

LANDSCAPES AND LANDFORMS



Source: <http://visas-services.com/canada-tourist-visa.html>

Canada 1: Major landforms, geomorphic processes and geomorphic hazards

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NOTE: this is a condensed and adapted version of an article published in the Geography Bulletin: Vol 47, No 4, 2015

GLOSSARY (<http://syllabus.bos.nsw.edu.au/hsie/geography-k10/glossary/>)

Landform: The individual surface features of the Earth identified by their shape eg dunes, plateaus, canyons, beaches, plains, hills, rivers and valleys

Landscape: An area created by a combination of geological, geomorphological, biological and cultural layers that have evolved over time eg riverine, coastal, urban.

Geomorphic processes: Natural processes that transform the lithosphere to create distinctive landscapes and landforms eg erosion, weathering, tectonic activity.

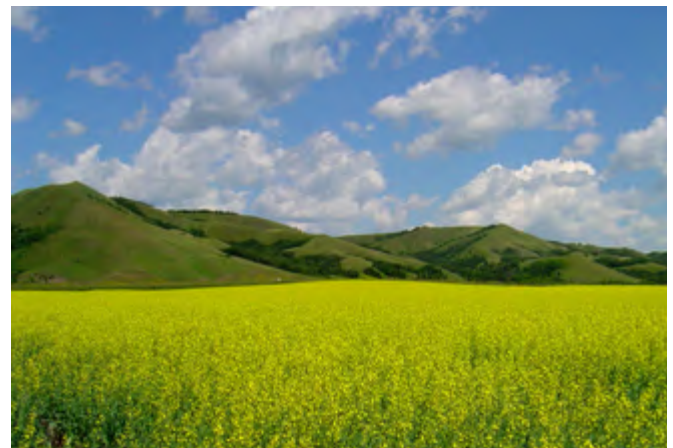
Environment: The living and non-living elements of Earth's surface and atmosphere. Where unqualified, it includes human changes to the Earth's surface eg croplands, planted trees, buildings and forests

Geomorphic hazard: Hazard event originating in the lithosphere eg volcanic eruptions, earthquakes, tsunamis and mass movement (landslides or avalanches).

Source A: Canada has a diversity of landscapes and landforms



Above: Moraine Lake Image: L Chaffer



Prairies of the interior plains in Saskatchewan Image: Kjfmartin. Source: <https://commons.wikimedia.org/w/index.php?curid=11278035>



What do you know about Canada?
Take the Quiz in Student Activity 1

LANDSCAPES AND LANDFORMS: CANADA 1

Source B: Major landform regions of Canada by elevation



Source <http://worldatlas.com/webimage/countrys/namerica/lcolor/cacolor.gif>

CANADA: FACTS

Canada is the second largest country in the world covering an area of 9,984,670 sq. km. It has the world's longest coastline – bordering the Atlantic, Pacific and Arctic Oceans – and shares an 8,892 km land border with the USA

With a large latitudinal and longitudinal extent (from 42° to 83° N and 52° to 141° W) Canada has a diversity of physical environments that support a domestic population of 35.7 million (estimated April 2015) and provide resources for global markets. A location on tectonic plate boundaries makes Canada's Pacific Coast vulnerable to *geomorphic hazards* such as earthquakes, landslides and tsunamis.

Source C: Major landform divisions of Canada



Source: <https://s-media-cache-ak0.pimg.com/originals/24/41/58/244158288c85fc9d493773cdd8ccda07.jpg>



What do you know about global plate tectonics?
Check your understanding in Student Activities

CANADA'S MAJOR LANDFORM

Canada can be divided into a number of major landform regions (Source C) shaped by **geomorphic processes** including tectonic activity, weathering, erosion and deposition. It has often been stated that Canada is a “smorgasbord of landforms”.

1. **Mountains and highlands** to the west, east and north vary in age and characteristics. They include:

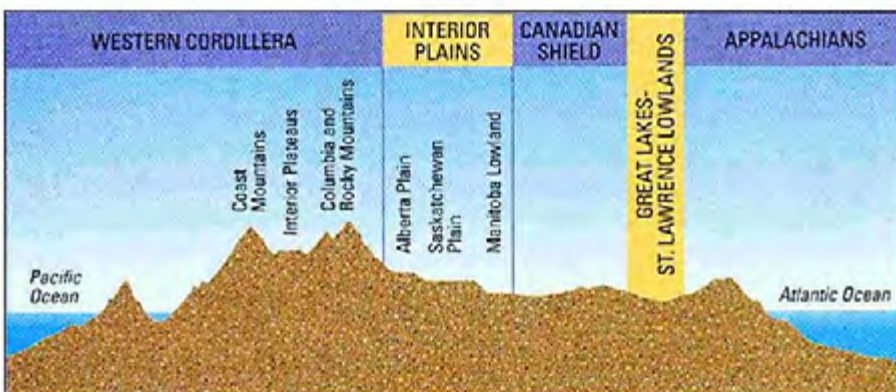
- **The Western Cordillera:** young mountains of that extend from the Pacific Coast to the interior plains in the west and comprise the Coastal Mountains, Rocky Mountains and other smaller ranges. These mountains were formed by **tectonic activity**, where the collision of the North American and Pacific plates caused folding and faulting of sedimentary rocks and volcanic activity. Rugged sharp peaks and glaciers in the Cordillera landscape reflect its more recent formation. Between the mountains are plateaus and valleys running north to south created by **rivers and glaciers**. Along the coast of British Columbia past volcanic activity created many islands and deeply indented bays and inlets. This landform region is covered by **rainforest, grasslands or shrubs** in the dry intermontane regions, **temperate evergreen forests** of Douglas fir, Western Red Cedar and Hemlock on the higher interior slopes of the Rocky Mountains and **tundra** above the treeline. The region is rich in water, forest and mineral resources.
- **The Appalachian Mountains:** older mountains in the east eroded significantly by **glaciation** leaving a flatter, lower landscape dissected by deep, narrow river valleys (gorges) and U-shaped glacial valleys. Steep cliffs occur where mountains meet the sea.
- **The Canadian Shield:** covers almost half of the country. The landscape consists of hills and plateaus created by **tectonic activity** in the past and eroded over time **by rivers and ice**. The shield is covered with boreal (coniferous) forest in the south and tundra in the north. The Canadian Shield has vast minerals resources including emeralds, diamonds and copper but is mainly unsuited to farming.

Landforms and geomorphic processes

2. **Lowlands and plains** formed by **glacial erosion** and filled with **glacial and river sediments** to create mostly flat plains with rich soils suited to agriculture and settlement.

- **The interior plains** are large, flat areas of **sediment** eroded from the Canadian Shield, crossed by shallow river valleys and covered with lakes gouged by past **glaciation**. Forested in the north (**boreal / coniferous forest**) and supporting grassland (**prairie**) in the south the plains are considered Canada's breadbasket because they support large areas of grain as well as cattle grazing.
- **The Great Lakes-St. Lawrence Lowlands** surrounding the Great Lakes and the St. Lawrence River supports large cities, rich farmland and manufacturing with some protected remnants of the original **forest biome** and steep escarpments such as Niagara Falls.
- **The Arctic and Hudson Bay lowlands** are cold, flat plains underlain by permafrost that can only support tundra. The Arctic climate and frozen ground make development difficult and agriculture impossible.

3. **The Canadian Arctic Archipelago** refers to the 36,000 islands such as Baffin and Ellesmere to the north and on the edge of the Arctic Ocean . Landforms include the Arctic and Hudson Bay tundra covered lowlands and permanently snow capped mountains



Source D: Cross section showing the relative altitude of Canada's major landforms

Source: <http://slideplayer.com/slide/4196105/>

TECTONIC ACTIVITY, MOUNTAINS, VOLCANOES AND GEOMORPHIC HAZARDS

Canada's west coast sits on a **subduction zone** where the Juan de Fuca tectonic plate is sliding beneath the North American Plate (Source E). This plate movement created the coastal mountains including the 18 now dormant **volcanoes** and many fields of volcanic material. Small **earthquakes** regularly shake the west coast, however it is large Cascadian quakes and **tsunamis** that Canadians fear. The last Cascadian quake occurred in 1700 and the tsunami destroyed First Nations villages and travelled the Pacific Ocean.

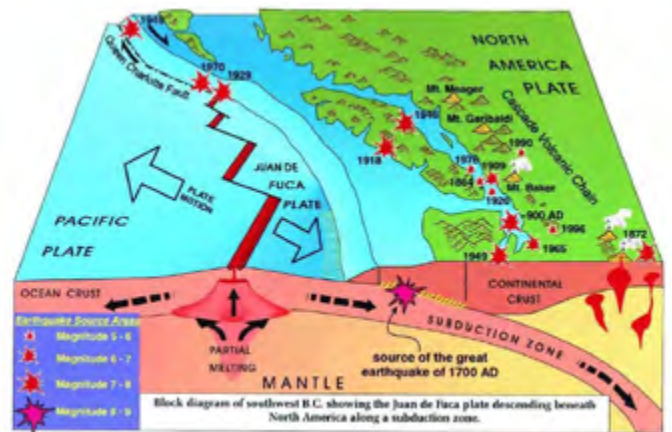
Scientists are predicting a "giant quake" in the future. Coastal communities, aquaculture farms, tourist resorts and the coastal timber industry would potentially be devastated by a large tsunami. The west coast contains many narrow inlets and channels that could amplify the impacts of a tsunami for example, a five-metre tsunami could become a 15-metre wall of water when restricted by a narrow inlet such as the Skookumchuck Narrows (Source I). Damage from a Cascadia quake and tsunami have been predicted at \$75 billion –100% greater than British Columbia's (BC) yearly budget.

The region is also vulnerable to **earthquakes** resulting from landslides in the steep slopes of the coastal mountains and along minor fault lines in the Georgia Strait that separates Vancouver Island from mainland BC. The government is making "catastrophic earthquake preparedness" a priority and signs of this are increasingly evident along the vulnerable west coast of Vancouver Island in British Columbia (Source F). Examples include tsunami-warning signs at low lying coastal areas such as Tofino and earthquake survival events in Victoria, the capital of BC. (Source G and H). A network of GPS satellites track movement to the ground monitoring stations and building codes have been changed to minimise the impact of earthquakes on new west coast homes and high rise buildings. The biggest obstacle to minimising damage from tsunamis is an effective warning system.

Thousands of **landslides** cost Canadians an estimated \$200 to \$400 million every year and vary from minor events involving a few cubic meters of material to over 10 km³. Some landslides have been measured as travelling up to 100 km/hour. Excessive rainfall, earthquakes (Source J) and human activities are earthquake triggers and can contribute to tsunamis in coastal areas.

One contemporary geomorphic hazard including causes, impacts and responses

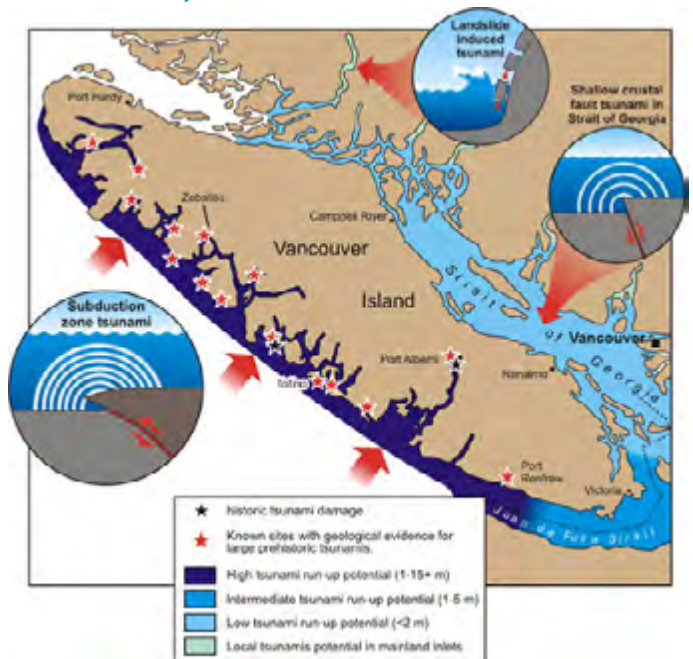
Source E: Cascadia subduction zone



New ocean floor is being created at the boundary of the Juan de Fuca and Pacific Plates. As material wells up on ocean ridge, the ocean floor is pushed toward and beneath the continent.

Source: <http://www.pac.dfo-mpo.gc.ca/science/oceans/tsunamis/tsunamiBC-CB-eng.html>

Source F: Tsunami Hazard map showing the vulnerability of Vancouver Island



Source: <http://www.sfu.ca/~qgrc/research2.html>



Source: <http://bc.ctvnews.ca/b-c-shakes-up-tsunami-alert-system-1.1035403>

Left: **Source G:** Tsunami warning sign at Tofino, BC

Below: **Source H:** Earthquake preparedness in Victoria, British Columbia



Image: L Chaffer

Source I: Skookumchuck Narrows



Twice daily tidal rapids create a spectacular turbulent display. Water builds up to a height of 2–3 metres on one side of the narrow inlet as up to 200 billion gallons of water try to flow through the narrow inlet. “Skookumchuck” is a Chinook name meaning turbulent water or rapid torrent.
Image: L Chaffer

Source J: Landslides are frequent hazards throughout Canada’s mountainous and coastal regions

