solid rock underneath looser materials such as soil



Figure 3-13 When the Big Earthquake happens, the plates beneath BC will come unstuck, sending waves outward and upward from its **epicentre**. The land will shake uncontrollably and create enormous damage to the built environment. This illustration depicts the possible

damage to a typical neighbourhood. Examine Figure 3-13 for a few minutes. How has the infrastructure of this community been damaged? For more information about infrastructure, see Chapter 2, page 69.

ACTIVITIES

1. In groups of four or five students, create a Disaster Education Program to help community members prepare themselves for a major earthquake. With members of your group, create a ten-point brochure that outlines the provisions and equipment people will need in

the event of an earthquake. In an opening paragraph, describe the damage to the community infrastructure that may make these emergency items necessary. Add pictures, diagrams, and captions to explain the impact of an earthquake.

1. Use the following headings to create an organizer comparing the Western Mountains, the Interior Plains, and the Canadian Shield:
 - original state
 - significant changes
 - result of changes
 - appearance today
2. Using a medium of your choice, create a small visual display to illustrate the principles of mountain building. Review pages 101 to 103 for information. You may have to experiment with a number of media in order to represent the results of tectonic plate collision.

THE CLIMATES OF WESTERN CANADA

continental climate: the climate of a continent's interior

maritime climate: a coastal climate, usually referring to the West Coast

Western Canada lies above 49 degrees latitude. Most areas experience a **continental climate** of temperature extremes and low precipitation. Coastal areas of British Columbia are moderated by a **maritime climate** of mild temperatures and high precipitation. Temperature and precipitation differences among communities in western Canada reflect their location and local conditions. These are described in the next section.

Factors Affecting Temperature

Latitude. The distance of an area from the equator determines the amount and intensity of sunlight it receives. In northern latitudes, the sun's rays strike the Earth at a lower angle than they do closer to the equator. As a result, there is greater seasonal variation in the length of day and night. Another effect is that temperatures are generally higher in southern Canada, because the higher angle of the sun in the sky results in more intense heating of the land.

Altitude. The higher the altitude, the colder the temperature. In general, for every 150-metre rise in altitude the temperature drops by 1 degree Celsius.

Distance from the Sea. The surface of land heats and cools more quickly than the surface of water. A large land mass such as western Canada can swing between temperature extremes—high temperatures in the summer and low temperatures in the winter. By contrast, the summer and winter temperatures of areas such as the West Coast of Canada are moderated by the water.

Wind Direction. Winds blowing from the ocean increase the moderating effect of water. The reverse is true for winds blowing off the land. West Coast communities are the only communities in Canada with winter temperatures above freezing. Prevailing winds are those that blow most often in an area. In western Canada, these winds are generally westerlies, that is, from the west, or northerlies, from the north.

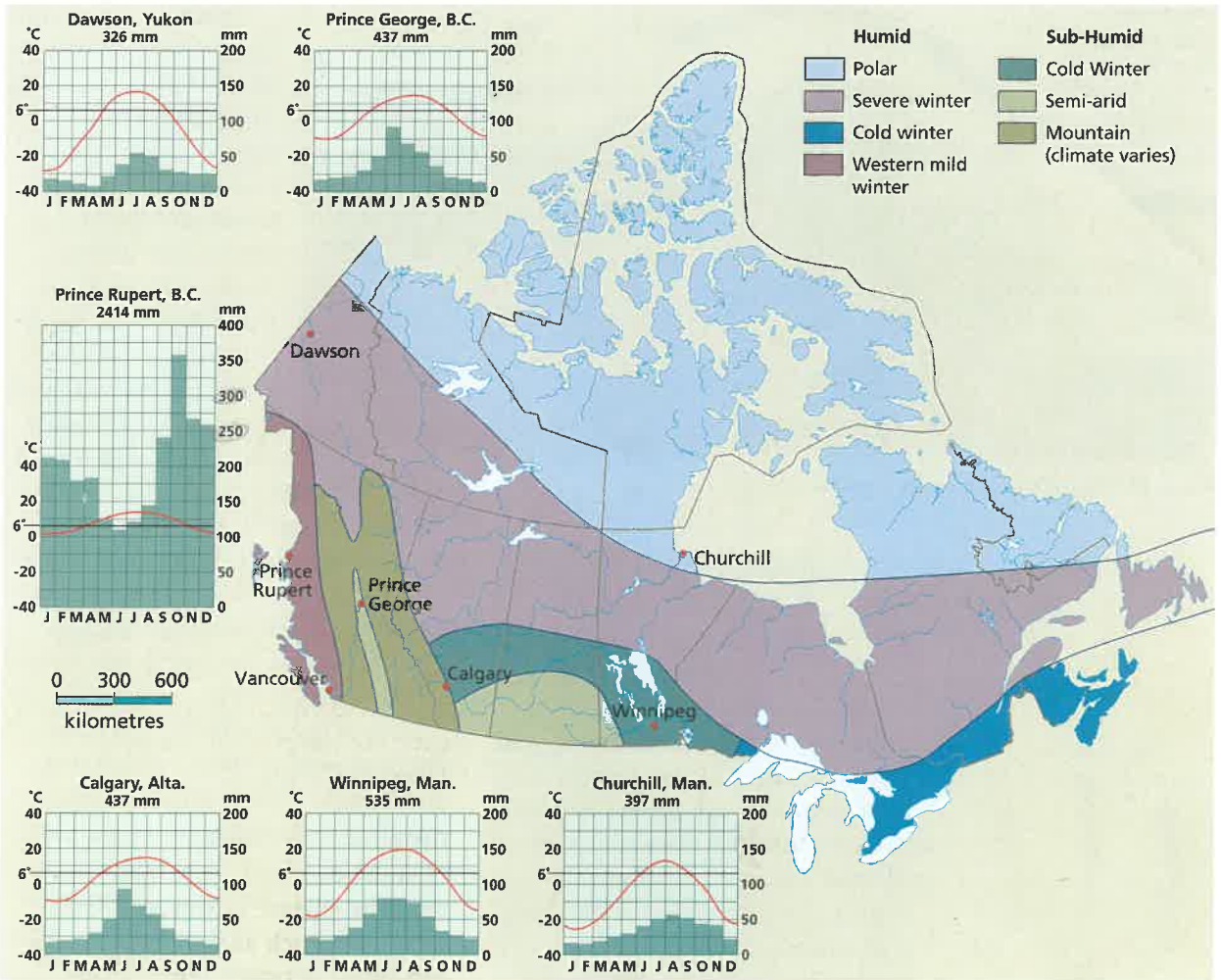


Figure 3-14 Climographs show the average monthly temperature of a community with a line graph and the average monthly precipitation with a bar graph.

Ocean Currents. Ocean currents are either warm or cold, depending on their origin. Ocean currents affect the temperature of the land by warming or heating the air blowing over them. Warm air can absorb more water than cold air. This is why the West Coast enjoys a mild, wet climate. The prevailing westerlies blow over the warm Alaska current, which comes from warm southern waters.

Precipitation. The amount of precipitation received by a location is determined by its distance from the sea and by the prevailing winds.

Heavy precipitation is often confined to a season, or seasons. In turn, the form of precipitation—for example, drizzle, heavy rain, snow, or hail—will have an impact on the location. Western Canada experiences three basic types of precipitation: orographic, convectional, and frontal.

Prevailing westerly winds push warm, moist Pacific air up against the mountains of Vancouver Island and the Coast Range and create orographic precipitation. As the winds force the air up the mountainside, the air cools and expands, losing its moisture as rain or snow. As the air

DID YOU KNOW?

The lowest temperature ever recorded in Canada was -62.4 degrees Celsius in 1948 at Snag, in the Yukon. The highest temperature, 42.8 degrees Celsius, was recorded at Osoyoos, BC, on July 27, 1998.

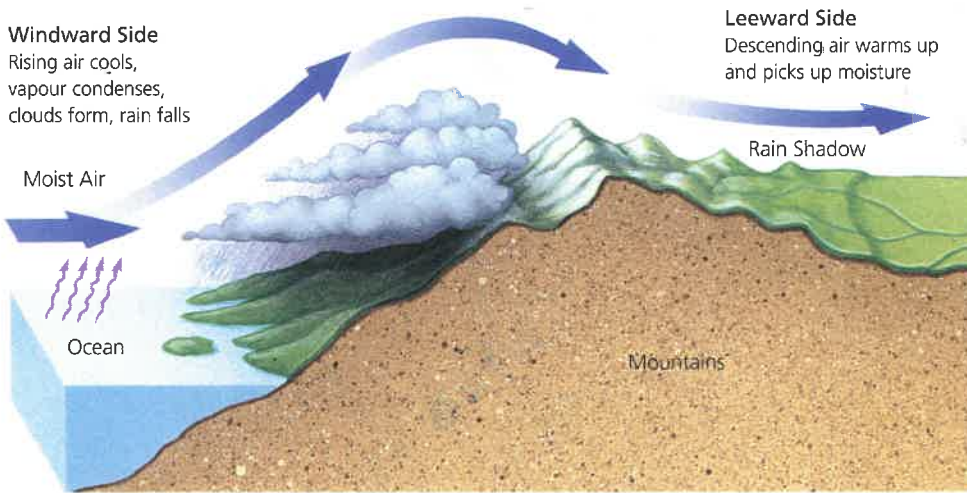


Figure 3-15 Orographic, or mountain, precipitation

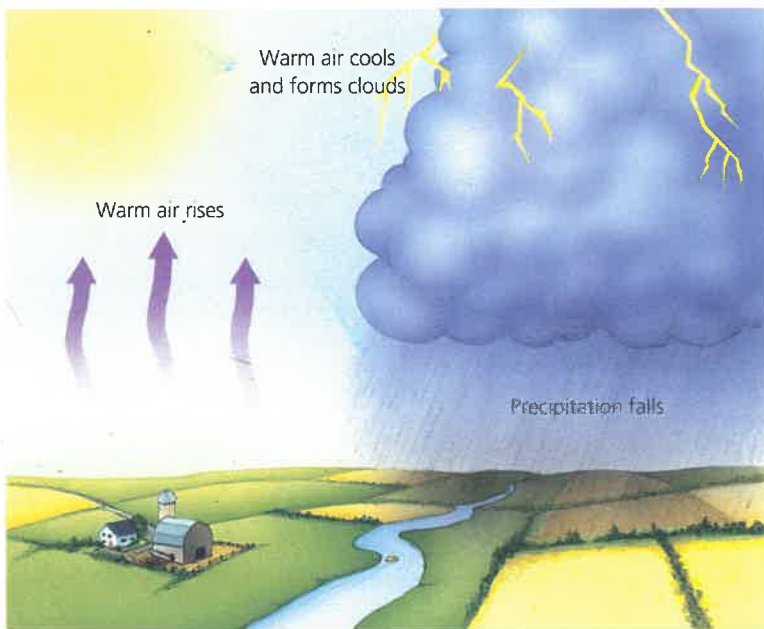


Figure 3-16 Convective precipitation

DID YOU KNOW?

Convective precipitation is commonly known as a thunderstorm.

convection: transference of heat by upward movement

descends on the eastern slopes, it becomes warm and dry; this area is called the rain-shadow. Orographic precipitation also occurs on the Rockies, although less rain falls on the western slopes. In winter, the winds that descend the eastern slopes of the Rockies—called “chinooks”—warm so quickly that they can raise the temperature 20 degrees in a matter of hours.

Convective precipitation is caused by **convection** currents in the atmosphere. It falls primarily on the prairies and on the Canadian Shield during the hot months. As the ground heats throughout the day, it heats the air. This warm air expands and rises, and meets cool air, which also warms,

rises, and cools, eventually forming a cloud of rain or hail, which falls back to the Earth. While this type of precipitation provides much-needed moisture to the arid prairies, it is unreliable, and the heavy rain or hail often damages crops.

Most of Canada lies in a zone between cold polar air, which originates in the North, and warm tropical air, which originates in the Gulf of Mexico. These two air masses cannot mix, and their line of contact is called a “front.” Because warm, tropical air is less dense than cold air, it rises over the cold air. As the warm air rises, it condenses and forms clouds, usually resulting in prolonged precipitation. There is more frontal activity during the Canadian winter because the polar air extends further south and the two air masses—warm and cold—vary most dramatically in temperature. Fierce frontal activity, known as “cyclonic storms,” result, and are pushed from west to east by the prevailing westerlies.

Water Resources Of Western Canada

Most of the rivers of western Canada begin in the cordillera. The high levels of precipitation and melting

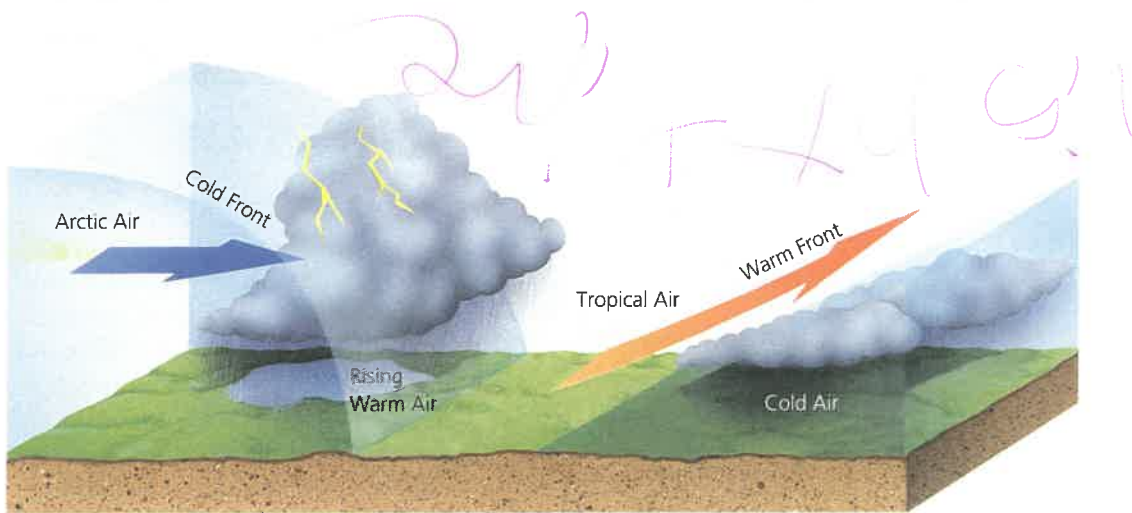


Figure 3–17 Frontal precipitation

snowpacks provide a constant flow of water. Rivers flow east or west from the highlands of the Rockies and Coast range until they meet a major body of water, such as Hudson Bay or the Pacific Ocean. Along the way, they join other rivers, flow through lakes, and form river systems that drain the land. A drainage basin is an area of land drained by one river system. Basins are formed as the rivers carry away eroded material from the land.

The abundance of water in most parts of western Canada has made many Canadians complacent. However, as population and development have increased, so too have threats to water quality. Today, seri-

ous efforts are underway to find solutions to these problems. For example, the Lower Fraser River Basin, which includes the greater Vancouver area, has been a dumping ground for industrial and municipal **sewage** and agricultural **run-off** for decades. In the early 1990s, communities in the lower mainland of British Columbia, along with the provincial government, set aside \$50 million to clean up the Fraser. At that time, most experts estimated it would take more than ten times that amount to treat the sewage dumped into the Fraser each year. For Canadians, water quality, not water supply, will be the issue for the future.

DID YOU KNOW?

Approximately 22 percent of British Columbia's population relies on ground water for its water supply.

sewage: municipal and industrial waste

run-off: pesticides, herbicides, and other materials that drain from fields into rivers and lakes

ACTIVITIES

1. Examine the climographs in Figure 3–14 to identify and explain which locations have the following: highest rainfall, lowest precipitation, lowest monthly temperature, highest monthly temperature, and the greatest range in temperature between summer and winter.
2. Explain why most rainfall in Winnipeg occurs in the summer months.
3. Explain which climograph location would have the most precipitation in the form of snow.
4. Use the map of physiographic regions on page 101 to list the three major drainage basins in western Canada. Which of the drainage basins is the biggest? Which of the drainage basins are likely to suffer from pollution from: a) urban sources, b) agricultural sources, c) industrial sources.

DID YOU KNOW?

The word "ecology" comes from the Greek *oikos*, which means "home." Ecosystems are homes to living things.

DID YOU KNOW?

More than 500 species of plants now found in British Columbia—approximately one in five of the total flora—have been introduced by humans either by accident or intention.

biome: an ecological community of plants and animals extending over a large area

interdependent: being dependent on each other

system: a group of things that interact with each other and together form a whole

THE NATURAL REGIONS OF WESTERN CANADA

Ecosystems and Biomes

A natural environment is defined as the conditions under which plants and animals live in relation to each other and with the non-living parts of the environment. The natural environment of western Canada is made up of a number of large ecosystems, or **biomes**, each with its own characteristic type of vegetation and animal species.

A biome contains a number of smaller ecosystems—natural areas where the life cycles of plants, animals, and other organisms are linked to each other and to their physical surroundings. Smaller ecosystems are in turn made up of habitats, places where plants and animals

have adapted to a set of specific conditions, for example, a bog. Because all the elements of an ecosystem are **interdependent**, altering one part of the system, or introducing a new organism into the system, usually sets off a chain reaction. For example, removing the forest cover has a dramatic impact on the animals that use the forest as a habitat. Here is another example: During this century, rats were introduced to Haida Gwaii—the Queen Charlotte Islands—by coastal trading ships passing by. The rats dramatically reduced the number of nesting bird colonies. In 1995, a rat control program was established to rid the islands of this unwanted species.

Systems

Geographers use the model of a **system** to explain natural events. A system can show how parts of something, such as an ecosystem, are linked together.

When the parts of an ecosystem are in balance, the system functions smoothly. If one part of the system is altered, however, the balance of the entire system is upset. For example, deforestation reduces the ability of the soil to hold water. Prolonged rainfall causes flooding of rivers and increases soil erosion. This leads to larger sedimentary deposits downstream, which in turn upset habitats.

Figure 3-18 This simplified example of an ecosystem shows how the physical and natural environments are balanced and interdependent. Interruptions and reorganizations in the system lead to imbalance and often undesirable side effects.

