

Landslide activity 6: **Landslides in Canada – History of disasters**

Description: This activity teaches students to use a database to graph and analyze landslide disasters in Canada. It is followed by a classroom discussion.

Materials: Overhead 1, graph of Landslide disasters in Canada
Student worksheet (Landslide disasters in Canada)

Teacher instructions and notes:

- Refer your students to the accompanying list of major Canadian landslide disasters. A landslide disaster has been defined as an event involving 3 or more deaths.
- Instruct your students to use the data in the list and the instructions in the accompanying student worksheet to make a bar graph showing landslide disasters in Canada. (Fatalities on the Y axis and date of the event on the x axis. Colour code the bars by province.) (If more than one disaster occurred a year, add the events together for the graph.)
- Students then analyze the patterns and answer the questions on the worksheet.
- The activity should be culminated with a classroom discussion. Talking points are provided below.

Talking points:

1. Patterns and reasons:

- Most landslide disasters occur in British Columbia and Quebec. (Steep slopes in BC; a particular geology [sensitive clay in St. Lawrence Lowlands] for Quebec. Plus population density in these vulnerable areas.)
- Earlier disasters occur in Quebec (Early settlement pattern)
- 1881-1929: Many large landslides in both eastern and western Canada (Population growth, opening the west, construction of highways and railways, general lack of geohazard knowledge for locating buildings etc)
- 1957-1980: Frequent disasters in eastern and western Canada, but generally involving fewer people. (Population density putting increased pressure on construction of communities and transportation routes may account for the increase in frequency. Improved knowledge of hazards and improved safety standards may account for decrease in size of the disaster.)
- Post 1980: Landslide disasters uncommon. (Improved safety standards both in land use planning and construction practices. Also improved methods of prevention or control of landslides.)

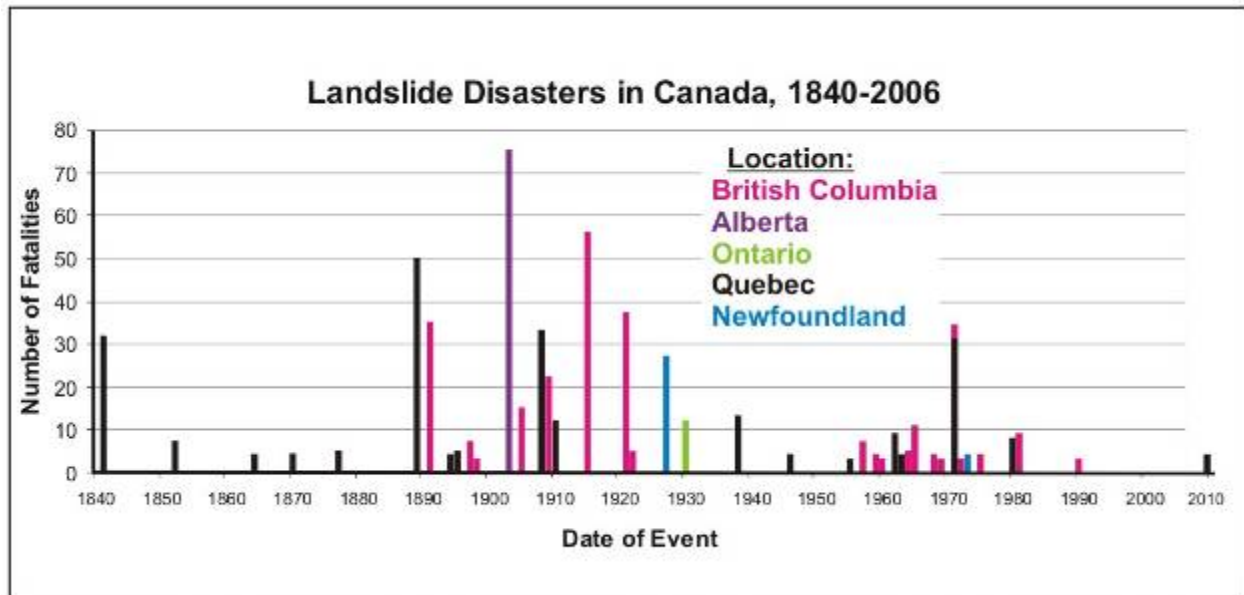
2. Canada's worst landslide disaster:

- Frank, Alberta.
- Teacher's note: At 4:30 am on April 29, 1903, 30 million cubic meters of limestone separated from the east side of Turtle Mountain and crashed into the small mining town of Frank, burying part of the town under 82 million tonnes of rock. The primary cause of the Frank Slide was the unstable geology of Turtle Mountain. Secondary causes include coal mining inside the mountain and a quick freeze that night. In about 100 seconds, a thick layer of rock rubble covered homes, roads, and the Canadian Pacific railway, killing at least 70 people.

3. 1929 disaster in Newfoundland?

- An earthquake triggered a huge underwater landslide off the Grand Banks. The landslide triggered a tsunami which ran up on the Burin Peninsula, killing 27 people.

Overhead 1: **Landslide disasters in Canada**



Landslide disasters in Canada

- A. From information provided in the accompanying list of **Major Landslide Disasters in Canada**, create a **bar graph** showing the number of fatalities and date of event. Let each province be represented by a different colour bar. Create a legend.

(Note: If more than one disaster occurred in the year, the bar should represent the sum of all events in that year, and the use of more than one colour on the bar will indicate the proportion of that sum attributed to different provinces.)



- B. Using your graph and information in the accompanying list, answer the following questions:

1. What provinces have experienced landslides causing 3 or more fatalities?
2. Graph interpretation: Describe patterns revealed by your graph. (distribution / clusters / locations / trends of landslide events over time.) In preparation for a classroom discussion, suggest possible reasons for these trends.

<u>Pattern</u>	<u>Reason</u>

Student worksheet 1 – Pg 2

3. Where was Canada's worst landslide disaster? _____
4. What caused the 1929 disaster in Newfoundland? _____

List of Major Landslide Disasters in Canada

Landslides in Canada have resulted in over 600 fatalities in historic times (post-1840). This number is a minimum value, based on the definition of a landslide disaster as 3 or more deaths in a single event. In some of these disasters the death can be attributed to secondary effects (flood waves and tsunamis) triggered by the landslide. Events with 1 to 2 fatalities are difficult to trace and have not been included in the database. It should be remembered that even when no fatalities occurred, damages caused by a landslide may involve great economic loss. For example the collapse of the Peace River Bridge in a 1957 landslide, while incurring no fatalities, cost \$60 million to replace.

- 1841: Quebec City, Que.** 1841-05-17. Rockslide destroyed houses on Champlain Street. 32 dead.
- 1852: Quebec City, Que.** 1852-07-14. Rockslide destroyed houses on Champlain Street at Cap Blanc. 7 dead.
- 1864: Quebec City, Que.** 1864-10-11. Rockslide destroyed houses on Champlain Street. 4 dead.
- 1870: Ste-Genevieve-de-Batiscan, Que.** 1870-10-25. Earthflow in Leda Clay, along the Champlain River, overwhelmed a house. 4 dead.
- 1877: Ste-Genevieve-de-Batiscan, Que.** 1877-05-01. Earthflow in Leda Clay overwhelmed mill and adjoining house. 5 dead.
- 1889: Quebec City, Que.** 1889-09-19. Rockslide destroyed houses on Champlain Street. 50 dead.
- 1891: North Pacific Cannery, B.C.** 1891-07-06. (District of Port Edward) Worker's homes overwhelmed by debris flow or flood caused by the breach of a landslide dam after heavy rains. 35 dead.
- 1894: St-Alban, Que.** 1894-04-27. Farmhouses carried away by massive landslide in Leda Clay. 4 dead.
- 1895: St-Luc-de-Vincennes, Que.** 1895-09-21. Home destroyed by earthflow in Leda Clay. 5 dead.
- 1897: Sheep Creek, near Rossland, B.C.** 1897-04-20. Debris flow struck railway maintenance camp at Red Mountain. 7 dead.
- 1898: Quesnel Forks, B.C.** 1898-02-???. Three miners killed.
- 1903: Frank, Alta.** 1903-04-23. Rock avalanche from Turtle Mountain buried part of the coal mining town of Frank, including homes, roads, CP Railway, and Oldman River. 75 dead.
- 1905: Spences Bridge, B.C.** 1905-08-13. Landslide in gravel moved into Thompson River and caused a displacement wave which swept victims away. 15 dead.
- 1908: Notre-Dame-de-la-Salette, Que.** 1908-04-26. Earthflow in Leda Clay into Lievre River caused displacement wave containing blocks of ice which destroyed homes. Victims were swept away. 33 dead.
- 1909: Burnaby, B.C.** 1909-11-28. Slump of railway embankment; work train derailed. 22 dead.
- 1910: St-Alphonse-de-Bagotville, Que.** 1910-04-15. Construction camp buried by earthflow in Leda Clay caused by blasting during construction of railway. 4 dead.
- 1910: Coucoucache, Que.** 1910-04-18. Slump of railway embankment; work train derailed. 6 dead.
- 1915: Jane Camp, B.C.** 1915-03-22. (Near Britannia Beach) Rock avalanche from above the portal of mine swept into mining camp. 56 dead.
- 1921: Britannia Beach, B.C.** 1921-10-28. Culvert in railway fill became blocked, damming Britannia Creek. Collapse of the fill triggered an outburst flood that swept away more than 50 houses 4.5 km downstream. 37 dead.
- 1922: Elcho Harbour, B.C.** 1922-09-30. Debris avalanche caused by heavy rains destroyed logging camp. 5 dead.
- 1929: Burin Peninsula (Grand Banks landslide), Nfld.** 1929-11-18. A massive (100 billion m³) submarine landslide off the continental slope south of Newfoundland, triggered by a magnitude 7.2 earthquake, generated a deadly tsunami that struck the shore of the Burin Peninsula, Nfld. 27 dead.
- 1930: Capreol, Ont.** 1930-06-26. Slump of railway embankment; passenger train derailed into Vermillion River. 4 dead.
- 1930: Crerar, Ont.** 1930-06-27. Slump of railway embankment; freight train derailed. 8 dead.
- 1938: Portneuf Station, Que.** 1938-08-30. Earthflow in Leda Clay caused by heavy rain. 9 dead.

Student handout 2

- 1938: St-Gregoire-de-Montmorency, Que.** 1938-09-01. Landslide caused by heavy rains destroyed apartment building below. 4 dead.
- 1946: Beattie Mine, Duparquet, Que.** 1946-07-19. Clay from the open pit walls flowed into a mine shaft, killing 4 miners underground.
- 1955: Nicolet, Que.** 1955-11-12. Earthflow in Leda Clay. \$10 M damage including destruction of church complex. 3 dead.
- 1957: Prince Rupert, B.C.** 1957-11-22. Debris avalanche triggered by heavy rains buried 3 houses. 7 dead.
- 1959: Revelstoke, B.C.** 1959-03-27. Landslide triggered by highway construction struck house. 4 dead.
- 1960: McBride, B.C.** 1960-09-07. Debris flow; victims were highway construction workers. 3 dead.
- 1962: Rivière Toulnostouc, Que.** 1962-12-11. Workers killed by landslide in Leda Clay caused by blasting. 9 dead.
- 1962: St-Joachim-de-Tourelle, Que.** 1963-12-11. Earthflow in Leda Clay; victims drove into landslide crater. 4 dead.
- 1964: Ramsay Arm, B.C.** 1964-09-16. Debris flow caused by heavy rains struck logging camp. 5 dead.
- 1965: Hope, B.C.** 1965-01-09. Massive rock avalanche buried 2 vehicles on B.C. Highway #3. 4 dead.
- 1965: Ocean Falls, B.C.** 1965-01-14. Slush avalanche/debris flow caused by melting snow struck community. 7 dead.
- 1968: Camp Creek, B.C.** 1968-06-05. Debris flow caused by heavy rains struck car on Trans-Canada Highway. 4 dead.
- 1969: Porteau, B.C.** 1969-02-09. Rockfall struck car at Porteau Bluffs on Squamish Highway. 3 dead.
- 1971: St-Jean-Vianney, Que.** 1971-05-04. Rapid retrogressive earthflow in Leda Clay swept away 40 homes, bridge. 31 dead.
- 1971: Boothroyd, Fraser Canyon, B.C.** 1971-05-04. CNR train derailed by rockfall. 3 dead.
- 1972: Michel, B.C.** 1972-03-20. Debris flow from a coal mine waste dump struck CPR maintenance crew, 16 km west of Crowsnest. 3 dead.
- 1973: Harbour Breton, Nfld.** 1973-08-01. Debris avalanche struck houses. 4 houses swept into harbour and destroyed. 4 dead.
- 1975: Devastation Glacier, B.C.** 1975-07-22. Rock avalanche buried a geophysical survey crew. 4 dead.
- 1980: Belmoral Mine, Val D'Or, Que.** 1980-05-20. Cave-in of mine roof triggered a flow of lacustrine sediments into mine workings. 8 dead.
- 1981: M-Creek Bridge, Squamish, Highway 99, B.C.** 1981-10-28. 4 vehicles plunged into creek after debris flow had destroyed bridge on Squamish Highway during heavy rains. 9 dead.
- 1990: Joe Rich, B.C.** 1990-06-12. Debris avalanche caused by heavy rains destroyed house. 3 dead.
- 2010: St-Jude, Que.** 2010-05-10. Earthflow in Leda Clay destroyed home. 4 dead.

Most of the information is derived from Evans, S.G. 2001. « Landslides »; in A Synthesis of Geological Hazards in Canada, (ed.) G.R. Brooks: Geological Survey of Canada, Bulletin 548, p. 43 - 79.