

# Natural Hazard Lesson Plans and Teacher Resources for Canadian Classrooms

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## Summary

Natural hazard knowledge, taught in the primary and secondary schools, can build greater awareness and preparedness across entire communities. To ensure that adequate resources are available for classroom use, the Geological Survey of Canada has recently prepared a series of authoritative, easily understood, easily reproduced, on-line resources on Canadian geohazards. These include maps, images, fact sheets and an extensive series of lesson plans designed for junior elementary to senior secondary grades.

## Introduction

Education is considered to be the first step in the successful mitigation of natural hazards and the formal education of children and youth in the school is considered to be particularly effective (e.g. Ronan and Johnston, 2003). Learning about a hazard and what to do before, during and after an event helps to prepare students to react and to help their family and community in times of disaster; the message reaches the family through the student; and it educates the next generation of citizens, thereby heightening awareness across entire communities.

This viewpoint was reinforced at the recent 2009 Global Platform for Disaster Risk Reduction, when the education of children was identified as a cornerstone of disaster reduction and teacher training and support was identified as the key (UNISDR, 2009). These messages reinforce the position of the United Nations International Strategy for Disaster Reduction Secretariat which produced an information kit entitled "Let Our Children Teach Us! - A review of the Role of Education and Knowledge in Disaster Risk Reduction" (Wisner, 2006). This review examined good practices to reduce disaster risk through education, knowledge and innovation and several gaps were noted for primary and secondary school curriculum. It asserts that teaching about geological or climate hazards is not enough to promote risk awareness or action on the part of students, but needs to be part of a comprehensive package that also includes disaster prevention and preparedness. Conversely, sole emphasis on behaviour preparedness for a hazard, without teaching hazard processes and context, is superficial and may not be retained. One specific recommendation was that some of the teaching should focus on locally relevant hazards. This review also stressed the absolute importance of inclusion of hazard education in school curriculum and concluded that teacher training and support is the key to a balanced and comprehensive approach to disaster risk reduction in primary and secondary education.

## The Canadian Case

Are current Canadian classroom resources adequate to educate our youth in geohazard awareness and preparedness? The lack of emphasis on Earth sciences in the curriculum may suggest that hazards and preparedness are marginalized by the curriculum. In addition, in Canada, as elsewhere, it has been acknowledged that present classroom resources may be unequal to addressing the task of earth science education. It may be that the teacher lacks the knowledge or the confidence to effectively teach the topic (van der Flier-Keller, 2008). It may be that the teacher lacks the materials to effectively engage the students. Textbooks may or may not be accurate and up-to-date (Williams, 2006), or even unavailable. Textbook examples are rarely Canadian, much less locally relevant. Finding Canadian datasets and theme maps for

classroom use can be difficult. Extra resources are often beyond the classroom budget and sometimes borne by the teacher personally. Some resources, used in the past, go out of print and become unavailable.

Although the above comments encompass all Earth sciences topics, it is likely that the perceived inadequacy in textbook and other resources is equally true for the teaching of natural hazards. Teachers must spend considerable time searching the web for resources and, without adequate training in the subject, may not know how to judge the accuracy of the materials they find there, or the found material may deal with examples from distant areas. Focusing on distant hazard events, no matter how dramatic, can create two problems. Firstly, without local relevance, it may not sufficiently engage the student and the important messages may fail to be retained and carried forward into home and community. Secondly, it encourages a 'not-in-my-backyard' reaction, actually suppressing awareness of local hazards.

## **New Geohazard Products from the Geological Survey of Canada**

In answer to these perceived needs, the Geological Survey of Canada has prepared a series of authoritative, easily understood, easily reproduced, on-line resources on Canadian geological hazards to be coupled with the "be prepared" Public Safety Canada message.

Requests from teachers for information comparable to the 1996 Canadian Natural Hazards poster, now out of print, have led us to compile and update material derived from this poster. At this time, the hazards include earthquakes, tsunamis, landslides and floods. Rather than a wall poster, materials are page-sized and generally in black and white format for easy printing in the school and will soon be available free from our website. The resources include Canada-scale theme maps, disaster timelines and event vignettes for each hazard, as well as information on personal preparedness.

The Geological Survey of Canada has also prepared an extensive series of lesson plans covering earthquakes, tsunamis and landslides. These lessons, in PDF format and in English or French, are available for free downloads from the Natural Resources Canada's Geoscape website ([geoscape.nrcan.gc.ca](http://geoscape.nrcan.gc.ca)). Each includes lesson instructions for teachers (with extra comments and the answers provided), all necessary data, map or image resources (designed for easy page-sized printing), links to on-line resources, and student worksheets. All lessons have been reviewed by a teacher. The lessons have been designed for a range of age and grade levels ranging from junior elementary to senior secondary school and they are suitable for inclusion in general science, Earth science, and physical and regional geography courses. Some lessons are multi-disciplinary. Some lessons are adaptable to a range of ages and can be used wherever they fit the curriculum needs. Some lessons may not easily fit the prescribed curriculum, but are hopefully included because of their importance to geohazard preparedness. The lesson choices for each hazard span geological processes, emergency preparedness, urban planning and hazard mitigation and, most importantly, they provide Canadian examples and datasets. Many address regional issues, particularly important when the actual processes comprising the hazard are locally controlled and vary across the country. The lessons are generally stand-alone, although occasionally they build on an earlier lesson. Lessons include teacher presentations, classroom discussions, lab activities or demonstrations, student research activities, mapping and map analysis, data plotting and data analysis, questions, quizzes and vocabulary games, and creative writing and design activities. The following lists briefly describe the lessons for each hazard.

### **Earthquakes**

1. Introduction to Earthquakes: An introduction to earthquakes for young students, including questions for class discussion, easy demonstrations, map analysis, and an earthquake safety drill. Junior Elementary School.

2. Creative Essay: Students write a 'newspaper article' describing an earthquake, written as if they were there at the time of the event. Junior Elementary School.
3. Introduction to Earthquakes: A teacher-led lesson introducing earthquakes, including cause, seismic waves, magnitude and intensity, and where they commonly occur. The lesson involves classroom discussion, map analysis and a brief lab demo. Grades 7 to 9.
4. Earthquake Vocabulary Game: Crossword puzzle. Grades 7 to 9.
5. Brochure on Earthquakes and Safety: Students create a brochure, focusing on advice to increase personal safety. Senior Elementary School.
6. Earthquakes in Canada: Student research using the Earthquakes Canada website to answer questions about Canadian and local earthquakes. Grades 7 to 12.
7. Locate the Earthquake Exercise: Students use seismograms and calculate the epicentre. Several Canadian earthquakes are provided. Grades 7 to 12.
8. Earthquake Quiz: Senior Secondary School.
9. Earthquake Damage and Earthquake Preparedness: Students research earthquake hazards and ways to reduce risk and make group presentations to class. Senior Secondary School.

### **Tsunamis**

1. Introduction to Tsunamis: A teaching lesson. Senior Elementary School.
2. Tsunami Demonstration: A lab demo of tsunami waves. Senior Elementary School.
3. Tsunami vocabulary games. Senior Elementary School.
4. Creative essay: A 'newspaper article' about either the Grand Banks or the Port Alberni tsunami disaster, written as if they were there at the event. Senior Elementary School.
5. Tsunami Damages: Students assess the possible damages that might occur if a tsunami struck a Canadian community of their choice. Senior Elementary School.
6. Tsunami Brochure: Students design and create a brochure about tsunamis, including advice on increasing personal safety. Senior Elementary School.
7. Introduction to Tsunami: An introduction to tsunami waves and tsunami hazard in Canada, followed by a student exercise involving calculations of wave velocity, amplitude and travel time and explanation of the results. Secondary School.
8. Create a Tsunami: A lab experiment, designed and conducted by students, to generate and measure tsunami waves and prepare a scientific report. It is followed by a classroom demonstration and discussion. Secondary School (adaptable to senior elementary classes).
9. Exploring the Damages of the 1929 Grand Banks Tsunami: A mapping and database exercise. Secondary School.
10. Tsunami Warning System: Introduction to tsunami warnings, followed by an exercise to calculate velocity, amplitude and travel time of an earthquake-induced tsunami and preparation of a tsunami warning notice for Prince Rupert. Secondary School.
11. Emergency Preparedness Plan: Students research and create an emergency preparedness plan for Port Alberni. Secondary School.
12. Brochure on Tsunamis and Safety: Students create a brochure about tsunamis, including advice on how to increase personal safety. Secondary School.
13. Tsunami vocabulary crossword puzzle: Secondary School.
14. Tsunami Quiz: Secondary School.

## Landslides

1. Introduction to Landslides: A teaching lesson using the Landslides in Canada PowerPoint presentation (download from Hazardscape) and accompanying notes.
2. Make a Debris Flow: This lab demonstration is an easy and fun way to effectively produce a model debris flow landslide in the classroom. Use as a simple demonstration or an experiment comparing different slope angles and sediment textures. Suitable for all grades.
3. The Frank Slide: A word search puzzle, map exercise, classroom discussion, and creative writing assignment on the historic Frank Slide. Junior elementary school.
- 4a. Landslide Quiz: Grades 7 to 9.
- 4b. Landslide Quiz: Senior secondary school.
5. Landslides in Canada – History of Disasters: Students graph and analyze a database of landslide disasters. Followed by a classroom discussion. Intermediate to senior students.
6. Landslides in Eastern Canada – Earthflows: Students learn about the main landslide type of eastern Canada – rapid earthflows in marine clay. Grades 7 to 9.
7. Prairie Landslides: Map interpretation, topographic cross-sections, and discussion of landslides along river valleys in the Prairies. Intermediate to senior students.
8. Landslides in Eastern Canada: A teaching lesson about the sensitive marine clay of eastern Canada and students use real data to calculate the depth of potential failure along a river and use borehole stratigraphy to determine the most and least hazardous areas along a valley. Senior Secondary School.
9. Debris Flows in British Columbia: Students discover the relationship between weather conditions and landslides by graphing and analyzing precipitation and runoff data prior to historic debris flow landslides in North Vancouver. Senior Secondary School.
10. Reducing Risk from Landslides: A classroom discussion focusing on reducing risk from landslides – minimizing personal risk and how communities reduce risk. Secondary School.

## Conclusions

There is compelling evidence that education of school age children leads to increased preparedness and reduced risk and that steps must be taken to ensure that children are exposed to hazard information in school. The free on-line products recently released by the Geological Survey of Canada will contribute significant new resources for Canadian teachers.

## References

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