

A Review of Three Significant Geohazards in the Canadian Cordillera: the Case of River Floods, Debris Flows/Floods, and Debris/Rock Avalanches

Olav Slaymaker

Department of Geography, The University of British Columbia, Vancouver, Canada

Abstract: Research into sudden-onset geohazards, such as river floods, debris flows/floods and debris/rock avalanches is prominent in literature on the Canadian Cordillera. The unresolved question is the relative importance of river floods, debris flows/floods and debris/rock avalanches over shorter and longer time scales and at smaller and larger spatial scales. River flooding is the costliest geohazard at regional scale and over century time scales but debris/rock avalanches are the deadliest at individual slope scale and over seasonal time scale. In terms of work done on the landscape, debris flows/floods are the most pervasive geohazard and have a huge influence on the long-term moulding of the landscape but figure less prominently in terms of fatalities and cost. Intensified land use, such as forestry, mining, agriculture and urbanization, is the primary reason for the increase in the cost of geohazards to society over the past three decades but climate change adds further uncertainties to the assessment of future geohazards.

Keywords: Canadian Cordillera, geohazards, forestry, mining, agriculture, urbanization, river floods, debris flows/floods, debris/rock avalanches

1 Introduction: Definition of Geohazards

Geohazards have been defined as long-term or short-term geological and environmental processes that lead to damage or risk. Geohazards may operate over small areas but they can also affect local and regional economies (Koch 1995). The reflexive relation between society and the environment is implicit in this definition such that, in the absence of people, there are, strictly speaking, no geohazards (White 1974). Three suites of sudden-onset geohazards that are known to be important in the Cordillera have been selected for review, namely river floods, debris flows/floods and debris/rock avalanches (as defined in Hungr et al 2001). Other sudden onset geohazards, such as earthquakes, tsunamis, volcanoes, meteorites, snow avalanches and geomagnetic hazards, are difficult to evaluate because of the shortage of historical data (Brooks

et al 2001). The economic impact of a hypothetical magnitude 6.5 crustal earthquake with a focus 10 km beneath Vancouver, for example, could cause a total economic loss of 14 - 32 billion dollars (Etkin et al 2004).

2 Causes of Instability in the Canadian Cordillera

There is a high incidence of slope and channel instability in the Canadian Cordillera, the mountainous region of western Canada that includes most of Yukon and British Columbia and parts of Alberta and Northwest Territories. The total area of the Cordillera is 1.6 million km². The Cordillera is tectonically active, volcanism is widespread, ground subsidence and snow avalanches are common; permafrost is widespread in discontinuous, sporadic and isolated form and, in the present context of

* Corresponding Author: Olav Slaymaker, Email: olav.slaymaker@ubc.ca, Tel: