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**VULNERABILITY TO NATURAL DISASTERS IN A RAPIDLY-GROWING, AFFLUENT
SOCIETY, BRITISH COLUMBIA, CANADA.**

By

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Wilfrid Laurier University

Bachelor of Arts
Wilfrid Laurier University, 1994

THESIS

Submitted to the Department of Geography
in partial fulfilment of the requirements
for the Masters of Arts degree
Wilfrid Laurier University
1999

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ABSTRACT

British Columbia is a province that experienced rapid demographic, urban and economic growth in the past few decades. It is a modern and technologically sophisticated society. Although the province possesses the knowledge and resources to combat most dangers that threaten its people and communities, these dangers continue to outstrip the precautions and safety measures in place. The reasons for this seem to lie less in the characteristics of dangers or hazards, but rather relate to socioeconomic processes and organisations that disadvantage particular people, groups and sectors of the population, or make them more vulnerable to dangers than others. This thesis is directed towards exploring this phenomenon.

The main objectives of this thesis are to: (1) examine the vulnerability to natural disasters of British Columbia's people and communities, and (2) demonstrate how socioeconomic order and processes can create or exacerbate different forms of vulnerability in some groups. These objectives are met mainly by applying existing vulnerability theories to British Columbia, including how we describe vulnerable individuals, groups and sectors, the forms of vulnerability that affect them, and the forces that contribute to them.

British Columbia's recent prosperity and growth marginalised some individuals, groups and communities, pushing them closer to the edge of the province's social, economic and political systems. They widened social gaps and regional differentiation between Vancouver and the rest of the province, leaving some groups disadvantaged, powerless, unprotected, and/or exposed to dangers.

Issues of vulnerability that pertain to peripheral resource communities include: (1) dependency on industries that are mobile, and controlled by unstable world market prices and availability of the remaining resources that they extract, (2) little to no influence on policies and organisations that affect their own interests and govern public resources, and (3) deterioration of physical landscape from resource extraction.

In Vancouver, rising living costs sent people seeking accommodation elsewhere, resulting in some people living in more vulnerable locations or situations. These include: (1) homelessness and involvement in illegal activities such as prostitution and drug trafficking and use, (2) those who migrated further from work, placing them in vehicles for longer periods of time, and thus increasing exposure to road risks, (3) those who migrated to satellite and peripheral communities which in themselves are often more vulnerable, and (4) those who remained in Vancouver where higher living costs meant less resources available for other "non-essential" expenditures.

Other issues contributing to vulnerability in some individuals, groups or sectors include: (1) dependencies, (2) tenancy, (3) poverty, and (4) tourists and other visitors.

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CHAPTER 1. INTRODUCTION

British Columbia experienced rapid demographic, urban and economic growth in the past few decades, particularly so in Vancouver and its suburbs. Much of this growth involved significant development in resource-based communities, and suburban cities, as well as intensification of existing infrastructure in Vancouver. However, numerous natural hazards continued to subject the province's people, infrastructure and social activity to danger. Floods and debris torrents often inundate occupied areas adjacent to creeks along the province's coastline. Large and countless small landslides plague mountainside activity and transportation corridors. Even though no serious damage has yet resulted from earthquakes, a history of them, and even earlier evidence of significant volcanic activity in the region, suggest these are continuing threats. However, these dangers only add to those that are often associated with urban intensification such as problems of congestion, pollution, crime and homelessness. Although the province is a modern and technologically sophisticated region, and possesses the resources, such as capital and access to "cutting-edge" technologies and research, to combat most of the dangers that threaten its people and communities, these dangers still continue to outstrip the precautions and safety measures in place, and result in accidents, emergencies and disasters. This thesis is directed towards exploring this phenomenon.

Natural hazards contributed to 145 disastrous events¹ in British Columbia between 1990 and 1995. However, approximately one hundred of these events were small and readily responded to, such as vehicle collisions, flooded highways, and avalanches that killed or injured skiers. However, a number of these “accidents” involved recreational participants which accounted for thirty-two deaths and twenty-seven injuries. This result seems to warrant that some attention be given to this group’s vulnerability. Table 1.1 summarises the number and characteristics of these recreational accidents.

Forty-two of the inventoried events were more significant in terms of damage and disruption. Almost half of these events involved large rain, wind, and snow storms and their impacts included losses of power to thousands of household, large evacuations from fires and floods, and damage to properties from water, wind and landslides. Additionally, eight of these events overwhelmed entire communities. They are regarded as disasters. In some cases the destruction was rapid, while in others, prolonged. In Salmon Arm, for example, a fifteen minute hail storm in August 1994 caused an estimated \$10,000,000 in damages to homes and businesses. The Salmon River inundated Sayward and interrupted “normal” life for over three weeks in November 1990. Table 1.2 lists natural hazards by the number of accidents, emergencies and disasters that occurred in the province between 1990 and 1995. A sample of these events can also be viewed in the Appendix.

1 An inventory of disastrous events in British Columbia between 1990 and 1995 was created. Its records were drawn from damaging and disruptive events, attributed in part to natural hazards, reported in the Vancouver Sun. Record classification as accident, emergency or disaster adheres to the properties outlined in Chapter 2, Table 2.1 (Britton, 1986, and Quarantelli, 1994).

Table 1.1 Recreational Accidents in British Columbia, 1990-1995.

Hazard	Events	Comments
Flood	2	stranded 10 people in national park; damaged historical park.
Landslide	2	stranded 5 people at hot springs when bridge destroyed; 1 dead (caver).
Snow Avalanche	14	22 dead and 14 injured (skiers, hikers, and rescue team).
Storm	5	6 dead and 3 injured (hikers, and whale watchers).
Wildlife Attack	11	3 dead and 10 injured (hikers, campers, and hunters).

Table 1.2 Disastrous Events in British Columbia, 1990-1995 (Hazard by Crisis Type).

Hazard	Accident	Crisis Type:			Total
		Emergency	Disaster		
Disease	5	3	0	8	
Extreme Heat	1	0	0	1	
Flood	4	6	6	16	
Fog	6	1	0	7	
Fire	2	3	1	6	
Ice Flow	1	0	0	1	
Rock/landslide	21	4	0	25	
Snow Avalanche	19	0	0	19	
Storm	25	17	1	43	
Wildlife Attack	19	0	0	19	
Total	103	34	8	145	

Interestingly, the eight disaster events occurred in relatively small, and often remote communities outside of the Lower Mainland. In fact, most of these events happened in southern interior communities such as Princeton, Penticton, and Salmon Arm. Figure 1.1 contains a map of the location and date of each disaster event. In contrast, most emergency events were located in Vancouver and its suburban communities and often remedied from within the affected locations, rather than by external assistance and aid, such as in the case of the eight disaster events. This relationship, as well as the characteristics of the impacted people and communities in the inventory, seem to suggest that there is more involved in vulnerability than simply

exposure to hazards and their impacts.

Emergence of a Problem

Why, in a region with the knowledge and resources to combat most dangers, do they still often result in accidents, emergencies, and disasters? The answers to this problem seem to lie less in the characteristics of dangers or hazards, but rather relate to

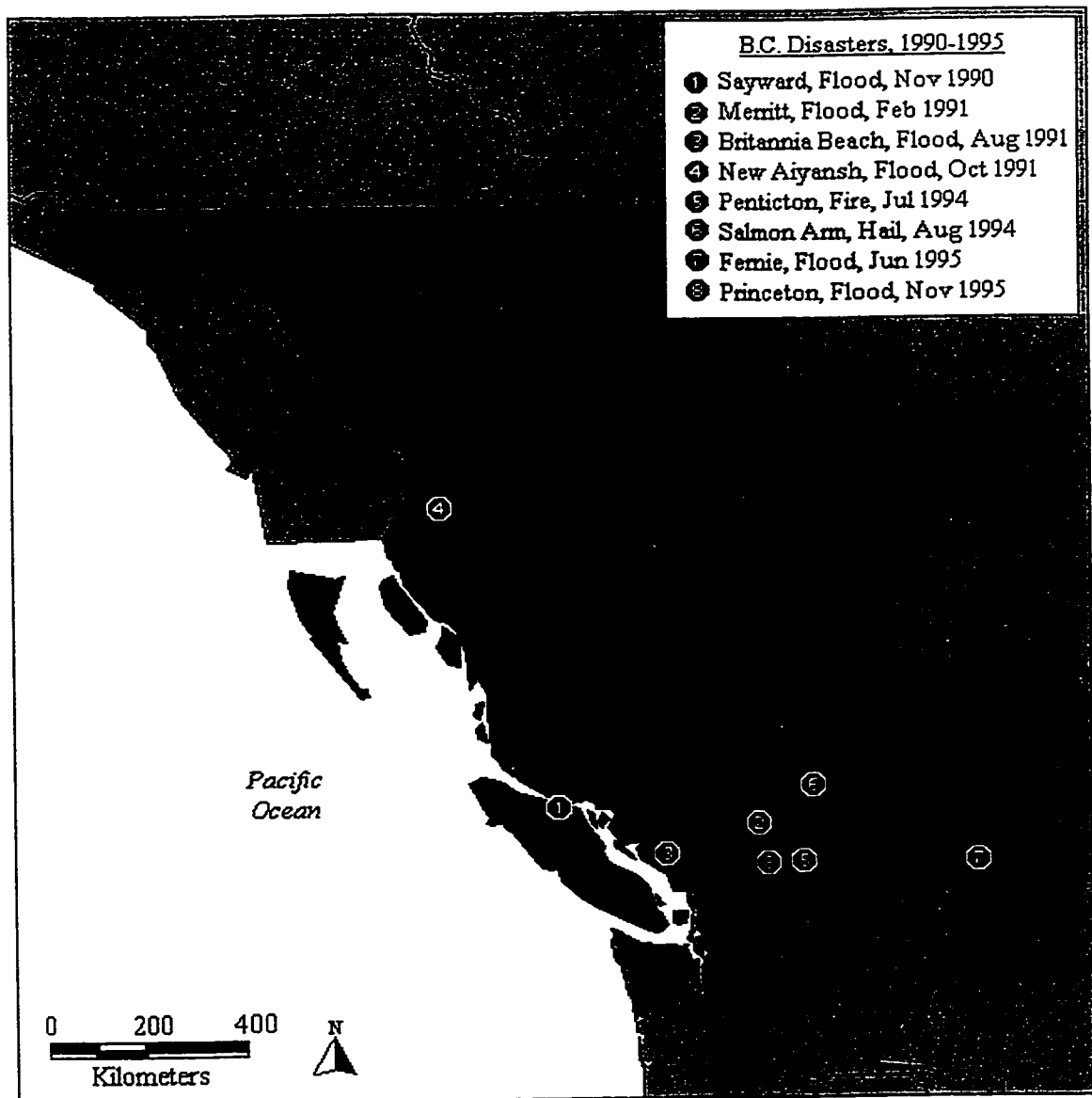


Figure 1.1 Locations of British Columbia Disasters, 1990-1995.

social processes and organisations that disadvantage particular people, groups and sectors of the population, or make them more vulnerable to dangers than others. In British Columbia, this problem seems even more mysterious in light of the region's recent prosperity and growth. "Good" effects are typically associated with growth. For example, it is reasoned that growth increases available resources and living standards. However, this is not an entirely true or complete picture of growth since it is never evenly distributed and often double edged. In more cynical words, the good fortunes of some often lead to the misfortunes of others.

The main objectives of this thesis are to: (1) examine the vulnerability to natural disasters of British Columbia's people and communities, and (2) demonstrate how socioeconomic order and processes can create or exacerbate different forms of vulnerability in some groups. Although the thesis primarily concentrates on natural hazards and disasters, most of the same social processes seem to apply and contribute to a population's vulnerability to other human and social dangers; natural hazards are often only one of numerous dangers that threaten 'the vulnerable.'

Methods

The thesis objectives are addressed mainly by applying existing vulnerability theories to British Columbia, including how we describe vulnerable individuals, groups and sectors, the forms of vulnerability that affect them, and the forces that contribute to them. It is argued that socioeconomic and political organisation are the main factors affecting where people build, live and work. These define who are more likely to be

exposed to hazards against which they are unprotected and, more importantly, who are weaker and less able to cope with and recover from dangers. This approach to vulnerability, which is against the mainstream view, goes beyond simply identifying areas and people that are exposed to particular hazards, rather it has greater concern with describing disadvantage and frailty.

Hewitt (1997, 27) outlined some basic forms in which vulnerability arises and can increase damage from given dangers. Through out this research, vulnerability is usually discussed in, or in a combination of, these forms:

- 1) **Exposure** to dangerous agents and environments.
- 2) **Weaknesses** – predisposition of persons, buildings, communities or activities to greater harm.
- 3) **Lack of protection** against dangerous agents and for weaker persons and items.
- 4) **Disadvantage** – lack of resources and attributes to affect risks or respond to danger.
- 5) **Lack of resilience** – limited or no capability to avoid, withstand or offset and recover from disaster.
- 6) **Powerlessness** – inability to influence safety conditions, or acquire means of protection and relief.

Existing vulnerability theories and the forms of vulnerability that pertain to them are discussed. These include:

- 1) **Differential vulnerability** – This is an underlying assumption of most vulnerability theories and it states that some people are more susceptible to danger than others even though they are in the same location and under the same physical conditions. Moreover, it gives definition to the “geography” of vulnerability. Vulnerability is more than just exposure to hazards and its geography, more than

human occupancy of dangerous places in relation to the occurrence of hazardous events.

- 2) **Social relations of production** – Socioeconomic processes and relations of production are causal processes of disaster. In other words, disasters can be seen as instances in the system of social reproduction.
- 3) **Marginalisation** – Exploitation, based on the world economy, causes disaster through deterioration of socioeconomic conditions and the physical environment. Moreover, marginalised people exist on the social, political and economic peripheries and have unequal access to the resources needed to cope with dangers.
- 4) **Systemic disruption** – Increasingly complex social, technological and economic linkages, and the general public's reliance on their normal functioning can reverberate disruption throughout the entire social system and thus increase vulnerability through wider exposure, both spatial and temporal, to danger.
- 5) **Risk inherent in technological advances** – As technology expands and is more readily used, high-risk systems with catastrophic potential are created. Some even argue that accidents in them are inevitable and even normal. (Perrow, 1984)

These theories provide a basis and starting point for the thesis's exploration of vulnerability in British Columbia. All of these theories place more emphasis on aspects of social landscapes or social spaces (i.e., socioeconomic relationships and order, technological advances, etc.), and seemly less on the distribution or occurrence of dangerous events. With these theories and the supporting disaster inventory in mind, exploration is done on two levels. The first, a macro-study, looks more generally at British Columbia and pays particular attention to the geography of vulnerability. The second, a micro-study, examines a particular vulnerable community in the province and demonstrates different forms of vulnerability that affect it and the forces contributing to

them. Although these studies are mostly descriptive, they are adequately supported by a case history of disastrous events and individual situations compiled from secondary sources (i.e., articles, published data, etc.).

Macro-Study

The macro-study looks more generally at British Columbia. It pays particular attention to the geography of vulnerability since many differences exist between regions and thus some aspects can become more important, in terms of vulnerability, to one than the other. Socioeconomic processes and “relations of production” provide the starting point in exploring vulnerability in the province since these are the main forces that determine a community or individual’s position in the social system. Additionally, the theory of systemic disruption is applied to the province, initiating discussion on resulting forms of vulnerability.

In British Columbia, there is a large difference between Vancouver and peripheral resource communities, as well as variations within each. Therefore, issues concerning each are dealt with separately. In addition, a distinction is made between the issues involving the different scales of disaster, i.e., those concerning an individual’s vulnerability to accidents as opposed to a general community’s vulnerability to disasters.

Micro-Study

The micro-study’s main objective is to demonstrate how socioeconomic processes and forces can contribute to different forms of vulnerability in some groups. With this in mind, a case study was “hand-picked” from the eight inventoried disaster events. More

specifically, the micro-study examines Britannia Beach where many vulnerabilities were brought to light by a debris flood on 29th August 1991 that resulted in significant damage and financial loss to many residents and businesses in the lower-town.

Britannia Beach is an “extreme” case relative to the rest of British Columbia. Although there are some similarities between this community and vulnerable groups in other communities, this micro-study should be considered as atypical. Britannia Beach exists on the social, political and economic periphery of the province and has unequal access to the resources needed to cope with dangers. The rationale for selecting an extreme case is that vulnerability and its contributing forces seem more pronounced and better demonstrated in such cases of disaster. In comparison to Britannia Beach, other micro-areas are often marginalised by only a few of these aspects, or only small numbers of their populations are likewise affected.

The vulnerability of families in the micro-study is relatively uniform, in part due to the small scale, thus internal geographical variations seem less important and social space more so. However, it is very important to place the micro-study itself in geographical context and describe its connections to surrounding regions, since vulnerability is often externally generated. The forms of vulnerability are discussed and explored through changes in the social landscape and history of disasters. Moreover, the description of the micro-area’s vulnerability is supported by individual situations in connection to the 1991 disaster event. These situations are compiled from local newspaper articles, as well as personal conversation with museum executives and observations gathered from visiting the micro-study area in 1998.

Thesis Structure

Chapter Two develops the theoretical framework of the thesis and discusses the vulnerability theories used to describe vulnerability in British Columbia. A review of literature provides context to the emergence of vulnerability theory. It also examines the contributions of earlier natural hazard and disaster research and interactions that stimulated theoretical diversity and differing viewpoints on the role that vulnerability plays in disasters. Furthermore, it presents a number of vulnerability theories (as noted above), including those more relevant to wealthier social groups, demonstrating that natural hazards are more trigger mechanisms than causal agents of disasters and the 'real' causes are embedded within social, economic, and political processes. Additionally, the chapter reviews existing disaster research specific to British Columbia.

To begin to understand the nature of British Columbia's susceptibility to hazards, its contributing factors are first identified and then placed in a geographical and historical context. Chapter Three provides an overview of the physical landscape and the social and economic organisation of the province, and explores the sources and reasons for its recent and rapid growth. Moreover, the chapter describes the population and its recent evolution. Only then are some pieces to the 'vulnerability' puzzle recognisable and suggesting some methods to explain it. The province's vulnerability is discussed both in terms of exposure to hazards, including the social processes that force or encourage it, as well as other forms of vulnerability.

Chapter Four draws on a micro-study of a disadvantaged community in British

Columbia to demonstrate changing patterns of vulnerability. This particular case study exemplifies many of the points made in Chapter Three. Vulnerability seems closely tied to power and control. It touches on the forms of vulnerability associated with social issues such as land ownership and tenancy, political powerlessness, and economic restraint. But most importantly, this chapter demonstrates the dynamic nature of people, communities, and societies and how change can either bring a reduction or improvement of safety. Hence, it reminds us that disaster preparedness and planning must be regarded as a continual process to cope with such changing patterns of vulnerability. Finally, Chapter Five restates the thesis's main objectives and methods, and summarises its findings.

CHAPTER 2. REVIEW OF HAZARDS RESEARCH

“70 tornadoes cut destructive path, killing at least 4”; “Huge quake on Pacific buries thousands”; “Flood exodus: 250,000 forced to flee rising waters.”²

Such news headlines have made words like *tornado*, *earthquake*, and *flood* synonymous with disaster. Although these and other extreme natural events have the potential to be highly destructive, they do not necessarily cause disasters. The terms, hazard and disaster, are very different and often mistakenly used interchangeably. Thus, it is important that the distinction between the two terms be made. In his review of hazards research, Mitchell (1989) described this distinction. He defined hazards as “natural events, manufactured systems, and people that threaten our lives and life-support systems, our emotional security, our property, and the functioning of our societies. When these threats materialise and overwhelm our coping capabilities, they are known as disasters” (Mitchell, 1989, 410). A rock avalanche (i.e., a threatening natural event or hazard), for example, on a deserted mountain slope cannot result in disaster, no matter how large the quantity or how fast the velocity of sliding material. A rock avalanche is only a disaster when it directly or indirectly results in death or injury, damages property, and/or interrupts human activities. From Mitchell's definition, it follows that 'natural' disasters are disaster events that include the occurrence of threatening natural phenomena or 'natural' hazards. This does not necessarily mean, however, that natural hazards are causal agents of natural disasters; some works have suggested that natural hazards are

2 Headlines are taken from various newspaper sources: Vancouver Sun, 20 May, 1995, A18; Vancouver Sun, 29 May, 1995, A1; and Calgary Herald, 2 February, 1995, A3, respectively.

merely trigger mechanisms of the disasters imbedded within social, economic, and political processes.

Terms such as 'risk' and 'vulnerability' are also closely associated with natural hazards and disasters and often appear in the literature. With the term 'hazard' reflecting a source of danger or potentially harmful event, 'risk' is the likelihood of such events occurring. Therefore, it follows that a high- or low-risk region refers to a geographic location with a high or low probability of danger respectively. However, this is not to say that risk only represents the frequency and distribution of dangerous events such as hurricanes, blights, and floods, rather it is, in the broadest sense, socially constructed and much more complex. As Hewitt (1997, 22) stated, "it embraces exposure to dangers, adverse or undesirable prospects, and the conditions that contribute to danger." Also, assigning a true value or rank to risk is somewhat hopeless since, as Douglas and Wildavsky (1982, 2) stated, we "do not uniformly attach the same dangers to different objects." 'Vulnerability' relates to attributes of people and communities, and social processes that can increase damage from given dangers or hazards. It is an important part of both risk and disaster, and is discussed later in this chapter at greater length and detail.

It also seems to make sense to distinguish between threats and losses affecting individuals or households, perhaps that are widely scattered throughout society such as heart attacks, and those that affect the general community. There are problems, however, relating to what is identified as a 'disaster' and of the scales of damaging event that warrant using the term. Many attempts were made to categorise the levels of social crisis or collective stress situations (re., Barton (1969) defined them as failures to receive the

expected conditions of life such as protection from the physical environment and attack, and provision of food, shelter, and income) and to distinguish a disaster from other types of 'less disastrous' events. Words such as calamity, micro disaster, mass emergency, and tragedy often appeared in the literature. Of particular note, Britton (1986) helped to disentangle the different scales of disaster, bringing them into the sphere of everyday conditions. He focused on three distinct types of social crisis – accidents, emergencies and disasters – and described each of these categories, as reproduced in Table 2.1, by their likely properties. Quarantelli (1994) felt an additional need to distinguish between events that may be called 'disasters' and the biggest events that he termed 'catastrophes'. Table 2.1 lists the properties of accidents, emergencies, disasters and catastrophes, and illustrates each with Canadian examples. Both Britton and Quarantelli stressed, however, that all of these levels can be relatively disastrous depending on who they affect. This point was also expressed by Turner (1978, 82) when he wrote that "an elusive line separates the accident from the disaster, a line which can never be finally drawn because any accident may be regarded as a disaster by those close to it." Therefore, a need for objectivity exists.

The Beginnings of Natural Hazard and Natural Disaster Research

The field of hazards research consists of sub-fields that include natural hazard and natural disaster research. The beginnings and subsequent evolutions are as distinct as the terms themselves. However, both share a close connection to public policy and a relevance to decision-makers which has helped to shape their respective methodologies.

Table 2.1 Properties of Accidents, Emergencies, Disasters and Catastrophes, and Canadian Examples (from Britton, 1986, and Quarantelli, 1994, 4-5).

Event	Properties	Examples
Accident	<ul style="list-style-type: none"> • extremely localised and bounded • disruption of only specific interest group (i.e., victims and their significant others) • little to any disruption of general community, but may be minimal disruption around immediate site 	<ul style="list-style-type: none"> • heart attacks • minor auto accidents • bear attacks
Emergency	<ul style="list-style-type: none"> • still localised but not as focalised as accident; may cover block of built up area • substantial number of people directly involved (i.e., victims and helpers) • time lapse between event and its resolution because emergency is more complex in terms of remedial action • small section of the infrastructure is temporarily rendered inactive as emergency services attempt to rectify incident • no disruption of overall social structure or ongoing social system processes of general community 	<ul style="list-style-type: none"> • <u>Oil spill in Vancouver Harbour, Feb 1990.</u> Two ships collided in fog and spilled 40,000 litres of diesel oil. Pollution affected 1.5 km of shore and 1 ha water. 1,000 birds coated and 100s died. Cleanup cost \$250,000. (Source: <i>Vancouver Sun</i>) • <u>Landslide on Sea-to-Sky Highway at Loggers Creek, B.C., Oct 1990.</u> 10,000m³ debris blocked highway for 12 days and severed road link between Vancouver and Squamish-Whistler region. Repairs and new construction est. at \$7M. Emergency ferry terminal built. (Source: <i>Evans and Savigny, 1994</i>)
Disaster	<ul style="list-style-type: none"> • produces overall breakdown in social processes, routines and interactions, requiring societal remedy • number of victims in proportion to total population may be high • chance of widespread destruction of infrastructure • potential to exhaust capabilities of community, thereby making it more reliant of external aid 	<ul style="list-style-type: none"> • <u>Tornado and hail storm in Edmonton, Jul 1987.</u> 1,700 people evacuated, 27 dead and 600 injured. 1000s left homeless. Est. \$300M in damage. (Source: <i>Bird, 1997</i>) • <u>Flood in Fernie, B.C., Jun 1995.</u> 702 people evacuated. 36 homes damaged, 2 highway bridges and one rail washed out. \$11M in payouts. (Source: <i>Vancouver Sun and Emergency Preparedness Canada</i>)
Catastrophe	<ul style="list-style-type: none"> • most or all of total community is impacted, and typically nearby localities are likewise stricken • facilities and operational bases of almost all emergency organisations are themselves directly hit and thus make their operation difficult • local officials often are unable to undertake their usual work roles, and this extends into recovery period • most of normal everyday community functions are sharply and simultaneously interrupted, resulting in “across-the-board” disruption of community life 	<ul style="list-style-type: none"> • <u>Ice storm across Ontario, Quebec, and New Brunswick, Jan 1998.</u> 4+M people without power for some time (300,000 for 3+ weeks). 29 deaths attributed to it. Complete closure of infrastructure, businesses, etc. Est. \$1.5B in short-term costs. (Source: <i>Emergency Preparedness Canada</i>) • <u>Red River Flood in Winnipeg, May 1950.</u> City flooded for 51 days. 107,000 people evacuated (one-third of pop.) and 1 dead. 5,000 buildings damaged. Est. \$606M in damage. (Source: <i>Bird, 1997</i>)

Both sub-fields began at similar times and ran parallel courses, but it was not until the late 1960s and 1970s that researchers within the two sub-fields began to interact and incorporate ideas from each other. It was from this convergence that terms like 'vulnerability' began to take on greater importance.

In discussing the emergence and development of the two sub-fields, reference is being made to the 'main stream' or core of research. This is not in any way denying the existence and importance of divergent or periphery research, as well as any additional parallel efforts.

Natural Hazard Research

Most people credit Gilbert White for initiating natural hazard research and Cutter (1994) even referred to White as the 'grandfather' of natural hazard research. In the 1950s, White became interested in how people respond to risk and uncertainty when faced with extreme natural events. This interest was with respect to one uncertain condition, floods, and in one particular geographic region, the United States. White et al. (1958) examined what happened under the conditions of uncertain flooding in several urban areas across the United States, examining the varying conditions of floods, urban land use, and existing flood mitigation measures. It was concluded that human response to floods modified the cause and the loss, and effected the distribution of loss. By understanding these responses and knowing the spatial distribution of hazards, White surmised that policy be used to guide public and private response to hazardous conditions. Throughout the next two decades, this research paradigm consistently ran

through much of the natural hazard research.

During the next two decades, the scope of natural hazard research broadened to encompass other geographical regions. In Canada, Sewell (1965) studied the problems associated with flooding in the Fraser River Basin. Additionally, research expanded to encompass a wide array of uncertain conditions (i.e., natural hazards). In 1968, Burton, Kates, and White collaborated in examining many types of hazards – specifically : drought, earthquake, flood, frost, landslide, hurricane, snow, tornado, and volcano – in a variety of settings (Burton, et al., 1968). This body of literature was later criticised in the 1970s and a re-examination of its methodology was demanded.

Natural Disaster Research

Disaster studies were largely initiated and shaped by social scientists to support civil defence policy during the Cold War. These studies tended to be very practical in nature, since the United States and other governments both funded the studies and had an immediate need to solve finite problems. Most notable was the research carried out at the National Opinion Research Centre (N.O.R.C.) at the University of Chicago between 1950 and 1954. N.O.R.C. undertook eight systematic field studies of varying natural and non-natural disasters, including an aeroplane crash into a crowd of spectators, three consecutive air crashes in New Jersey, a series of explosions and fires, a coal mine explosion, a series of tornadoes that struck Arkansas, and an earthquake (Fritz and Marks, 1954). Speaking from his involvement with the N.O.R.C. project, Quarantelli (1987) implied that effort was made only to study peacetime disasters that had close parallel to

wartime situations. This was echoed in comments made by Dynes et al. (1994). The disasters chosen to be studied had the common characteristics of being sudden, widespread events with the potential for extensive damage. Other disasters involving events such as droughts, riverine flooding and epidemics were not considered appropriate subject matter. Furthermore, these studies had the notion that the basic problem associated with disasters was to be found in the reactions of people to danger, loss, and deprivation. With this assumption in mind, the intent of the research was to find out how to maintain social control over a disaster-stricken population. This practical focus had a profound effect on early disaster research by influencing methodology and creating a preoccupation with planning for disasters with very little concern on their management.

Interaction Between the Fields

It is of no great surprise that there was very little interaction between these two sub-fields of hazards research in their respective beginnings. Natural hazard research concentrated on human adjustments and mitigation to most forms of threatening natural events, whereas, disaster research was limited to specific hazards (i.e., technological and natural hazards that closely paralleled wartime situations) in specific geographical locations (i.e., the United States). It was not until the late 1960s and 1970s that the two sub-fields began to interact, stimulating debate. This interaction and other interdisciplinary activity increased the theoretical diversity within hazards research. Metaphorically, Mitchell (1989) compared hazards research to a rapidly growing tree: “The roots are spreading out to draw upon an increasingly large number of disciplines for

inputs that enable the trunk to send out many new branches in the form of specialised research institutions and specialised fields of inquiry” (Mitchell, 1989, 414). Included amongst these new arms of research was the evolution of vulnerability.

Evolution of the Vulnerability Perspective

Dissension Voiced

Dissension from the natural hazard field began to surface in the 1970s. Natural hazards research had a wealth of case studies on different types of hazards in various locations, yet, there was still no clear consensus as to why people responded to hazards the way they do. Kates (1971) proposed one of the earliest models of human adjustment to natural hazards. This model is often labelled as the 'human ecological' perspective, in which Kates characterised the human use and natural events systems as separate entities. However, the extreme natural disturbance (or event) remained at the centre of the model. The model reflected a continuing effort, through human adjustments, “to make the human use system less vulnerable to the vagaries of nature” (Kates, 1971, 438).

In criticism to the natural event-centred stream of research, other works argued that natural disasters were more a function of socio-economic and political forces, than natural factors. In an article entitled, *Taking the Naturalness out of Natural Disasters*, O'Keefe, Westgate, and Wisner (1976) strongly suggested that some rethinking was needed on the nature of natural disasters. They went on to plead for some form of precautionary planning that considered vulnerability of a population as the real cause of disaster; furthermore, this vulnerability was induced by constraints placed on their

responses by socio-economic conditions. Additionally, they stressed that these constraints can be modified by man, and were not simply acts of God. The first step in this process was to eliminate the 'naturalness' from natural disasters.

The Spectrum of Approaches to Vulnerability

It is generally accepted that natural disasters involve “an interaction between extreme physical or natural phenomena and a *vulnerable* human group” (Westgate and O’Keefe, 1976, 64, emphasis added). However, the interpretation of this interaction’s importance is a matter of contention. The debate revolves around one’s view or approach to the emphasised term vulnerable. It is best to look at vulnerability as falling within a wide spectrum of ideas and interpretations. The respective viewpoints taken by Kates (1971) and O’Keefe et al. (1976) reflect the emergence of two distinct approaches to vulnerability, the ‘dominant’ and ‘alternative’ approaches. Hewitt (1983) first proposed the notion of a ‘dominant view’ and critiqued it. In contrast to this view, he proposed several properties of disaster that constituted an ‘alternative’ viewpoint. Figure 2.1 summarises the spectrum of approaches to vulnerability.

In examining the causes of disaster, it is important to keep in mind that every disaster is unique in magnitude and nature of disruption, as well as in its causes. Therefore, the relative contributions of the two components to disaster (i.e., threatening 'natural' phenomena, and social or 'human' processes) vary from situation to situation. Keeping this in mind, it is best to view the 'natural' and 'human' components of each disaster as opposing weights on a 'scale of causation' (see Figure 2.2). On one side of the

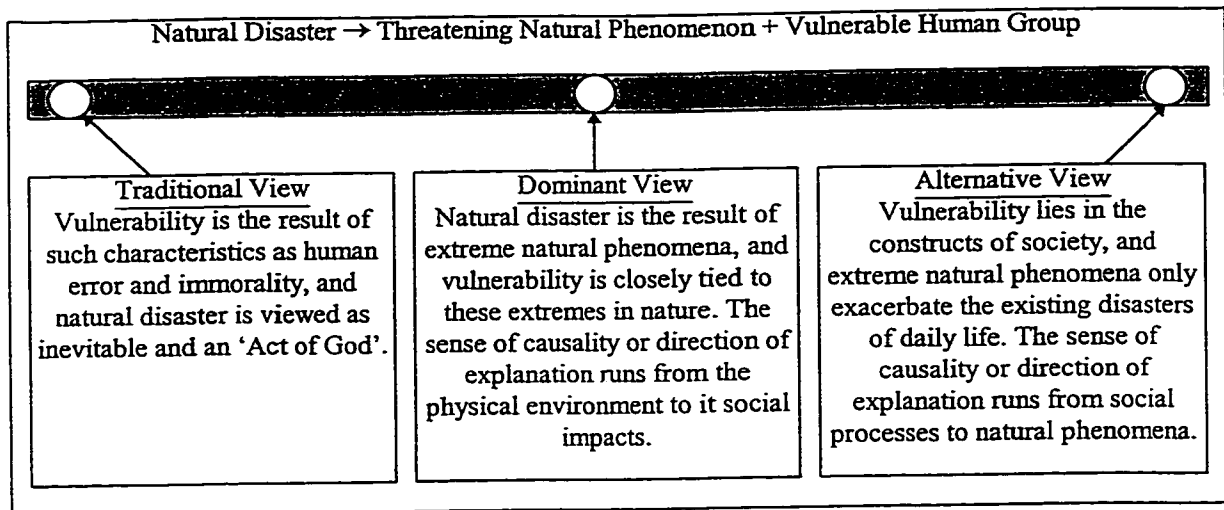


Figure 2.1 The Spectrum of Approaches to Vulnerability (from Hewitt, 1983, 5-29).

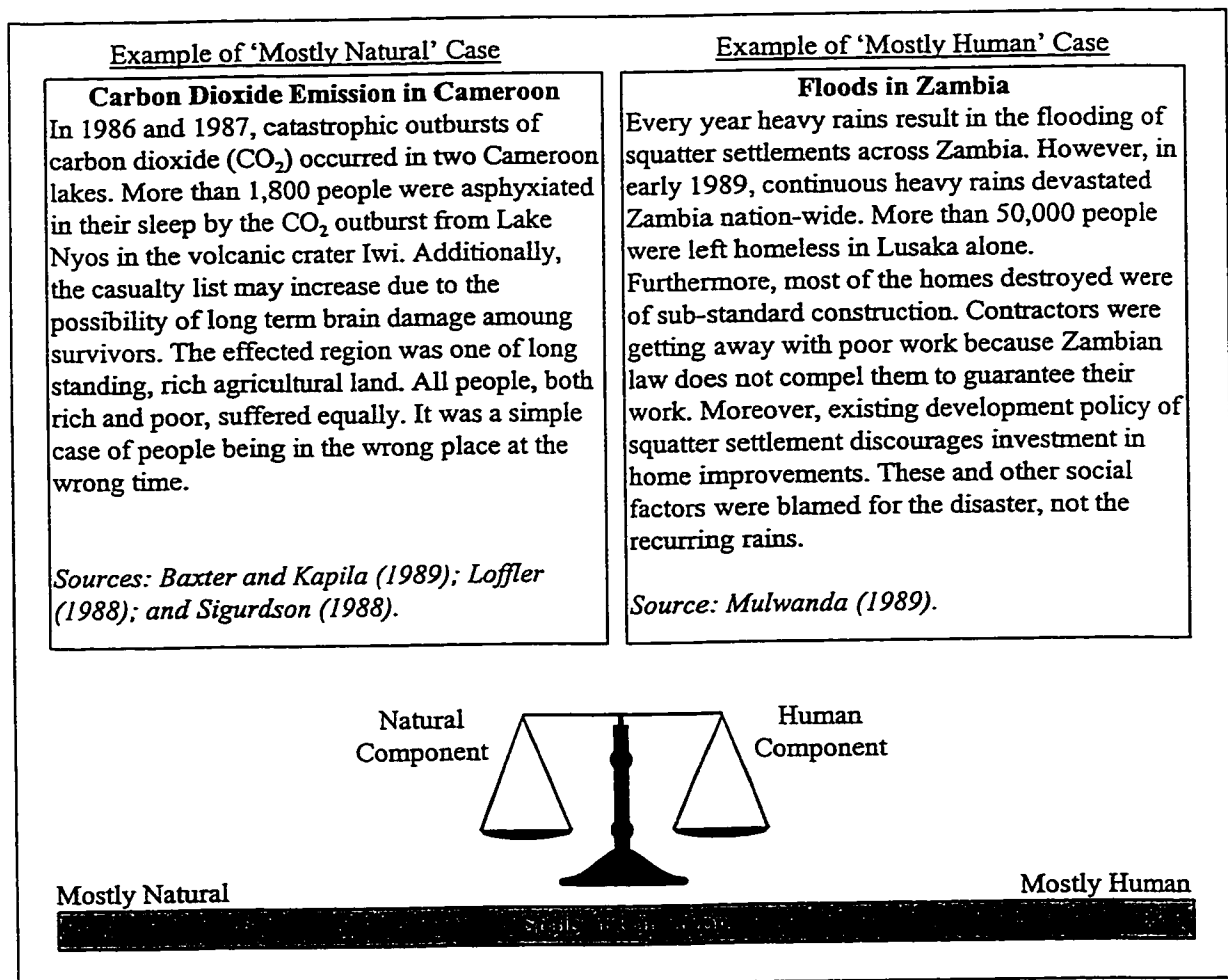


Figure 2.2 Two Examples of Disaster Illustrating the Opposing Sides of the Scale of Causation.

scale, a natural hazard causing disaster can occur in which no 'human' component to disaster exists besides someone being in the wrong place at the wrong time. This scenario is at the 'natural' end of the spectrum of causation. On the other side of the scale, the cause of a disaster is within its 'human' component and the natural phenomenon is merely the trigger mechanism. This scenario is at the 'human' end of the spectrum of causation. Figure 2.2 illustrates these opposing situations with two examples of disaster.

Traditional View

At one end of the spectrum, the causal agent of disaster is viewed, solely, as the impact of destructive natural events on people and their activities. In other words, vulnerability does not play a significant role in disasters. Natural disasters take the traditional view that they cannot be avoided. "They are 'acts of God', both unpredictable and inevitable," (Fournie d'Albe, 1986, 3). As quoted in Maskrey (1989, 2), under the traditional view, a natural disaster is "an unforeseen consequence of unpredictable and uncertain natural forces". Therefore, vulnerability is removed from the generally accepted notion of natural disasters, leaving only the natural phenomena as causal agent.

Under the traditional view, where vulnerability is not a significant element of natural disasters, research focuses on the characteristics of the hazards themselves. Thus, research enables the prediction of a hazard's magnitude and frequency through sciences such as: hydrology, meteorology, climatology, volcanology, and seismology. Exemplifying this viewpoint, Foster (1980) took a naturalist view of disasters in which he placed all blame proportionate to the magnitude of the natural phenomenon.

Additionally, Sheets and Grayson (1979) admitted that most volcanological research is conducted by earth scientists (such as geologists, geophysicists, geochemists, seismologists, and tephrochronologists) and contains a clear focus on natural events and processes. They did stress, however, that an interdisciplinary approach in volcanological research is needed between both earth scientists and social scientists.

'Dominant View'

The majority of research reflects an approach to vulnerability, the dominant approach, that rests near the centre of the spectrum. It is argued that vulnerability lies in a human group's ability to cope with the occurrence of threatening natural phenomenon (i.e., hazard). The assumption is made that everyday life and disasters are opposite. In other words, everyday life is normal – that is secure and productive – and with the interruption of hazard, disaster procures insecurity and unproductivity. Yet, embedded within this assumption (i.e., the interruption of hazard), the hazard remains at the centre of focus, as the causal agent of disaster.

Predominant within the research is the notion of the human ecology of hazards. As in early works, such as Burton et al. (1968), Kates (1971), and Hewitt and Burton (1971), research focused on the interactions between human populations and their environments. All human societies have the means to cope with environmental fluctuations and much has been learned about how people adapt and deal with these predictable fluctuations. Central to this stream of research is a focus on the coping or adjusting mechanisms of societies to hazards. As seen in Figure 2.3a, Kates' (1971)

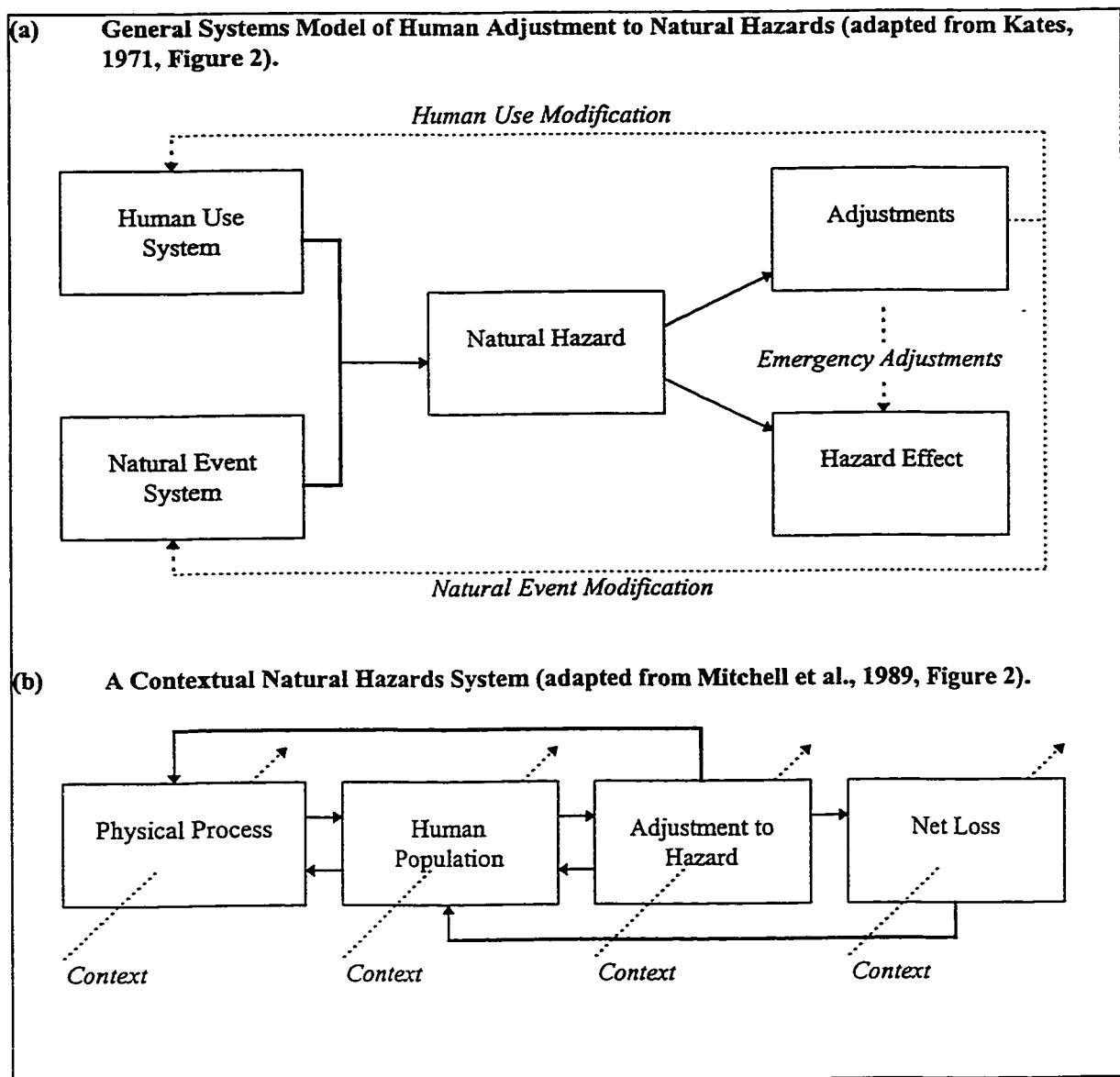


Figure 2.3 Two “Dominant View” Models of Natural Hazard Systems.

blueprint systematic model of human adjustment reinforced the notions that the natural hazard is the causal agent of disaster (i.e., as possible 'hazard effects'), and that human adjustments have the potential to modify the hazard and their vulnerability to it. This model also demonstrates that such 'box and line' diagrams are not realistic. It tries to connect events and complex interactions, and bears little relation to actual places or

conditions. As Hewitt (1983, 13) stated, these “are not models of reality at all, but managerial devices to show the relations among the study areas or dimensions currently fashionable in the discipline and related fields.”

In a practical application that illustrates the dominant viewpoint, Anne White (1974) introduced a model of adjustments to tropical cyclones that was anchored in the geophysical aspects of the hazard and technically based adjustments. She suggested possible human adjustments such as forcing precipitation through cloud seeding, making use of warning systems, and the usage of insurance to distribute the losses. Table 2.2 summarises a range of possible adjustments to the hazard of tropical cyclones as outlined by Anne White.

The dominant approach was reinterpreted in response to intense criticism from Waddell (1977) and, especially, of Torry (1979). In a review of Gilbert White's (1974), *Natural Hazards: Local, National, Global*, Waddell (1977) attacked the limited questionnaire methodology used in his cross-cultural studies as “notable only for their naïveté” (Waddell, 1977, 73). Added to this assault, Torry (1979) called for a total

Table 2.2 Adjustments to the Hazard of Tropical Cyclones (adapted from White, A., 1974, Table 30-3).

Modification of Natural Event	Modification of Damage	Distribute Losses
<ul style="list-style-type: none"> • cloud seeding 	<ul style="list-style-type: none"> • protective shore works • warning systems • evacuation • zoning and building codes • flood and wind-proofing • construction of raised areas as refuges 	<ul style="list-style-type: none"> • insurance • emergency relief • bearing the loss

'house-cleaning' of the entire body of hazards literature and the evaluation of the expertise of particular 'experts' (referring to White, Kates, and Burton) in the natural hazards field. This professional friction caused a reinterpretation of the society-environment interactions in the dominant approach.

Continuing to use a human ecological approach, research was embedded within a larger political, cultural, social, economic, and historical framework. In other words, the natural hazard components (i.e., using Kates' (1971) terminology: natural events system, human use system, adjustments, and hazard effects) were penetrated or overlapped by larger problem sets. Adjustments to natural hazards were just one of many social problems confronting nations, and as a result, they can be overlooked or muted by more pressing problems.

As seen in Figure 2.3b, Mitchell et al. (1989) proposed a natural hazard system to be placed in 'context'. Their proposed system was composed of two subsystems: one consisting of the hazard components, and the other of largely independent exogenous factors that interacted with and modified each of the hazard components. Exogenous factors included such things as: movement of tectonic plates, rapid demographic growth, and technological advances. Furthermore, these factors could be spatial and temporal in nature.

'Alternative View'

The alternative or 'political economy' approach emphasises the human component of natural disasters. This approach came about during the intense criticism of the

‘dominant view’ in the mid 1970s. With this interpretation, threatening natural phenomena (i.e., hazards) are seen as “normal” characteristics of regions in which they occur. In contrast to the ‘dominant view’, natural disasters are viewed as extreme situations within normal everyday life, and not as events outside of normal social functioning. Furthering this point, Westgate and O’Keefe (1976) argued that vulnerability embraces the endemic conditions inherent in a particular society that may exacerbate the risk of disaster. In other words, the risk of disaster is implicit in the normal everyday conditions of a human group and the risk of disaster is only exacerbated by the ‘normal’ occurrence of threatening natural phenomena. Vulnerability is thus seen as an effect of social and economic processes and disaster as a socially constructed event.

Illustrating this approach to vulnerability, Winchester (1992) stated that conditions of crisis (i.e., failure to receive the expected conditions of life such as food, shelter, and income) exist every day for most people in cyclone-prone areas of South India. He argued that “the relationship between crisis and cyclone is not the crucial one. Cyclones are the most extreme risk that people face but their efforts only heighten the existing symptoms of the real disaster of development policy” (Winchester, 1992, 44). Reflecting on their own experiences, Peruvians are in agreement with Winchester's notion when they make reference to their own 1970 disaster as the ‘500 year earthquake’; they blame its devastation on the conditions of severe underdevelopment that began almost 500 years earlier with the conquest and colonisation of Peru (Doughty, 1986; Maskrey, 1989; Oliver-Smith, 1994). Surviving Guatemalan peasants of the 1976 earthquake that killed 25,000 and left over one million people homeless, also expressed a similar

resentment. They were caught in a vicious circle in which they were denied access to social and personal protection making them more vulnerable to further disasters. A New York Times journalist referred to this event as a 'class-quake', and not as a natural phenomenon (Blaikie et al., 1994).

Under the alternative viewpoint, natural disasters are socially constructed. In order to understand disasters, therefore, one must look to the constructs of society for the root cause of disaster, and not at the threatening natural phenomenon itself. This notion led to many interpretations of the alternative approach, such as: Susman et al. (1983) on theories of underdevelopment and marginalisation, and Warrick (1979) and Perrow (1984) on complex social linkages and 'systemic disruptions'. Additionally, Wilches-Chaux (1996) outlined an interesting approach to vulnerability that he used as a tool for communities in disaster prone regions to examine their own vulnerabilities and develop stronger coping capabilities. He proposed eleven different approaches to view a community's 'global' vulnerability. These views included inter-related elements such as physical (i.e., location of settlement), social (i.e., social organisation in community), and political (i.e., autonomy of community to participate in decision-making).

Theories of Vulnerability: An 'Alternative View' Interpretation

Differential Vulnerability and the Geography of Vulnerability

The theory of differential vulnerability is an underlying argument of most alternative interpretations of disaster since it is rooted in social characteristics. It states that some people are more susceptible to danger than others even though they are in the

same location and under the same physical conditions. As Hewitt (1997, 176) stated, “not everyone or everything in given places or societies is equally vulnerable.” Every person has unique strengths and weaknesses, thus, a single danger may have varying effects on impacted individuals. This is of particular importance to the geography of vulnerability. In other words, vulnerability is more than just exposure to hazards and its geography, more than human occupancy of dangerous places in relation to the occurrence of hazardous events such as in flood plains and seismic zones. Although proximity and exposure to hazardous areas are important, vulnerability cannot only be mapped by the distribution of a geophysical event, since it is not uniform among those within an event’s spatial limits. Instead, Hewitt (1997) suggested that vulnerability also be mapped in terms of “defenceless spaces,” and patterns of frailty and absent protection.

On a household level, the effects of disaster depend on who and/or what (i.e., household assets) is lost and their relative values to the household. These assets, which includes intangible qualities such as will power and adaptability, determine how a household recovers and survives future events. To illustrate, take two families: a peasant farmer in Bangladesh, and a middle class banker in Switzerland. Both families lose their only child in a disaster. The child in the peasant farmer household provided necessary labour in the fields, and although the loss of a child can be emotionally devastating to both families, the loss to the peasant farmer may prevent their household from surviving future events. Table 2.3 examines some of the asset characteristics that govern an asset's relative role to the vulnerability of individual households.

Table 2.3 Asset Characteristic Influencing the Relative Vulnerability of a Household (after Winchester, 1992).

Characteristic	Example
Susceptibility	This relates to the physical characteristics of the asset. For example, a cow is more susceptible to be lost or killed in a flood than a necklace.
Dependence	This relates to a household's dependence on a particular asset. For example, a peasant household may depend more on a cow (i.e., for subsistence) than on a necklace.
Transferability	This relates to the transferability an asset, or the ability to move it away from hazards. For example, a cow is far more transferable than a house.

Despite minor nuances, most works support the theory of differential vulnerability. Two examples of these works include: Liverman (1990) and Winchester (1992). Liverman (1990) looked at vulnerability to drought in the states of Sonora and Puebla, Mexico. Using empirical measures of vulnerability, in terms of the productive process, such as land tenure conditions and access to technologies (i.e., irrigation, improved seeds, and fertiliser), she examined productivity during periods of drought. More importantly, the study's conclusions support the hypothesis of differential vulnerability in the sense that “the pattern and severity of reported drought losses were different from the pattern of meteorological conditions” (Liverman, 1990, 67).

Complementing Liverman's research, Winchester (1992) examined vulnerability to cyclones in Andhra Pradesh, Southeast India. Adhering to the hypothesis of differential vulnerability, Winchester focused on “individual households and their characteristics, and the key relationship between those characteristics and the context in which households live. This relationship largely determines the vulnerability of households to all internally or externally generated shocks” (Winchester, 1992, 124),

including periodic cyclones. Common characteristics of the most vulnerable households were determined from a 42-household sub-sample (this was methodically narrowed down from a much larger sample of the population); Table 2.4 illustrates the characteristics and their frequency in the fourteen most vulnerable cases. Note that the common characteristics of the most vulnerable households reflected those of small peasant agricultural-based families.

Social Relations of Production

The most encompassing work of alternative interpretations of disaster is contained in Hewitt's (1983), *Interpretations of Calamity*. The other contributors to this work (in particular Watts, Susman, O'Keefe and Wisner), demonstrated and extended some the ideas presented by Hewitt in his introductory chapter. In critiquing the 'dominant view', Hewitt suggested that natural disasters are better explained in terms of normality rather than by the extreme natural phenomena of a given area. The natural extremes involved in

Table 2.4 Summary of Household Characteristics and their Frequencies in the Fourteen Most Vulnerable Households in Andhra Pradesh, Southeast India (after Winchester, 1992, Table 6.7).

Characteristic	Household Located:		Total
	On Coast	Inland	
Small Households*	6	7	13
Deaths in Cyclones	4	3	7
Prolonged Bad Health	4	4	8
Old Age	2	3	5
Agri. Labour As Main Occupation	6	3	9
Migrate to Work	5	5	10
Informal Credit Only	4	7	11
Without Assets	4	6	10
Number of Households	6	8	14

* Two or less people.

disasters are “more expected and knowable than many of the contemporary social developments that pervade everyday life” (Hewitt, 1983, 25). What are the normal conditions of everyday life? The 'normal' everyday life of many people is a continual struggle and often resembles a disaster in itself. People are limited in coping with natural extremes by the stresses of living everyday life – “avoiding the daily hazards of work and home, and evading the predations of the more powerful” (Blaikie et al., 1994, 13). Furthermore, Hewitt went on to argue that most natural disasters would not occur except as a direct result of contemporary social developments, in particular, the causal processes of the social relations of production.

Watts (1983a) stated that the “forces and social relations of production constitute the unique starting point for human adaptation” (Watts, 1983a, 242). Following Watts observation, natural disasters can be seen as instances in the system of social reproduction. Using a case study on drought in Hausaland, northern Nigeria, Watts argued that colonialism altered the traditional cycle of reproduction of Hausa peasant households to include a contingency on the production of export commodities. To the peasant farmer, who has marginal subsistence security, a forced devotion to cash crop production (i.e., due to a need for hard currency) at the expense of foodstuffs deepened the importance of hunger and indebtedness. The peasant farmer was plunged into poverty because they were vulnerable to “relatively slight oscillations in harvest quality; a 'light' harvest could herald a subsistence crisis of famine proportions, particularly if prevailing export crop prices tended to be unfavourable; ... the Hausa peasantry lived constantly in

the shadow of famine” (Watts, 1983a, 252). He concluded that drought (as well as famine) is an instance in the system of social reproduction. Furthermore, its significance is related to an individual household's position in the productive process, and the 'nexus' of social relationships.

Underdevelopment and Marginalisation

The alternative interpretations of vulnerability stem from the “experience of research in situations where 'normal' daily life was itself difficult to distinguish from disaster” (Blaikie et al., 1994, 11). The search to explain disaster through vulnerability focused on case studies of marginal people in 'underdeveloped' countries such as Bangladesh (Brammer, 1992), India (Winchester, 1992), Nepal (Blaikie et al., 1980), Nigeria (van Apledoorn, 1981, and Watts, 1983b), and Peru (Maskrey, 1989, and Oliver-Smith, 1994).

Models of underdevelopment and marginalisation, and their relationship to disaster also were discussed by Susman et al. (1983). They suggested that these continual processes of exploitation - based on a world economy which sustains technological dependency and unequal exchange - increase disaster through the deterioration of socio-economic conditions and the physical environment. Figure 2.4 illustrates some events and processes that contribute to marginalisation and its relationship to disaster.

Marginal people are those who cannot find permanent employment, have been forced off the land or onto very poor or insufficient land. They have little political clout and a poor standard of living. Marginal people respond to potential and actual disaster in

ways that may appear to be irrational since they do not have the capital or organisational resources to provide modern adjustments. Due to their poverty, their response often causes physical degradation to the environment. In many ways, they are disadvantaged, powerless, unprotected and exposed to dangers.

In the process of marginalisation, marginal people remain marginal. Moreover, disasters produce a 'catch-22' effect where more marginal people as survivors are often unable to recover their livelihoods. Their vulnerability is reinforced as they become destitute and forced to live in even more vulnerable situations. For example, several households in Winchester's (1992) study of cyclones in Andhra Pradesh were unable to rebuild after the 1977 cyclone and were forced into a more vulnerable and desperate

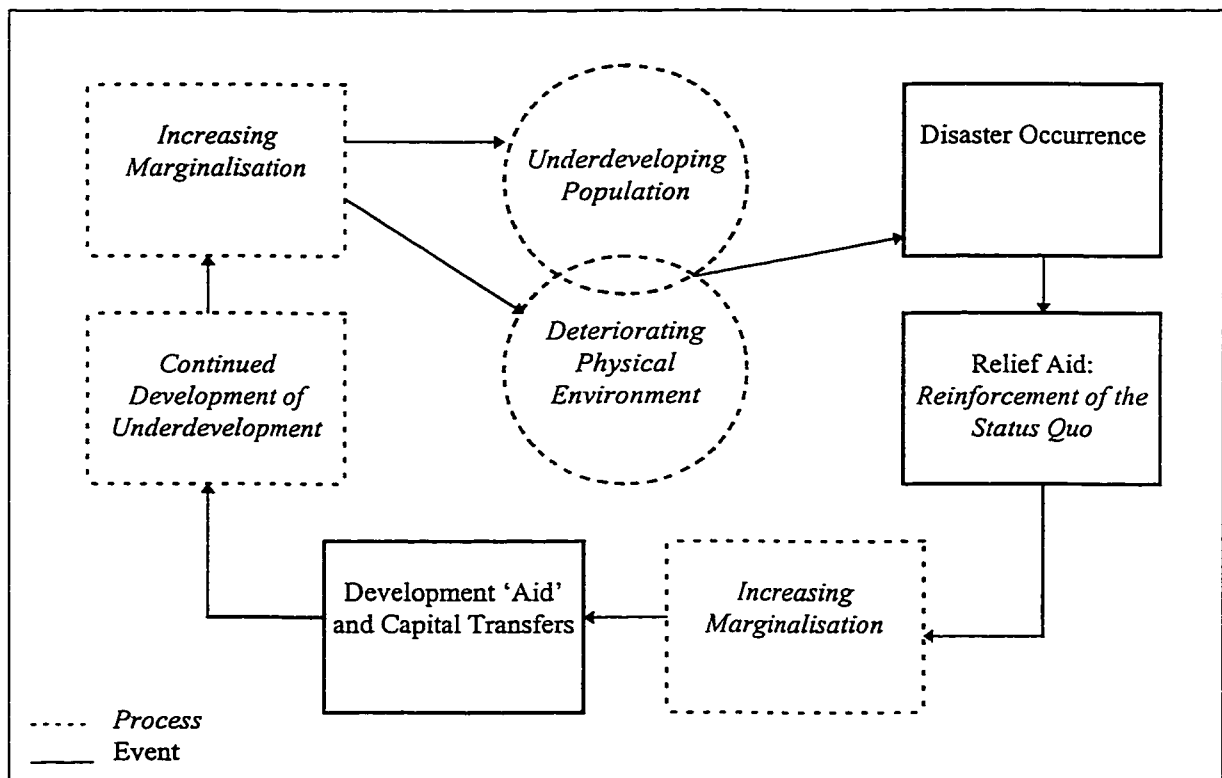


Figure 2.4 Process of Marginalisation and Its Relationship to Disaster (after Susman et al., 1983, Figure 14.3).

situation.

Marginality and vulnerability are undoubtedly linked. People on the social, political, and economic peripheries have unequal access to the resources needed to cope with calamities. Numerous studies illustrated a disproportionate vulnerability to natural disasters in 'underdeveloped' countries – where marginalisation is predominantly more severe – than in developed countries (Susman et al., 1983). Therefore, it is not surprising that the majority of research focuses on situations in 'underdeveloped' countries, and little research pertains to developed countries. It is important to note, however, that in most 'underdeveloped' countries, wealthier regions, sectors, or groups are in no sense 'marginalised'. Rather they are powerful, well-endowed and much less vulnerable than many of those people in developed countries.

Marginalisation plays a less significant role in developed countries, such as Canada, than in developing nations, since the gap between the marginal and general populations is relatively small and lessened by existing social nets (i.e., unemployment insurance, emergency aid, and unilateral health care system). However, certain regions, sectors, or groups within developed countries (such as native groups and the Maritime provinces in Canada) can provide cases of disaster where conditions of perennial underdevelopment or disempowerment typical of marginalised people exist. However, this linkage only provides a partial explanation for occurrences of natural disasters in developed countries. Therefore, other theories of vulnerability, perhaps more relevant to wealthier social groups, must also be explored.

“Modern” Society and Systemic Disruption

The notion of 'systemic disruptions' is a growing concern, especially for developed countries, where one wonders whether the dynamic social construct is unknowingly building up the potential for major disruptive events. Increasingly complex social, technological, and economic linkages pervade our society; and “our social systems appear to place a greater reliance on their normal functioning” (Warrick, 1979, 177). Specialised regional industries, major transportation corridors, and interconnected energy networks are all examples of these linkages. Due to interconnection, a disruption in one link can reverberate throughout the entire social system.

The disruption caused by a single event may also be felt at a later time and in other places, and effect vulnerability. The complex linkages pervading society can increase vulnerability through additional exposure, both spatial and temporal, to disruption. To illustrate, on 15 November, 1965, a power failure created a total 'blackout' across an area spanning eight U.S. states and Ontario, left 30 million people in the dark. The New York Times stated that “the blackout was neither the judgement of God nor an Armageddon with the Communist ... but rather [the region] had simply fallen victim to its very dependence on the system ... in this case, the sprawling, interconnected grid of power networks” (New York Times, 1965, 48). This instance clearly shows how a small disruption, resulting from the breakdown of a tiny relay device in a remote area, can reverberate throughout society. As systems get more complex, it becomes harder to identify areas of possible failure. Prior to the 'big blackout', it was stated that the power network was infallible and boasted as being able to withstand a nuclear strike. There was

also a large surge of births in the region nine months post-'blackout' showing the temporal element of disruptions. As well, Krug et al. (1998) concluded that suicide rates increased after severe earthquakes, floods, and hurricanes in the United States, thus illustrating the impact a disaster can sometimes have years after the event actually occurred.

In addition to the reverberation effect of complex systems, Perrow (1984) examined risk that is inherent within technological advances. This is of particular interest to developed countries, where most 'cutting-edge' technologies emerge and are initially implemented. He stated that as technology expands, high-risk systems with catastrophic potential are created. Such systems include: nuclear power and chemical production plants, air and sea crafts, nuclear and biological weapons, and genetic engineering. Furthermore, "risk will never be eliminated from high-risk systems," (Perrow, 1984, 4) and accidents in them are inevitable and even 'normal'. He argued that an accident results from two or more failures in a system's components (i.e., in design, equipment, procedures, operators, supplies and materials, and environment). For example, on 6 February, 1992, two passenger ships collided at the north end of Active Pass, British Columbia, injuring 23 people. This event can be interpreted as a typical case of Perrow's 'normal accident'. Failure in the environment component occurred with a thick fog that limited visual contact between the ships. Failure in the equipment component occurred when the collision radar were rendered ineffective due to the orientation of the pass. The result was an accident based on combined component failure.

Social, technological, and economic linkages in British Columbia play important roles in the province's vulnerability. Not only do these often reinforce marginalisation

and thus leave some individuals, groups and communities disadvantaged, powerless, unprotected, and/or exposed to dangerous agents, but also act as potential carriers of danger to a wider number of people. For example, power network failures can lead to disruption of 'normal' social activity across vast regions. Numerous accidents involving aircraft, trains, ships and automobiles, also demonstrate dangers associated with technological innovation in British Columbia.

Natural Disaster Research Specific to British Columbia, Is There Any?

Natural disaster research specific to British Columbia is limited in focus. Most of the available literature concentrates on site-specific studies of the natural processes of particular hazards. Such works include: Green et al. (1988) on the eruptive history of the Garibaldi volcanic belt; Obee (1989) and Ng et al. (1992) on tsunami threat, in terms of maximum positive wave heights, to the Pacific Coast due to local earthquakes; and Brooks and Hickin (1991) on the natural impoundments of the Squamish River on debris avalanches in the Mount Cayley area. Additional literature examined hazard mitigation and human adjustment. However, these works tend to narrowly focus on single strategies and/or single hazardous situations. Sewell's (1965) work on water management and adjustments to floods in the Fraser River basin, and Hickson's (1994a) analysis on Canada's communication pathways and response to volcanic eruptions, when combined with numerous publications from Emergency Preparedness Canada concerning subjects such as public response to hazardous situations such as the predicted subduction earthquake, all give good but limited views which ignore the holistic and interrelated role

of disasters. With a few exceptions of limited success, no comprehensive study has brought together the scattered information on natural disasters in British Columbia.

Of particular note, Hightower and Coutu (1996) provided an excellent overview of government responsibilities and the administrative and legal structures of disaster response in British Columbia. They stressed that horizontal co-ordination, rather than hierarchical, was needed to achieve effective disaster response in complex multi-jurisdictional settings such as the Lower Mainland. Coquitlam's disaster response was used as an example of efficient horizontal co-ordination. The city continually works on preparedness and planning with its residents, businesses, and community officials, and conducts regular emergency exercises to test its capabilities, procedures, and readiness.

The Geological Survey of Canada has funded and/or been involved with a multitude of studies addressing geoscience concerns, including those of British Columbia. By bringing together a collection of works in *Geology and Geological Hazards of the Vancouver Region, Southwestern British Columbia*, Monger (1994) attempted to summarise this widely scattered geoscience information and integrate it with the current hazards research in the Vancouver region.

The majority of this collection concentrated on the physical processes and elements that formed and comprise the current landscape. However, articles written by Luternauer et al. (1994), Rogers (1994), Hickson (1994b), and Evans and Savigny (1994) focused on, both potential and historical, geological hazards, such as earthquakes, volcanoes, and landslides. Unfortunately, with the exception of limited sections within Hickson's article and Evans and Savigny's article, only the physical aspects of particular

hazards were discussed, with no mention of terms such as vulnerability or human adjustment.

In Hickson's article, potentially active volcanic fields in the region were identified and by using Yokoyama's et al. (1984) method for assessing the general risk of a volcano, with their associated risks from eruption being identified as low. Of particular interest, Hickson stated that those most likely to be at risk from an eruption are the passing aircraft traffic, which includes many major national and international air routes. The engine(s) of an aircraft will seize if it passes through a volcanic ashcloud, which is visually indistinguishable from normal clouds, placing it at a great risk of crashing. Evans and Savigny's article, identified the mass movement diversity of the region. In discussing the different mass movement types, examples of past disaster and development of hazard mitigation strategies were identified.

In terms of raw statistical records of natural disasters in British Columbia, no adequate compilation exists which encompasses all forms of natural disaster. Generally, the existing compilations are either disaster-specific or subsets of larger-scale studies. For example, the Aviation Safety Bureau of Transport Canada maintains records of aviation accidents limiting its compilation to one disaster type. In contrast, studies by Jones (1992) and Bird (1996) summarised all types of major Canadian disasters, which include data on British Columbia, spanning several centuries. In such large-scale studies, arbitrary limitations are often used to obtain a manageable number of records through their definition or criteria for disaster. For example, Jones (1992) only included "single events, occurring at one time, within Canadian territory out to the 200 mile economic

zone offshore, in which loss of life was 20 or more persons” (Jones, 1992, 43), but did make note of other important events that did not meet the requirements. In Jones' study, 13 of 77 disasters meeting the criteria occurred in British Columbia from 1867 to 1989, where weather played a factor in less than half. Therefore, these limitations exclude the more frequently occurring small-scale disasters, such as the majority of flood related disasters, from the data set.

Of historic interest, Pethick (1978) examined fifteen disasters that occurred in pioneer British Columbia. The examined disasters included events such as: the smallpox epidemic of 1862 to which the *British Colonist* (June 12, 1862) commented: “at the present rate of mortality, not many months can elapse ere [*sic*] the northern Indians of this coast will exist only in story” (Pethick, 1978, 11); the Nanaimo Mine explosion of 1887; and the 1948 Fraser Valley flood. In Pethick's recounting of the history of early disasters in British Columbia, the causes and effects of these tragedies were deeply probed. Furthermore, he maintained that some of the disasters were avoidable and quite foreseeable, and that vulnerability was the product of the respective social environments shaped by the human characteristics of greed, cowardice, and ignorance.

Chapter Summary

Natural disasters involve interactions between extreme natural events or hazards and vulnerable human groups. The ‘dominant view’ emphasises natural hazards and vulnerability is often treated in terms of hazard exposure. In contrast, the “alternative view” or “vulnerability perspective” places greater importance on human components of

disaster. It views vulnerability as not only involving exposure to hazards but more importantly social attributes and aspects of individuals, groups and communities that can increase damage from given dangers. The exploration of British Columbia's disasters and its people and communities' vulnerability in the following chapters uses the later theoretical approach in which social context is stressed.

Vulnerability derives more from social context rather than inherent qualities of people or places. It is too simple to say, for example, that she is vulnerable since she is a woman. It may be characteristic of some vulnerable groups, but it is economic, social and political processes that produce or transform vulnerability and often undermine an individual, group or community's capability to avoid or recover from disaster, regardless of their abilities. For example, vulnerability can take the form of political powerlessness, disadvantage, and technological dependence. As Hewitt (1997, 27) noted: "a major concern of the modern and modernising world is how vulnerability can be affected more or less drastically by social change and patterns of development."

CHAPTER 3. BRITISH COLUMBIA, GROWTH, AND VULNERABILITY

“The serenity of the climate, the innumerable pleasing landscapes and the abundant fertility that unassisted nature puts forth requires only to be *enriched* by the *industry of man* with villages, mansions, cottages and other buildings to render it the most lovely country that can be imagined.” Captain George Vancouver's description of the Lower Mainland in 1792 (q. in Wynn and Oke, 1992, xiii, emphases added).

During the past two hundred years, the “industry of man” has indeed “enriched” the Lower Mainland, as well as other developed areas of British Columbia; trading posts grew into towns and expanded into cities, likely far beyond Captain Vancouver's wildest expectations. Possessing a natural beauty and pleasing climate, many people still concur with Vancouver's original description of the region bearing his name and describe the area as a paradise on earth. However, images, like reputations, often outlive the circumstances of their creation, and as Wynn and Oke (1992) metaphorically stated: there seem to be serpents in this Eden.

Vulnerability in British Columbia's paradise often lies hidden like ‘serpents’ amongst the cover of everyday life, perched and ready to strike at their unsuspecting victims. More and more, foreign attention and investment flowed into the province in part contributing to its relatively rapid rise and growing affluence. However, this growth increased susceptibility of particular individuals, groups and communities in the province, to natural disasters. To understand the nature of this susceptibility, the contributing factors must first be identified and then placed into geographic context. As Cutter (1996, 526) stated: it is fundamental to understand “the physical and social processes, as well as the spatial and temporal variations in the processes and outcomes.”

This chapter looks more generally at British Columbia and its vulnerability to natural disasters. It describes vulnerability in relation to social space, rather than hazardous events, since socioeconomic and political processes often leave some groups disadvantaged, powerless, unprotected, and/or exposed to dangerous agents (re., Chapter 2, “vulnerability perspective”). Moreover, it uses case history to demonstrate these forms of vulnerability.

The Physical Landscape of British Columbia

Unquestionably, the history and social development of British Columbia is integrally linked to its physical landscape. Natural features and associated resources are the foundation of the province’s economy and thus central to its development. In fact, many social, economic and political processes are tied to the extraction and movement of these natural goods. Also, the physical landscape is a source of extreme natural events, such as storms, floods and earthquakes, that occasionally endanger the province and its people.

British Columbia totals 948,600 square kilometres in area, spans approximately 1,300 kilometres north to south and extends some 800 kilometres from its Pacific Ocean coast line to its most eastern mountain chain. The province is subject to a moderate but rainy climate, especially on the coast, and is often characterised by its seemingly endless mountains, large interior plateau, and long rugged coast line. Only in its south-western tip and its far north-east is physical movement relatively easy. These restricting, yet alluring characteristics are reflected in the reaction of a young wife to her husband's, Eli

Harrison, proposal of accompanying him on his judicial duties in the Cariboo during the 1870s: "That vast, mountainous region of grand vistas, precipitous plateaus and hairbreadth highways was a mysterious, forbidding empire... To a Victorian, it was pretty much like suggesting a trip to Tibet." (Harrison, 1951-53).

The complex geology of British Columbia produced vast mineral deposits, many of which have been historically exploited (i.e., Fraser Valley gold rush in 1858³), as well as currently exploited (i.e., the Cominco-owned Sullivan Mine at Kimberley has produced a constant supply of ore, zinc and lead for almost 90 years), subsequently shaping the social development of the province. Furthermore, the same geology also created many chains of mountains. The Coast, Skeena, Monashee, Selkirk, Purcell, and Rockies ranges, to name a few, traverse the province from north-west to south-east. These parallel ranges create natural corridors running north and south, and ensure a degree of east-west isolation for many of the province's inhabitants.

Bordered by the basins of the Fraser, Columbia, Skeena, and Peace rivers, British Columbia's large interior plateau contains the northern extension of the great North American desert. Much of its soils are stony and barren, and incapable of supporting agriculture. The character and size of this desert-like plateau, some six hundred square kilometres in area, helps to explain why under three per cent of the province is arable or

3 News of gold along the Fraser River, kept quiet for several years before, became public in San Francisco during the spring of 1858. At least 20,000 miners, including many from California, entered the mouth of the river that year, most arriving via Victoria. Harris (1997, 80-81) suggested that this and other gold rushes of the period shifted the economic balance towards resource industries and ushered industrialisation into British Columbia.

potentially so. Furthermore, the only significant areas suitable for agriculture (i.e., the Fraser and Peace River valleys, Okanagan Valley, and eastern Vancouver Island) are scattered and isolated. As Barman (1996, 5) pointed out: even “early arrivals quickly became aware of this... an 1884 settlement promotion warned that British Columbia's extremely rugged and mountainous character rendered its agricultural areas comparatively small, far removed from each other, and difficult of access.”

The long rugged coastline has a very distinct physical setting and, not surprisingly, these characteristics are also reflected in its 'social mix'. Journalist Gwen Cash (1939) described the coast as containing “deep fjords twisting between precipitous cliffs, glaciers glistening on mountainous horizons, dark forests, tiny bays, enchanted islands, [and] tumultuous tides.” (q. in Barman, 1996, 5). It was these elements, especially the thick 'dark forests' of cedar, fir, spruce, and hemlock, that attracted initial settlement and further exploitation of the land. Furthermore, these natural characteristics effectively separate the social composition of the coast into distinct regions. The Lower Mainland and Vancouver Island contain fertile lowlands, as well as, large natural harbours in Burrard Inlet and at Esquimalt, respectively. These and other 'positive' natural features, in relation to modern economic and social conditions, have ensured permanent settlement and growth in these regions. However, north of the Lower Mainland, the land becomes more rugged and modern settlement is restricted to isolated resource-based communities (i.e., cannery and logging communities) connected to the south through its demand for particular natural commodities.

The physical landscape of British Columbia provides an unique setting for the

province's development. Over the years, from a fur trading haven to Vancouver's present large involvement in the global economy, the province has developed in relative isolation from the rest of Canada. Even internally, the varying landscape has, in part, helped create distinct communities, each with their own inherent strengths and weaknesses.

From Fur Trading Frontier to World City

Industrial development has had major impacts on the environment in British Columbia, with its infrastructure affecting the province's mountains, plateaus and rugged coastline. Ironically, these same natural features and associated resources also, in part, prescribed the evolution of and relationships between communities. These relationships and social, economic and political processes contribute to vulnerability (re., Chapter 2), thus, it seems important to understand the province's socioeconomic organisation and the factors contributing to it.

At one time small, uniform, self-contained communities existed, yet as they expanded, power and prestige concentrated in Vancouver which was aided by its favourable geographic location, while economic ties extended outwards ensuring centralised control. More recently, the rise of the newly industrial economies of the Pacific Rim stimulated provincial economic and demographic growth. Moreover, Vancouver's economy increasingly expanded far beyond Canada's national border, and rapidly elevated its position in the world economy, claiming its role as what Friedmann (1986) described as a 'world city'.

The economic relationship between the Lower Mainland, as managerial and

service centre, and the rest of the province, as source of natural goods, has existed in much the same fashion over the last century. In fact, some have argued that the linkages have increasingly strengthened. The direction towards British Columbia as a cohesive unit replaced the image of small communities that Bourgon (1979, 72-73) fondly recalled as "self-contained universes all own their own." Similarly, Davis and Hutton (1989) concluded that the economy of British Columbia was increasingly divided between two segments: the service-oriented urban economy of Greater Vancouver, and the resource-based hinterland economy; yet, they remarked that both segments remained integrally linked. The Lower Mainland constituted a market for particular commodities produced in the rest of the province such as agricultural goods, forest products, and speciality manufactures, however, more importantly was its role as a gateway. Greater Vancouver "impels growth in the provincial economy via its economic port functions (sea, air, and rail) and port-related activities (finance, insurance, communications, and trade) which materially assist in moving hinterland products to export markets." (Davis and Hutton, 1989, 11). Yet, this is not to say that Vancouver was merely a port through which raw materials flowed; value was added to some materials through manufacturing. Moreover, Barman (1996) pointed out that Vancouver thrived as Canada's gateway to Asia and became a centre for trans-Pacific commerce, banking and trade.

Vancouver and its Juxtaposition to the Pacific Rim

The industrial rise of a number of countries in the Pacific Rim since the 1970s, especially the 'newly industrialised economies' of Hong Kong, Singapore, South Korea,

and Taiwan, coupled with Japan's strong economy, in part gave rise to a major shift in the global economy⁴. Such developments hastened deindustrialisation in many traditional West European and North American manufacturing regions. For example, Markusen and Carlson (1989) wrote of significant job loss in part due to plant closing and disinvestment in the industrial core of the United States (comprised of Ohio, Michigan, Indiana, Illinois, and Wisconsin), a region often synonymous with the term 'Rust Belt'. However, some areas, such as Vancouver, thrived under this new global economic restructuring. Barnes et al. (1992, 73) argued that the rise of the Pacific Rim nations procured Vancouver's evolution "from an important local metropole, concerned with economically managing and accumulating capital from the rest of the province... to a 'world city' with a global role and reach." Yet, despite this transformation, staple commodities (i.e., hew wood, extract ore, and harvest crops) remained the foundation of the province's economy.

Vancouver's position and role within the world economic hierarchy remained based on the circulation of particular commodities; yet, through this function, it stimulated an increasing movement, to and from itself, of additional goods, capital, and people. Beginning in the 1960s, trade with Japan increasingly expanded, and as other Pacific Rim nations industrialised, they to became important trade partners due to their high demand for raw material and seemingly endless supply of refined goods (see Table 3.1). This expansion further shifted the province's trading and commercial orientation

4 Many works addressed this shift in the global economy, however, of particular note is the book by Froebel et al. (1980) entitled, 'The New International Division of Labour'. Additionally, Clement (1997) examined these ideas in a Canadian context.

Table 3.1 British Columbia's International Trade with Selected Countries, 1976-1996
(compiled from Statistics Canada Catalogues 65-003, 65-006).

	Imports in \$1000 (% of World)			Exports in \$1000 (% of World)		
	1996	1986	1976	1996	1986	1976
<i>Pacific Rim Nations:</i>						
China	1,086,091 (5.61)	72,410 (0.66)	9,186 (0.30)	510,472 (2.03)	1,223,797 (9.22)	189,334 (2.83)
Hong Kong	226,350 (1.17)	153,628 (1.39)	50,597 (1.65)	257,116 (1.02)	59,071 (0.44)	29,991 (0.45)
Japan	2,905,736 (15.00)	4,026,758 (36.54)	715,155 (23.7)	5,945,347 (23.60)	3,374,446 (25.42)	1,732,411 (25.92)
Korea, South	548,335 (2.83)	700,551 (6.36)	54,284 (1.77)	859,976 (3.41)	338,580 (2.55)	48,515 (0.73)
Singapore	151,510 (0.78)	42,306 (0.38)	33,306 (1.09)	67,224 (0.27)	41,921 (0.32)	10,602 (0.16)
Taiwan	494,370 (2.55)	351,081 (3.19)	60,891 (1.99)	353,340 (1.40)	193,865 (1.46)	20,392 (0.31)
<i>Traditional Trading Nations:</i>						
United Kingdom	210,901 (1.09)	114,990 (1.04)	73,924 (2.42)	344,999 (1.37)	457,796 (3.45)	366,080 (5.48)
United States	10,440,434 (53.90)	4,088,821 (37.10)	1,636,237 (53.48)	13,814,471 (54.83)	4,916,841 (37.03)	2,810,899 (42.06)
World	19,369,748 (100.00)	11,019,849 (100.00)	3,059,742 (100.00)	25,196,935 (100.00)	13,276,571 (100.00)	6,683,424 (100.00)

from the rest of Canada and the United States to across the Pacific Ocean.

Piggybacking the increasing volume of trade across the Pacific, particularly that with Japan, was a large influx of foreign capital initially concentrated in the resource industries of British Columbia. Japanese trading companies and their banks directly invested in Canadian enterprises, typically Vancouver based corporations, in order to secure access to raw materials and provide a gateway for their own refined exports. The Japanese trading companies were willing to leave organisational control in Canadian hands; this practice was contrary to American corporate investment that typically sought total acquisition of or majority control over enterprises. In a spatial context, most of the

foreign investment entered the province's economy via its existing social hierarchy. In other words, capital was initially directed into Vancouver as the managerial and economic centre of the province, which in turn partially trickled down to favourable isolated resource communities. Furthermore, with this concentrated infusion of capital came a demand for financial, insurance, real estate, and business services in Vancouver, giving rise to the city's expanding service economy.

A telling indicator of the changing orientation of Vancouver towards the Pacific Rim was the swelling number of people crossing the ocean for both business and pleasure. The participants of this flow widely range on an economic spectrum, from positions of poverty to those of affluence (see Figure 3.1). At one end of the spectrum are the poor, mainly comprised of women, who temporarily move from developing to developed countries to earn meagre wages and perhaps gain insightful experiences before returning home. In Vancouver, Japanese and Asian nannies are prime examples of this

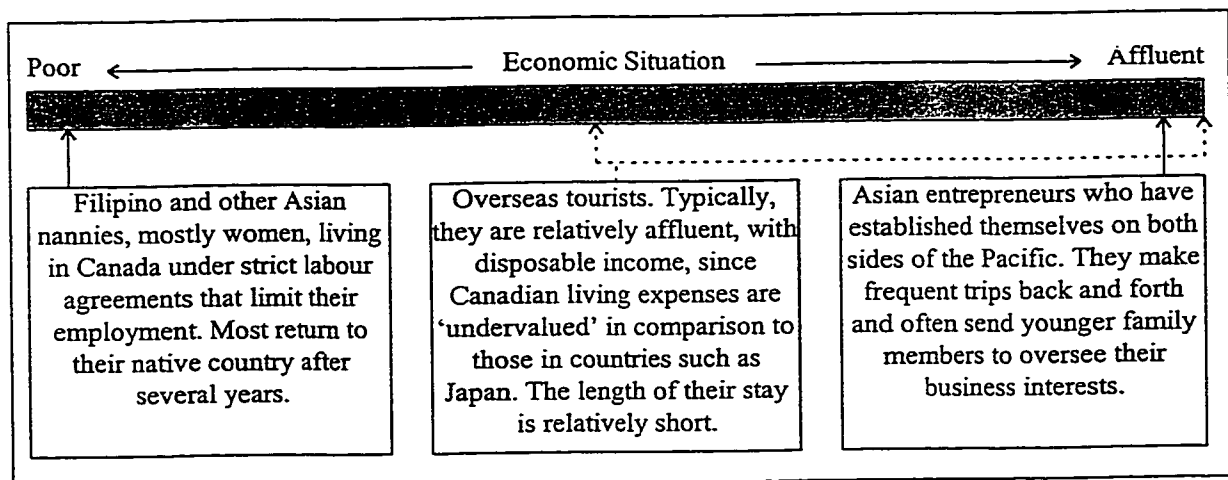


Figure 3.1 Examples of Population Flow, Ranging Along an Economic Spectrum, to British Columbia from Pacific Rim Nations.

group, as well as others employed as menial chefs or illegal factory workers. At the other end of the spectrum lie the affluent. Many affluent Japanese and Asian entrepreneurs have come to Canada and established successful businesses in Vancouver, often bringing their families with them. In 1978, the Canadian government introduced new immigration policy allowing those willing to invest at least \$250,000 in a Canadian business venture to enter the country as an 'entrepreneurial immigrant'; a similar category, 'investor immigrant', was later added in 1986. Many Asian families took advantage of such opportunities, resulting in a rapid growing number of affluent immigrant families purchasing property in and around Vancouver. Lam (1989) described many of the newcomers as coming "with capital, with a lot of skills, [and] a lot of know-how." This phenomenon represented a shift from the traditional experience of immigration, i.e., arriving in Canada with little money and few specific skills. A third group of people, falling towards the affluent side of the spectrum, are the overseas tourists. As seen in Figure 3.2, Japan currently is the prime source of overseas travellers reaching British Columbia, surpassing traditionally strong source countries such as the United Kingdom; travellers from other Pacific Rim nations have also significantly grown in numbers. It is important to note however that the Asian market in tourism significantly decreased in the late-1990s, in part, due to the devaluation of the Yen and stock market crash in 1998. This relatively rapid increase in tourism launched the industry into British Columbia's second largest. As Francis (1992, 11) commented "British Columbia's most viable asset is not its coal, timber, or mineral potential. Its riches are most rooted in the fact that it is postcard pretty." Additionally, foreign investment in tourism paralleled the growth of the

industry. Many major downtown-Vancouver hotels are owned by Pacific Rim investors; the beautiful Pan-Pacific Hotel and Canada Place, for example, were built and operated by Japan's Tokyu Corporation.

The economic rise of the Pacific Rim nations transformed Vancouver into a 'post-industrial' city strongly embedded into a global hierarchy. Heavy industry was largely absent from the city and its inner rings of suburbs, as economic restructuring either eliminated or shifted this sector to remote locations. Moreover, Pacific Rim investment became a significant motor of industrial expansion based on new kinds of commodities – knowledge and skills. The investment was initially concentrated in real estate, but it later

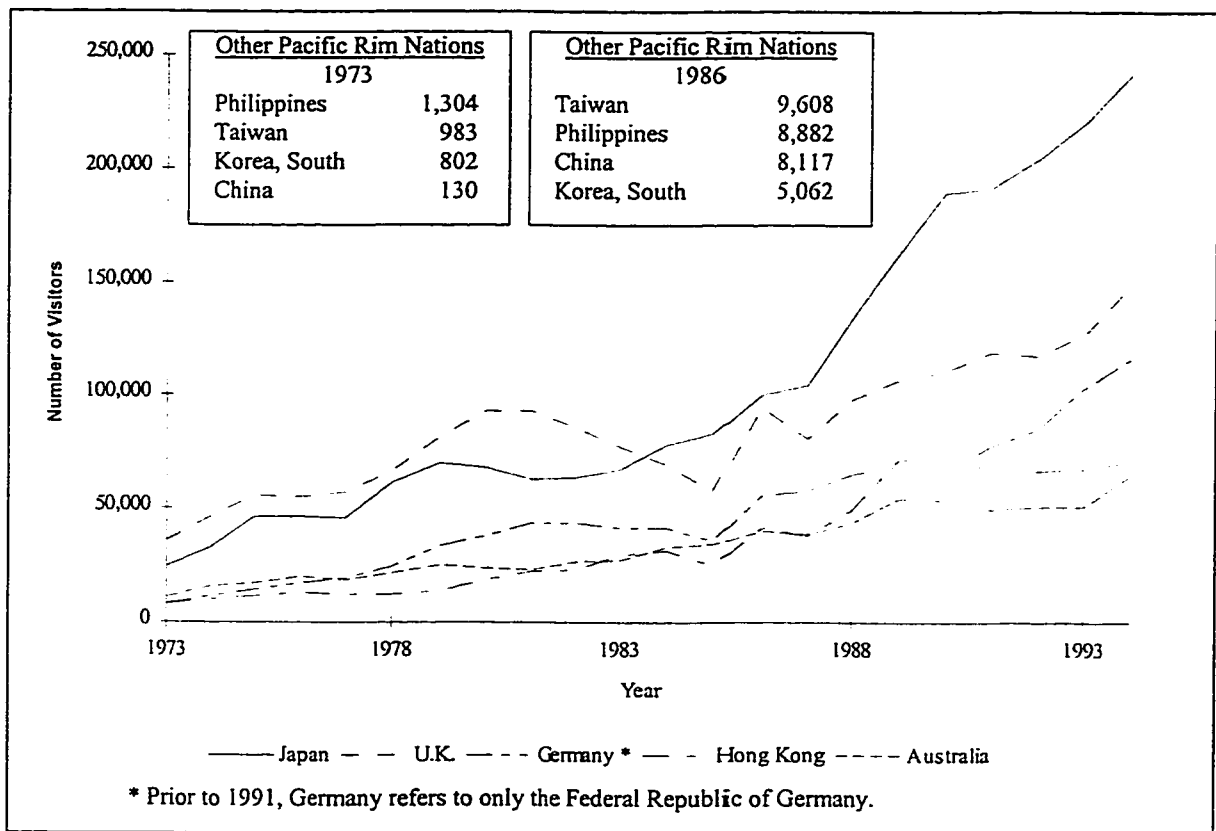


Figure 3.2 Top Five Sources, excluding United States, of Foreign Travellers Entering British Columbia, 1973-1994 (compiled from Statistics Canada Catalogue 66-001).

diversified into such things as electronics, pharmaceuticals and tourism. The production of goods became secondary to the production of services. However, the orientation of the peripheral resource economy remained relatively unchanged, its linkages to Vancouver reinforced, and it continued to supply vast quantities of raw materials to distant markets.

A Rapidly-Growing, Technologically Sophisticated Population

Growth in British Columbia was not uniform in character or distribution. Moreover, it contributed to regional disparities in the province and thus disadvantaged many groups and, in some cases, entire communities. Groups, such as some aboriginal people and peripheral resource communities, for example, live below provincial standards and have unequal access to the resources needed to cope with some dangers. At the same time, growth contributed to a more affluent and technologically sophisticated general public. However, this often leads to high public demand of, and dependence on, modern services and products.

With British Columbia's expanding economy and high employment opportunity, coupled with its pleasing climate and landscape, the province continued to attract people to its mountains, valleys, and shores in the 1990s. Over the last century, it experienced several population booms, but none large in sheer numbers as the one it is currently experiencing (see Figure 3.3). In only a five year span, from 1991 to 1996, the population of British Columbia increased by nearly half a million people, with over fifty per cent of this number concentrated in Vancouver and the Lower Mainland; never before has the province experienced such a sharp increase of population. However, Barman

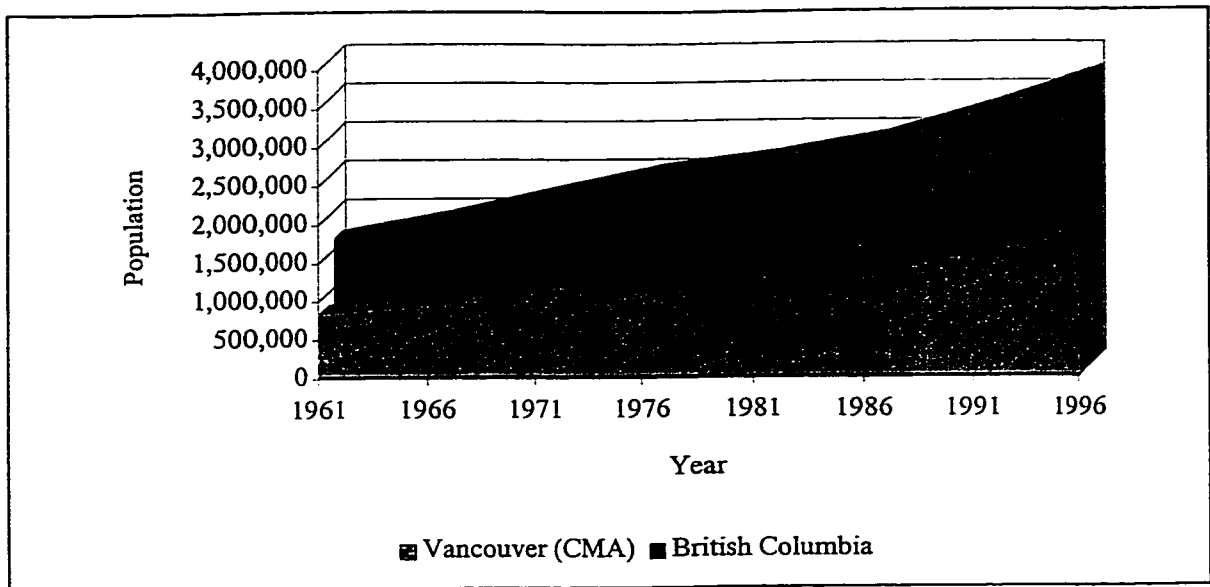


Figure 3.3 Population of British Columbia, 1961-1996 (compiled from Canada Census).

(1996) suggested that this population growth exacerbates regional disparities and thus places some people at a disadvantage, since the growth is not homogenous in character or distribution. She provided an example of regional disparity by comparing the relative affluence of particular regions and reported that “in 1991 the average per capita income in British Columbia was below the provincial mean in every region with the exception of the Lower Mainland and Greater Victoria; it was lowest in the Cariboo, parts of the Kootenays, and the central coast.” (344)

Throughout the twentieth century, British Columbia has had a relatively low rate of natural increase, yet has maintained an increasing growth rate through migration. Between 1991 and 1996, the population increased by almost a half million people with only twenty per cent of it attributed to natural increase. In the most part, this phenomenon is attributed to the migration of people from other provinces and from

abroad, making them both important agents of growth. Furthermore, this has strengthened ethnic and racial diversity in the population and partly contributed to the distinctiveness of British Columbia's society. Interestingly, Strong-Boag (1996) compared the persistence of particular immigrant communities which help to maintain the province's cultural heterogeneity with that of the isolated native tribes of pre-European contact.

In the 1990s, men and women continued to arrive from other parts of Canada and from abroad faster than British Columbians left the province (see Figure 3.4). The 1996 Census reported that close to five-hundred thousand people migrated to British Columbia

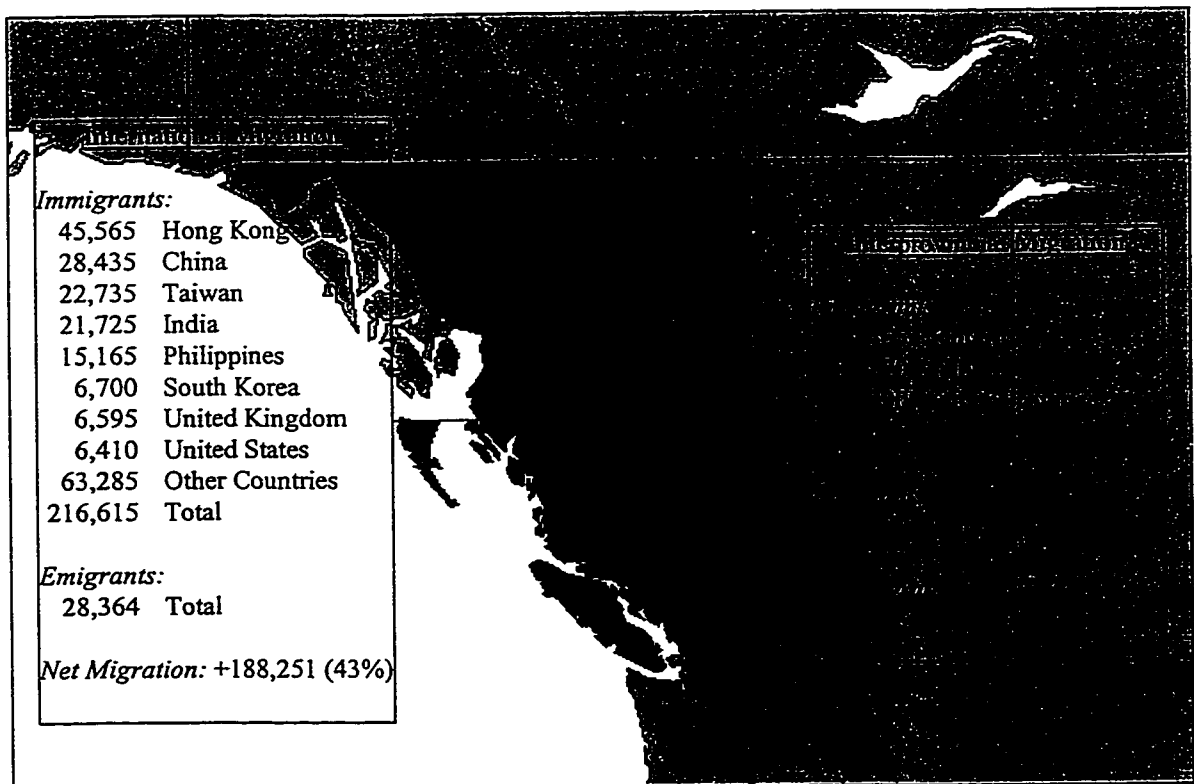


Figure 3.4 Sources of British Columbia's Population Growth, 1991-1996 (compiled from Statistics Canada Catalogues 96-003 and 96-010).

between 1991 and 1996, and a significantly less number of people left. Most often, in-migrants were young men and women aged twenty-five to thirty. In addition, there was a higher percentage of university degree holders among the in-migrants than residents, and employment was often the incentive for the move.

Technological Sophistication

Relative affluence affords a certain level of technological sophistication to a population. However, this sophistication often leads to a household's dependence on certain services and products, and failures to receive these undermines its ability to function "normally." The 1980s marked the emergence of, what Devereaux (1988) referred to as, 'new necessities' in domestic Canadian households. Many new technological innovations had such wide appeal and rapidly gained public acceptance that they became 'necessities' in most homes. In some developing countries, household items such as food, water and blankets are viewed as necessities and a telephone is seen as luxurious. In British Columbian households, however, necessities not only include these items but incorporate such 'new' services and appliances as cable television, microwave ovens and VCRs. Even a telephone is no longer regarded as a 'new necessity', reaching its saturation level (i.e., existing in 90 per cent of households) in the mid 1960s, but rather multiple telephones are now considered as new (see Figure 3.5). Public demand for, and expectation of such 'necessary' products indicates a technologically sophisticated population.

The general community's technological sophistication and demand have led to a

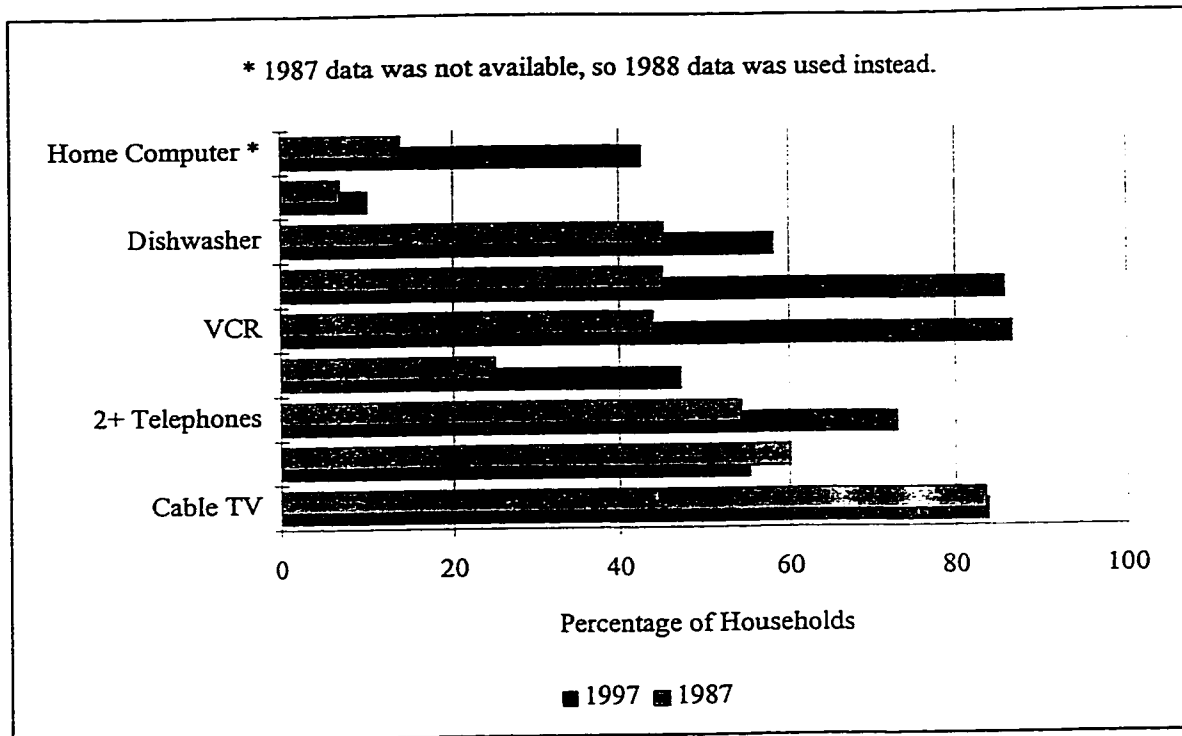


Figure 3.5 Percentage of Households with 'New Necessities' in British Columbia, 1987 and 1997 (after Devereaux, 1988, 34 and Statistics Canada Catalogue 64-202).

growing dependence on new innovations and services. This dependence is by no means limited to the Lower Mainland, but perhaps is more significant to it because its public has a relatively greater range of and access to modern services than those in the rest of the province. Many items and services such as computers and electricity, which were once considered luxuries and in some developing countries remain so, are now deemed necessities in most households. The temporary loss of such items can effect the coping capabilities of a household. An excellent example that illustrates this technological dependence involves the province's extensive power network. The power network is integrally linked to most facets of British Columbian society. The province is also subject to high winds and intense snow and ice storms that occasionally knock power

lines down and damage transformers, resulting in a temporary loss of electrical power and costing millions of dollars to repair. During these times, routine life appears to come to a complete halt; businesses close their doors, production ceases, and the majority of people patiently wait for normal conditions to be restored. The Vancouver Sun reported fifteen separate incidences of extensive power loss to thousands of households between 1990 and 1995. Thankfully, these incapacitating conditions are typically rectified quickly, yet on occasion the period can be significantly longer, thus prolonging the conditions of disaster. Following an ice storm in December 1995, described as the 'worst strike in 10 years', many homes in the Lower Mainland were without power for more than three days. In one situation, an Abbotsford farmer lost 5,000 turkeys which suffocated to death due to the loss of power to the fan supplying them with air. In another instance, traffic flow came to a complete stand still, causing havoc in Vancouver streets when 75 of its electric trolley buses lost power and instantaneously stalled. These are just two examples illustrating a technological dependence on the power network for maintaining routine goings-on in British Columbia.

A Smaller, But Disenchanted Sector

Thus far, this chapter describes British Columbia's population as relatively affluent, affording them many freedoms and expectations. However, this is not to say that certain sectors or groups in British Columbia do not exist in conditions of perennial underdevelopment or disempowerment. In fact, there are such sectors; many indigenous groups or the homeless population, for example, neither gain from or reflect the general

characteristics of British Columbian society.

Most aboriginal people still hover at the edges of modern society and have become a disenfranchised people as a consequence of discrimination and lack of employment opportunity; as Shelford (1987, 130) observed, "many just gave up and let Indian Affairs look after them." In 1990, forty-four per cent of aboriginal people lived below the poverty line, compared to fifteen per cent of the general British Columbian population. A 1997 Provincial Health Officer report stated that aboriginal children are less likely than non-aboriginal children to survive and achieve healthy growth and development as a result of a combination of lifestyle and environmental factors. In the summer of 1992, partially due to poor living conditions, outbreaks of Tuberculosis swept through three native reserves, Kullest Bay Reserve, Cape Mudge 10 and Babine 6, at rates far beyond provincial norms. In 1991, reserve household's reported unsafe drinking water in a quarter of their homes, nine percent had no electricity, and eight percent had no indoor bathroom facilities. In making reference to many grim northern British Columbian reserves, Brody (1982, 72) said it best: "[native people] pay the price for modernity, yet receive few of its benefits."

Many other groups likewise exist below provincial standards, perhaps not living in conditions of perennial underdevelopment, but they certainly are disadvantaged in comparison to other affluent sectors. The inhabitants of some peripheral resource communities live in relative poverty and cannot afford the security money can buy (e.g., insurance, household maintenance, and defensive structures). Britannia Beach, for example, is a small community comprised of numerous low-income families (see micro-

study in Chapter 4). Even though the lower town is situated in a flood zone, most people cannot get insurance, nor can they afford to move to a “safer” community. Moreover, disadvantaged groups demonstrate a form of differential vulnerability, thus, geography seems important.

Regional Issues of Vulnerability: Vancouver and Peripheral Resource Communities

The rapid growth, concentrated in the Lower Mainland, has contributed to a deepening regional differentiation between Vancouver and the rest of the province. Although both remain integrally linked, they differ in social composition, thus in terms of vulnerability, different issues become more relevant to each. Moreover, growth marginalised some individuals, groups and communities in the province, pushing them closer to the edge of its social, economic and political systems.

In Vancouver and its suburban fringe, rapid growth and expansion represents an escalation in typical urban-related risks. Moreover, increasing real estate prices and living costs marginalised some groups and forced others into more vulnerable locations and situations, as well as heightened issues of increasing commute distances and traffic. However, some affluent groups voluntarily migrated to more vulnerable, but scenic places.

Relative to Vancouver, many communities in the rest of the province have unequal access to the resources needed to cope with disaster. Many of them, particularly resource communities which show many of the symptoms of marginalised groups, are vulnerable because of their position and role in the economy. However, this is not to say

that all communities outside of Vancouver are marginal and vulnerable. In fact, many, such as Kelowna, Kamloops and Victoria, are far from marginal and contain diverse and healthy, residents and economies.

Growth in Vancouver

The rapid growth in British Columbia is primarily concentrated in Vancouver, where both newcomers and capital amass. As a result, Vancouver's cost of living has significantly increased, pushing some vulnerable groups into often more vulnerable locations or situations. It forced some low-income families into the street (i.e., homeless) or into other communities that are exposed to more dangers and/or have less influence in terms of available resources, as well as, exacerbated existing conditions of vulnerability in some groups within its 'inner-city'. Even though this growth encouraged a technological sophistication and a greater range of modern services, its 'under-side' (i.e., increasing heroin and prostitution trade, AIDS, and homelessness) inspired a *Globe and Mail* reporter to dub Vancouver, the "city of death."

Continued interest by Pacific Rim investors contributed to rising real estate prices in Vancouver since its market was considerably 'undervalued' in comparison with those such as Hong Kong and Tokyo. Yet, in comparison to other Canadian locations, housing prices in Vancouver were significantly higher than in all other municipalities with Victoria a distant second. In January 1998, the Canadian Real Estate Association reported the residential average price in Vancouver was \$279,754 compared with \$233,067 in Victoria and \$206,209 in Toronto. These rising real estate prices resulted in

the disappearance of cheap land and the opportunity for many families to build, purchase or rent homes near to jobs in major cities. In its extreme, Baxter (1991) described these factors as producing increasing populations of homeless and 'at risk of becoming homeless' in Vancouver and many of its suburban communities. Furthermore, she illustrated that affordable housing stock was being lost, and not replaced, at an alarming rate via demolition and subsequent conversion into luxury condominiums; she cited that over a three month period in 1989, Vancouver lost more than 1,000 housing units.

The homeless are often viewed as an 'undesirable' group and tend to be neglected and often mistreated, thus making them one of the most vulnerable populations. They lack any real political representation because it is difficult for them to register and thus are discouraged from voting. They are exposed to numerous social and natural dangers, often forgotten and left without shelter or protections; their options, especially during disasters, are extremely limited. A 1998 policy report to the Vancouver City Council (Davidson, 1998) recommended that they endorse the City of Toronto's proposal to declare homelessness a national disaster. It also stated that homelessness continued to be a concern in Vancouver, where 300 shelter beds (plus an additional 130 temporary spaces for the winter months) were nearly always filled and perhaps another three to six hundred people slept in the streets, under viaducts and bridges, or in parks.⁵

5 It is often difficult to determine a "true" number of homeless people. First, homelessness is most often a temporary condition; therefore, the numbers of homeless can significantly fluctuate from day to day. Second, some homeless people are not counted because they are too difficult to find. These "unsheltered" or "hidden" homeless often stay in automobiles, camp grounds, offices or other places that researchers cannot effectively search.

Vancouver's high cost of living and affluent sectors have contributed in part to its growing number of disadvantaged groups. Additionally, Vancouver's trade linkages to and position in the Pacific Rim also provided the opportunity for growth in the "black" market and illicit trades (Schneider, 1997). For some people on the verge of poverty and homelessness, this high cost of living either forced them into the streets and/or to become involved in illegal activities. The city, especially in its "inner-city", also experienced a large increase in drug trafficking, particularly that of heroin, cocaine and marijuana products. Addicts and drug users, numbering between ten and fifteen thousand people in Vancouver, became more visible in back streets, and syringes and needles littered some downtown alleyways. Vancouver experienced an epidemic of death and disease related to injection drug use. In 1998, a record 371 fatal drug overdoses occurred in British Columbia, almost ten times the number (39) occurring in 1988. Additionally, the prostitute and sex trade likewise paralleled the growth of the illegal drug industry (in some cases to support it since many drug addicts engage in prostitution to pay for their habit), and much of its demand and clientele came from other affluent sectors (e.g., foreign business men).

In this 'drug' environment, the risks of AIDS, hepatitis C and other intravenously transmitted diseases are high, yet these only represent additional social risks to this already highly exposed population. Vancouver's "Downtown Eastside", for example, is a fifteen block area of misery and in a downward spiral. It has the lowest per capita income (under \$10,000) in Canada, HIV and hepatitis C epidemics, and problems of housing, drug trafficking and use, alcohol abuse, child prostitution, racial tension, gang activity

and urban native issues. Cernetig (1997) wrote that the six to ten thousand heroin addicts who inhabit the area have developed the world's highest HIV transmission rate of 18.6 per cent. In other words, if one thousand addicts were free of AIDS, 186 of them will contract it within twelve months. Moreover, these epidemics are thought to be localised, however, many people disagree. One doctor commented that the 'Downtown Eastside' is an incubator for AIDS and that many addicts simply frequent the area but live elsewhere, therefore, the disease is bound to spread to other areas. In terms of coping, the physical and psychological conditions of a drug addict in themselves imply a disability; some would argue that they continually exist in conditions of a social disaster.

As more people migrated to Vancouver, an overflow to surrounding communities resulted. The overflow of people was primarily created due to an 'idealised' living condition; moreover, it consisted of both voluntary and involuntary migrations. When the living conditions of a household surpass its 'acceptable' threshold, be it economic or aesthetic, an exodus to a location where conditions are adequate occurs. For some this threshold represented an economic value at which they could no longer afford accommodation, whereas for others it corresponded to a level of aesthetic beauty where their surroundings no longer appealed to them. For whatever reason, the end result was a movement of people to other locations. In terms of vulnerability, these people often migrated to regions exposed to a greater number risks and hazards, or to communities of less political influence and available resources to cope with dangers, and/or without protection. Even for those that remained in Vancouver, higher living costs meant less resources available for other non-essential expenditures (including protections such as

insurance and savings). Therefore, the question of whether the move was voluntary or not becomes important.

Escalating real estate prices and cost of living in Vancouver have bolstered the populations of many suburban communities. Many low to middle income households can no longer maintain an 'acceptable' standard of living in Vancouver and are forced to move to distant communities in which they can do so; however, many of these 'affordable' communities tend to be in more vulnerable locations. For example, many of the satellite communities along the Fraser River such as Richmond, Delta and Surrey are located in a historic flood plain and are inundated by annual flood waters. Furthermore, many studies, such as British Columbia Hydro and Klohn Leonoff Limited (1992), concluded these same areas to be highly susceptible and vulnerable to soil liquefaction under conditions of intensive seismic ground accelerations, i.e., large earthquakes.

Some people were willing and able to assume the burden of commuting from increasingly remote locations. Many of these migrating residents were young families who were unable to afford suitable accommodation, so they turned to newer, more distant developments where homes and lots were spacious and less expensive. Furthermore, the decision to migrate was eased by the government's enthusiasm towards supporting highways, and to a lesser degree, railways and ferries to diminish the physical distances that separated people from each other and labour from industry and resources. Over the last century, many significant transportation linkages were completed, such as Lions Gate Bridge (1938), the Hope-Princeton Highway (1949), the Sea-to-Sky Highway between Horseshoe Bay and Squamish (1956) and its extension to Pemberton (1965), and the

Coquihalla Highway between Hope and Kamloops (1986). However, these projects facilitated the continuous expansion of private transportation and, as Strong-Boag (1996, 288) put it, “the province's love affair with trucks and cars.” As illustrated in Figure 3.6, in excess of 1,800,000 passenger automobiles were registered to drive on the roads and highways of British Columbia in 1991, representing more than one automobile for every two inhabitants.

Voluntary migration is a phenomenon indulged in by a predominately affluent population who have the freedom of relatively few limitations. Blaikie et al. (1994, 10) pointed to the example of particular rich groups inhabiting hillsides for the view. In its extreme practice, they presented the example of Taal Volcano in the Philippines. (186). Many famous and wealthy people, including former political leaders of the country, built summer homes on the slope of this potentially destructive, active volcano. Similar examples can be drawn from British Columbia. Lion's Bay, for instance, is a relatively new 'affluent' community of primarily post-1971 construction and lies a few kilometres north of Vancouver. In 1991, its 1,328 inhabitants had an average household income of \$85,695; moreover, almost all of their dwellings were privately owned, large (i.e., 8.2 rooms average), single detached homes with a mean value of \$340,317. The village is situated in a high-risk environment, yet still attracts affluent families due to its scenic location on a steep mountain slope over looking Howe Sound and its good accessibility to Vancouver via the, appropriately named, Sea-to-Sky Highway. Debris flows, triggered by heavy rains and steep slopes, have historically occurred in creeks running through Lions Bay. On 11 February 1983, for example, a debris flow along Alberta Creek had a

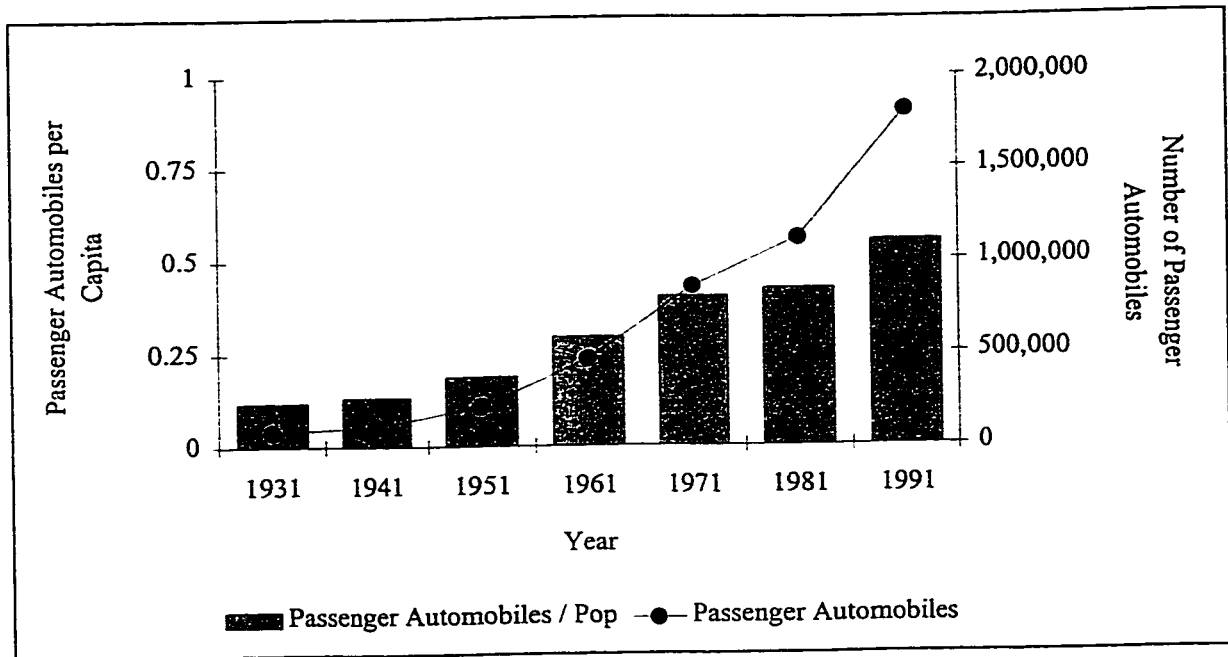


Figure 3.6 Passenger Automobiles in British Columbia, 1931-1991 (compiled from Statistics Canada Catalogue 53-219).

disastrous impact on the community. Lister et al. (1984) wrote that the flow occurred in the early hours of the morning and consisted of six surges over a period of two and one-half hours. Moreover, it damaged road and rail facilities, destroyed three homes and crushed a mobile home, killing two of its occupants. A concrete-lined channel has since been built in an attempt to confine flood or debris flow discharges in the Alberta Creek fan. Also, in constructing many of the large houses on the upper slopes, land was levelled and vegetation stripped, contributing to possible future slope instability.

There are some exceptions to a predominately affluent voluntary migration. With escalating real estate prices in Vancouver, some people simply take the lucrative financial opportunity of selling their property in a seller's market. However, in these cases, they do not have the same economic freedom to indulge and relocate as do affluent migrants.

Instead, they simply bolster the number of involuntary migrants exiting Vancouver for its less expensive satellite communities, the only difference being that it was their choice to do so and they accepted the risks involved.

The Mobile Commuter

Vancouver, as well as in other cities, became increasingly captive to corporate development and investment; however, this development rarely made provisions for any but the affluent. In part, this captivity contributed to an increasing cost of living in Vancouver, that in turn produced a flow of people to its suburban ring, bolstering their populations and establishing a growing number of commuters. In 1996, approximately two-thirds of the Vancouver labour force commuted more than five kilometres to their place of work with a median of 7.7 kilometres in distance, almost three kilometres greater than the median of the rest of the province (see Figure 3.7); moreover, the vast majority of people did so in cars, trucks and vans. This placed more people in vehicles for longer periods of time and thus increased their exposure to the 'chronic' risks and hazards of the road, including those posed by rain, snow and ice storms, flooding and landslides.

An increased exposure to road hazards is of particular importance to traffic on railways, roads and highways in mountainous environments where avalanche and landslide occurrences are relatively frequent. In October 1990, for example, ten thousand cubic metres of rock and debris fell onto the Sea-to-Sky Highway near Loggers Creek cutting off the Squamish, Whistler and Pemberton areas, including many of their commuters, from Vancouver (see photograph in Figure 3.8). This interruption was

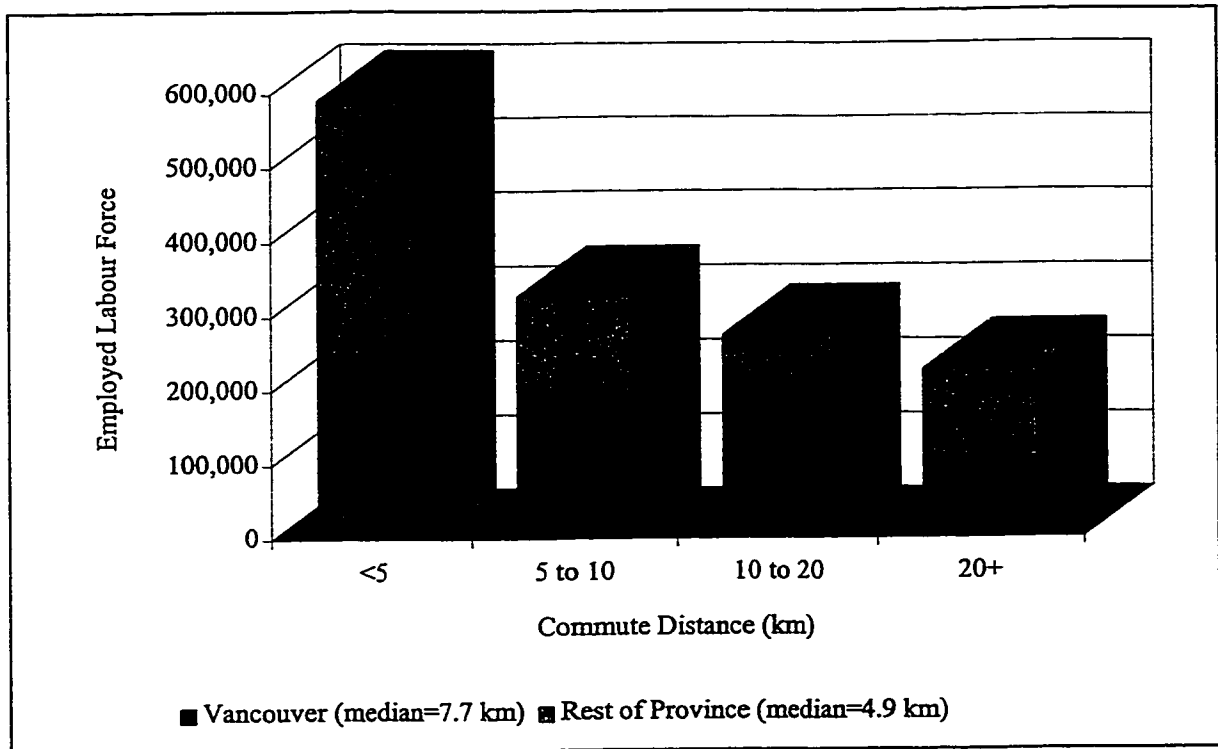


Figure 3.7 Commute Distance to Place of Work in British Columbia, 1996 (compiled from Statistics Canada Catalogue 96-018).

significant enough to warrant provincial funding to build an emergency ferry dock (e.g., to ferry traffic around blockages on highway), as well as to re-examine the possibility of constructing an alternative highway to Whistler heading north-west from North Vancouver. Also, in September 1991, a large rock fell on the same highway near the northern entrance of Porteau Cove Provincial Park puncturing a car, killing its driver instantly. Incidents such as these are bound to increase with greater traffic on mountain roads. In the most part, however, these incidents are limited to small accidents, and occasionally emergencies.

It is not surprising that motor vehicle accidents increased. In the year beginning April 1997, Provincial Emergency Program personnel responded to over one thousand

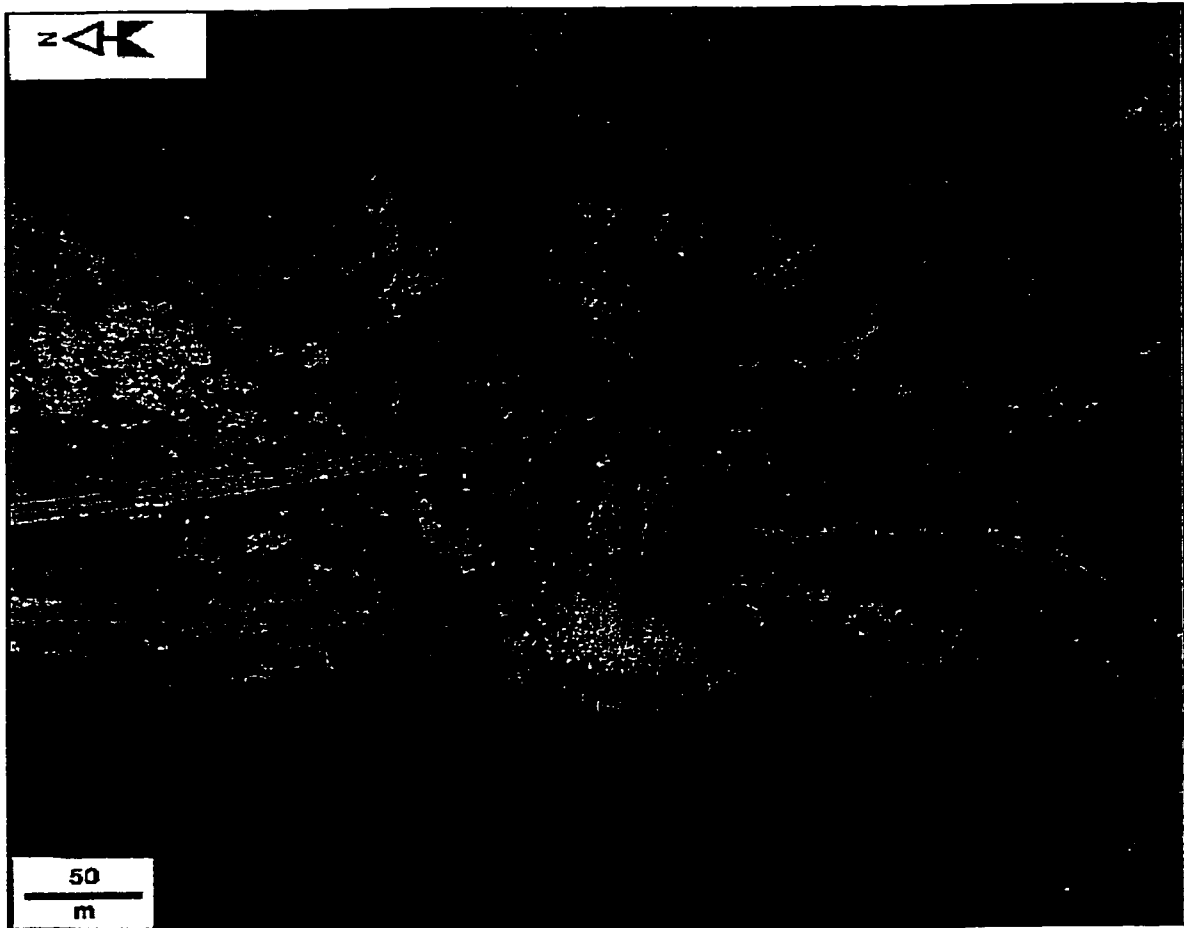


Figure 3.8 Landslide on the Sea-to-Sky Highway, 4 Kilometres North of Lion's Bay in October 1990 (from Evans and Savigny, 1994, 254).

motor vehicle incidents in British Columbia, which is more than five times as many incidents as eight years prior (see Figure 3.9). Moreover, in 1997, almost four hundred people lost their lives in motor vehicle accidents. Although these statistics may reflect a number of aspects, such as driving skills and weather conditions, it seems reasonable to assume that an increase in commute distance and traffic also contributed.

Additionally, in times of disaster people are more vulnerable while remaining in their vehicles; vehicles are not constructed with disaster in mind, thus provide little protection in disastrous conditions. Also, the lost control of a moving vehicle is

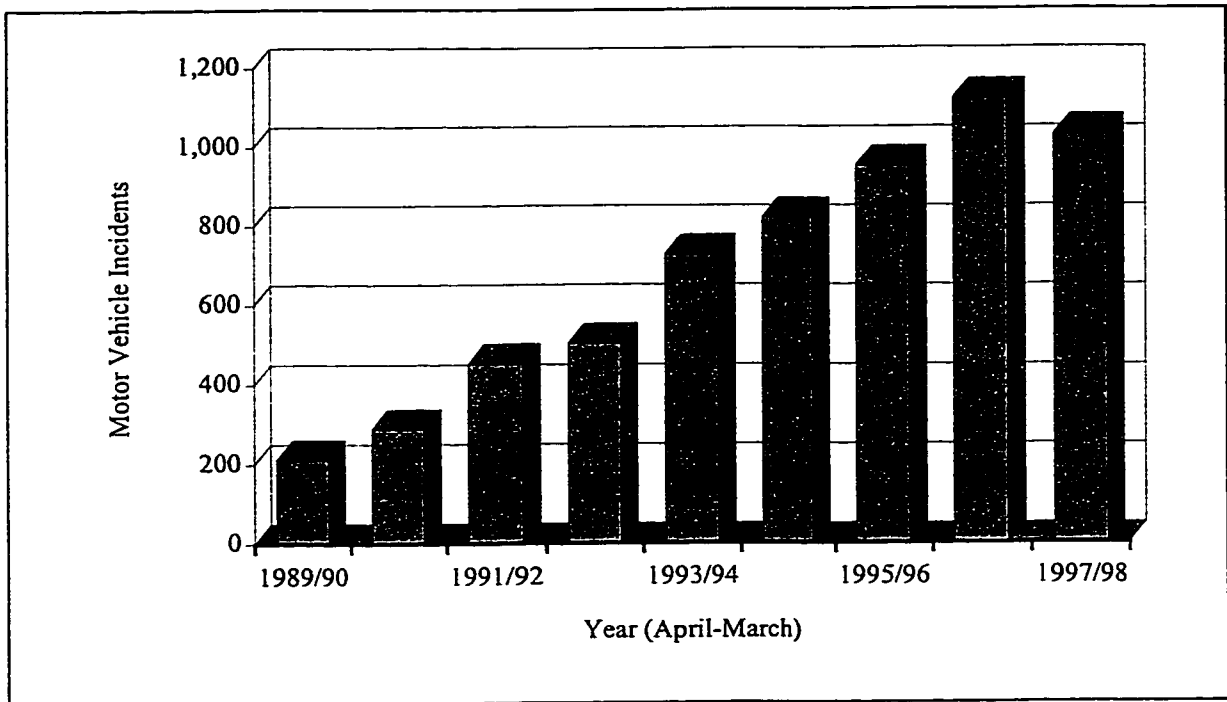


Figure 3.9 Provincial Emergency Program Responses to Motor Vehicle Incidents in British Columbia, 1989-1998 (from British Columbia, Provincial Emergency Program).

potentially dangerous to both the driver and those people in its immediate surroundings, and during times of disaster control is often more difficult to maintain. This is of particular importance in Vancouver, where vehicle traffic is significantly increasing. If a major earthquake were to strike during commuting times, for example, the panic and damage would intensify since a large number of people would be in more vulnerable positions, i.e., in their vehicles.

Peripheral Resource Communities

In British Columbia, the home of the staple industry is a scattering of single-resource cities and towns in the province's peripheral region. However, the continued stability of such communities is suspect in part due to their sole dependence on the

resources they exploit. Yet, this is not to say that all peripheral communities depend on a single resource; in fact a few communities, such as Kelowna, have diversified economies as not to solely rely on one industry for their continued existence. The fluctuating pattern of these single-resource communities is a direct result of the nature of the exploited resource itself, since non-renewable resources are location-specific and subject to depletion. To illustrate, Barnes et al. (1992) pointed to the communities of Ocean Falls and Mackenzie. They concluded that over-cutting the timber stocks around Ocean Falls partially led to the community's demise in the 1980s, and that exploitation of interior forests helped to explain the rise of Mackenzie as a prominent forestry town. Furthermore, the dependence on exporting resources characterised by high price elasticity has manifested itself directly on the landscape; single-industry communities literally appear and disappear with the vicissitudes of world export prices and demand. In 1982, for example, the price of molybdenum dropped from \$48 per pound to \$2 and the fate of Kitsault, a mining community about 120 kilometres north-west of Terrace, was sealed. The mine was closed and the inhabitants quickly deserted the town-site leaving behind a host of facilities. More than ninety houses, seven apartment buildings, a shopping centre, medical clinic, curling rinks, library, theatre, and recreation centre were left empty and to be maintained by the town's single inhabitant, the caretaker.

A community's dependence on a single resource often creates an uncertain future, as described above, in terms of employment for its inhabitants. In turn, this relates to coping capability since economics certainly plays an important role in the recovery process of disasters. Therefore, the survival of a community's industry is often an

important element in the population's vulnerability, and threats to this survival represent hazards. Forest fires and pests, for example, are extreme hazards to the forestry industry, as is outbreaks of disease to the fishery industry. In 1993, an outbreak of the fish disease *haematopoietic necrosis* in Kitimat, forced the government to order the destruction of 2.6 million chum salmon fry in March and another 66,000 Chinook salmon in May.

Although the community of Kitimat is primarily know for its aluminium smelter, its fishing industry would have been economically devastated and possibly eliminated if not for the government restitution received by the local fisheries. Additionally, the mobile nature of such industries adds to the instability of the community. If a company believes its production threatened or becomes unequitable, it can simply liquidate, or pick up operations and move to a more profitable location. This can be particularly important in the aftermath of disaster, when an industry may be forced to re-examine its position. As seen many times before, such as Ocean Falls in 1981 and Kitsault in 1982, the closure of a community's primary company often leads to the loss of its accompanying tertiary sector, and ultimately ending in either major industrial restructuring or its transformation into a 'ghost town'.

The effects of disaster often significantly outlive the disastrous event itself. This is of particular concern to a single-resource communities since their normal functioning relies on the quick recovery of the affected industries; they have no other secondary industries to support them while the other recovers. Murphy and Bayley (1989) described one such concern in their case study of the East Kootenay fires of 1985. In July 1985, three massive fires raged across the Nelson and Invermere forest districts threatening

local communities and their respective tourism and recreational activities. However, it was the sensationalistic media coverage that posed the greater problem to the tourism industry. Images of the fire and its effects were shocking, but lacked sufficient attention to the relative scale of destruction. "The pictures of walls of flame shown on news broadcasts left a mistaken impression that the whole Columbia valley and Kootenay region were on fire." (Murphy and Bayley, 1989, 43). These misleading images resulted in a reluctance to come and lost visitors, whose numbers could have been much larger if not for the Ministry of Tourism's post-disaster campaigning in key market areas.

Resource extraction often leads to an increase in the physical vulnerability of the exploited region. The harvesting of forests on mountain slopes and river banks, for example, can contribute to future slope failure and flooding respectively. In June 1990, a mudslide, one and a half metres deep in some places, roared down the mountain slope near Fall Creek taking three metres of topsoil with it; more than thirty people were rescued and three people died as their home, one of four that were destroyed by the slide, collapsed on top of them. Reports suggested that logging on the mountain slope was a contributing factor to the mudslide. The same type of relationship can be seen in mining. The extraction of rock ore or coal contributes to instability in the mine walls often accelerating their eventual collapse. In April 1990, three million tonnes of rock crashed down into the open-pit, Brenda Mine, closing it indefinitely because it was determined that the cost to extract the remaining molybdenum exceeded any possible revenue; more than three hundred employees lost their jobs earlier than the mine's anticipated closure. Also, underground mining, especially coal, often releases methane gas that under certain

circumstances⁶ can accumulate and ignite, resulting in a massive explosion. In addition, old resource extraction communities, once depleted beyond economic feasibility, often transform into new, relatively inexpensive residential developments. The attractiveness to develop such locations stems from the already existing infrastructure (i.e., less expensive to develop). However, as mentioned above, these areas are often left more physically vulnerable than they were prior to their initial exploitation.

A Growing Vulnerability: Tourism and Recreational Accidents

In the 1990s, a 'newly realised' natural resource was increasingly exploited in Vancouver, but to a greater extent in the rest of British Columbia: its aesthetic features. However, this exploitation gave rise to issues of risk and vulnerability associated with the tourism industry. The world fair in 1986 exposed British Columbia to millions of people and since, tourism has become one of the province's most promising industries; in 1996, tourism accounted for a record revenue of \$8.3 billion. Moreover, many land developers transformed previously pristine locations into world class ski meccas such as Whistler and Blackcombe that lure hordes of tourists and money to their slopes each year. These phenomena give rise to particular issues concerning the vulnerability of visitors. In part, tourism can expose its participants to potentially damaging natural events because of its attachment to high-risk areas. As evidence, the expansion of tourism has paralleled an increase in recreational fatalities and accidents. Beyond simple exposure, tourists and

6 Several studies of ambient atmospheric pressure in mine entrances indicated that changing atmospheric pressure may contribute to methane gas build up in mines.

visitors also represent a vulnerable group in a population, in part due to their high expectations of safety and their different reactions than residents in conditions of crisis.

Drabek (1994) compared the tourist industry to “a ticking time bomb... [that] represents a vulnerability of enormous catastrophic potential.” Although his conclusion was primarily directed towards the tourist industry in the United States and perhaps exaggerated, similar warning can be issued to British Columbia. In the most part, tourism is associated with enjoyment, security and comfort. These three characteristics are in the tourist's mind as they decide their travel destination, thus, an expectation of the characteristics' fulfilment, particularly that of security, exists. Here in lies the foundation of one problem; as Drabek (1996) observed, tourists and other transients such as business travellers, migrant workers and the homeless have “disaster performance expectations for business executives and local government officials that are not being met.” In other words, businesses and government agencies do not provide the security that tourists and other transients have come to expect from them.

Traditionally, disaster planning has primarily focused on the needs of permanent residents, however as tourism increasingly becomes a component of development in British Columbia, its requirements must also be incorporated into the planning process. This is of particular importance since most visitors are unfamiliar with an area and its local emergency or disaster plans, and thus are at greater risk than most local inhabitants. In contrast to residential population responses following two earthquakes in California, for example, “most of the transient earthquake victims took actions, such as rushing to another room or immediately running outside, that placed them at greater risk of injury.

In hindsight, these people emphasised that lack of familiarity with their location and absence of post-impact instructions led to these responses” (Drabek, 1996, 308). As Drabek (1996) illustrated in five case studies of United States disasters occurring during the 1990s, when people are away from home, they respond differently when subjected to disaster; some of the study's major findings are summarised in Table 3.2. Therefore, some form of contingency for the non-residents must be incorporated into a community's disaster planning.

The tourist industry is especially vulnerable because it depends on so many components and individual businesses. A general temptation to offer people immediate

Table 3.2 Major Findings of Transient Disaster Evacuation Study (from Drabek, 1996).

- Transients are less likely to receive initial disaster warning messages from the media than residential populations. Other sources included “temporary neighbours”, “lodging firm staff” and “direct observation”.
 - Transients receive initial disaster warning much later than residential populations; thus, the length of disaster forewarning was shorter for transients than for residential populations.
 - A significant proportion of transients receive perceived warning information as lacking precision.
 - In comparison to residential populations, transient exhibited a more bi-modal response pattern; one-fourth ignored the initial warnings completely and one-third reacted immediately.
 - Two-thirds received some type of assistance from management or staff of the lodging firm prior to their evacuation.
 - When transient populations receive disaster warning messages, about one-half try to contact relatives or friends to inform them of their circumstance.
 - When transients evacuate from an area, significant proportions leave personal property at the threatened site.
 - In sharp contrast to residential populations, very small proportions of transients stay overnight at the home of either a friend or relative, rather they find refuge in such places as public shelters, another room in private firm, or return home.
 - A significant majority of those who evacuated from a threatened area tried to return, with most encountering some type of difficulty getting there.
 - Over one-third of transients indicated that they had gone to more than one evacuation site.
 - While only a few transients were injured physically, or psychologically, over one-fifth lost personal property; only one-twentieth filed insurance claims.
-

access to spectacular scenery and activities in high-risk areas exists. However, many small businesses and entrepreneurs simply do not have the conceptual and/or fiscal capabilities to incorporate a thorough risk assessment into their development plans; therefore, risk of disaster to the individual business and their participants increases. Additionally, although these businesses are resistant to dwell on the risks associated with travel and recreation, the need to warn visitors of potential dangers still exists.

Visitors and tourists represent a vulnerable sector in a population, as described above, due to their weakened and disadvantaged coping capabilities. In a disaster context, this sector would likely be only one disadvantaged group among many in the general community. Simple exposure to natural hazards, however, represents yet another issue dealing with tourism. A greater number of people are participating in activities, such as skiing, snowmobiling and hiking, that place them at risk because of their locations. Due to the nature of such activities, however, the relative concentration of participants is small; therefore, the potential for disaster is negligible because the number of victims is limited and no disruption to the general community or social infrastructures is likely. Yet this exposure certainly represents an increase in accidents and emergencies amongst this sector of the population.

More and more people, tourists and native British Columbians alike, have expressed a growing popularity for back-country recreation. However, these back-country activities involve traversing dangerous terrain and subject participants to the risks

posed by phenomena such as avalanches⁷, landslides and wildlife attacks. Moreover, affluence or at least the willingness to spend large amounts of capital on back-country recreation has provided greater access to more remote and dangerous terrain. Helicopters, for example, provide a growing number of skiers with widespread access to pristine, and often high-risk locations at opulent prices; these prices declined in recent years making it more affordable to a greater number of people, yet they still remain relatively extravagant. Snowmobiles also provide quick access to avalanche terrain. Furthermore, Stern (1999) suggested that the incentive to ski in 'out of bound' areas (i.e., avalanche terrain) for free is strong with ski resorts charging fifty dollars for lift passes. Interestingly, he also stated that more than eighty percent of fatal avalanches are triggered by the victims themselves. Thus, as more and more people participate in back-country recreation, increasing numbers of victims are likely to result. Hendricks (q. in Wood, 1998, 21) compared this relationship to traffic accidents, "if more people go on the roads, you're going to get more accidents." Providing further evidence of recreational vulnerability, Table 3.3 summarises avalanche-related ski fatalities in back-country British Columbia from 1990 to 1995, including the disastrous incident that took place on Bugaboo Mountain, killing nine tourists and dubbed the "worst heliski disaster" in terms of death to date by the *Vancouver Sun*. More recently, on 2 January, 1998, an avalanche killed six back-country skiers in Kokanee Glacier Provincial Park on a day that saw an

7 Jamieson and Geldsetzer (1996) provided a detailed account of avalanche accidents in Canada between 1984 and 1996. Furthermore, they illustrated an increasing trend in avalanche fatalities and accidents, including those associated with recreational activities.

additional three recreational-related deaths (two skiers and a snowmobiler) in two separate avalanches. Wood (1998) further remarked that these avalanches brought the total number of fatalities for the 1997-1998 winter season to fourteen, exceeding the average number of deaths per year during the 1990s (10) by four.

Exposure to risk associated with tourism is not limited to the tourist, but also extends to include those people attempting to accommodate it. In a somewhat ironic relationship, people trying to protect tourists and recreationists from mishap, often place themselves in the same high-risk environments as those they are trying to keep safe. These situations can include implementing safety procedures, such as avalanche risk assessments, or those mitigating impact such as search and rescue efforts. On occasion these situations can likewise end in tragedy. For example, an avalanche killed a person in Hemlock Valley while they examined snow packs in order to assess the avalanche risk on

Table 3.3 Avalanche-Related Ski Fatalities in British Columbia, 1990-1995 (as reported in the Vancouver Sun) and the 2 January 1998 Incidents.

Date	# of Dead	Location	Additional Comments
30-Jan-1990	2	Kokanee Glacier Provincial Park	
12-Mar-1991	9	Bugaboo Mountain	heliski party of 14 (foreign tourists); in number of dead, it was the worst heliski disaster in history.
09-Apr-1991	1	Corona Ridge near Blackcombe	2 back-country skiers
19-Dec-1992	1	Cypress Provincial Park	2 skiers in out of bounds area
06-Feb-1995	1	near McBride	heliskiing
02-Jan-1998	6	Kokanee Glacier Provincial Park	back-country skiers
02-Jan-1998	2	near New Denver	8 downhill skiers in remote terrain

19 November, 1994. Also, on 27 November, 1991, a six person mountain rescue team

was engaged in a mock rescue attempt on Hudson Bay Mountain when they were hit by an avalanche, killing one of them and injuring the other five.

Mitigating Its Disasters

Hazardous events are inevitable and often result in disaster when they contact vulnerable populations (re., Chapter 2); therefore, to mitigate the impact of disaster, the vulnerability of a population must first be identified, understood and then reduced. In British Columbia, much time and capital has been invested in reducing its vulnerability to disaster, especially in the 1990s, when its efforts coincided with a global attempt to reduce natural disasters, i.e., the United Nations International Decade for Natural Disaster Reduction. Yet, even though the province has made significant strides in preparing for disaster, some issues impede their endeavours, while other new concerns arise with change in the province's social landscape.

More and more, high expectations of a safe environment have become synonymous with high levels of technological innovation and scientific knowledge, both of which are prominent in affluent societies. This relationship is not hard to comprehend since so many people place a lot of faith in technology and science for the solutions to most problems; moreover, this faith is reinforced by past experience and examples. The number of deaths and injuries suffered by British Columbians, as well as other Canadians, has been considerably reduced by scientific and technological advances; for example, the development of new drugs and the use of new communication technologies greatly improved care and containment of many communicable diseases. Furthermore,

demands for such improvements are not limited to medicinal products but rather are reflected in all aspects of risk, including those posed by landslides, floods and earthquakes.

Unfortunately, expectation does not always reflect personal reality. In British Columbia, Hewitt (1997) remarked that some hazards seem to outstrip the safety measures put in place despite the presence of numerous scientists and other professionals with the knowledge and skills to deal with most of these problems. Moreover, he noted that insurance companies are even “looking hard at reducing their exposure to property losses, if not pulling out, for fear of [the eventuality of disaster].” (265). Yet still, in the aftermath of disasters, so many victims claim ignorance; the familiarity of such statements as “I did not think it could happen to me?” reinforces this notion. In so many cases people believed or were misled to believe that their situations were secure; in other words, they were misinformed to their actual reality.

The distribution and availability of capital and human resources is an important issue in disaster mitigation in British Columbia. Although the technology and expertise to alleviate most disasters exist, the resources to implement them are limited, resulting in a difficult decision for the bureaucracy: how to distribute the resources to minimise the population's vulnerability to natural disasters? Grunfest and Huber (1991) furthered the dilemma and asked the question, with “limited resources... is it reasonable and cost effective in all cases to protect against extremely rare events when perhaps more lives can be saved by reducing the risk from more common environmental extremes?” In British Columbia, a large proportion of these resources are used in Vancouver due to its

concentration of people, political and corporate power and urban development, thus placing further constraints on the resources available to other communities. Cities usually contain most of the medical, engineering, and other professionals, the best hospitals and research facilities, and the purse-strings to provide the needed resources for emergency assistance. As a result, Vancouver can afford costly expenditures, such as reinforcing parts of its infrastructure to withstand large earthquakes, whereas smaller communities can not allocate their limited resources to such expensive tasks. For example, Moore and Reid (1996) described Vancouver's partially completed fire water pumping system, designed to reliably function under disaster conditions; it is independent from the city's conventional water supply and, when completed, able to supply 40,000 gallons per minute of salt water flow. Most other communities simply can not afford a like system. If, for example, an earthquake capable of rupturing 'typical' water pipes shakes the province, Vancouver can still fight the subsequent fires, whereas other communities may be forced to watch these fires spread with practically no ability to stop them.

The lack of resources to mitigate disaster often results in an investment in a particular location only after a disastrous incident has occurred. For example, in March 1991, a vehicle returning from Manning Park was struck by a falling boulder, severely injuring both of its two occupants. Work on stabilising the cliff was only initiated after the incident occurred. In June 1994, the victims were awarded damages of \$3.5 million due to government's negligence in maintaining highway safety.

In the most part, emergency social services are organised and implemented at the

community level. Moreover, individual businesses and households are encouraged to develop and initiate their own disaster response plans, with many of them complying. For example, the Lions Gate Hospital, an acute community hospital in North Vancouver, developed an evacuation plan for patients and staff in times of calamity. In 1993, the multidisciplinary plan involving hospital, police, fire, ambulance, and volunteer organisations was tested in a mock disaster exercise by evacuating 'acting' patients to a mobile hospital. It proved to be very successful, but some communication and patient transportation problems arose. Likewise, emergency awareness programs exist at a community level. Moreover, many of these programs are facilitated by *Safeguard*, a national public recognition program that allows for the possibility to achieve higher visibility for disaster preparedness messages at lower costs through resource sharing. The North Shore Neighbourhood Emergency Preparedness Program, for example, teaches participants how to minimise personal injury and damage to their property in times of disaster. Bean (1996) outlined their mission statement: "as you walk through the process of becoming better informed and prepared, some of your fears may actually increase, while others are laid to rest. Fortunately, intellectual and physical control encourage emotional control and will lead to less stress during the event. This is critical because during calamity, your survival can depend on how you cope with emotional stress and shock. If you have thoroughly thought out the possibilities in an emergency ahead of time, this will help you to control your panic reactions, make correct decisions and assist other."

Chapter Summary

In recent years, the “industry of man” evolved into a rapidly expanding entity in British Columbia; its face transformed, deepening regional differentiation between Vancouver and the rest of the province. In other words, the rapid growth was not uniform in character or distribution. Social, economic and political power concentrated in Vancouver which was aided by its favourable geographic location, while economic ties extended outwards ensuring centralised control. This left some groups disadvantaged, powerless, unprotected, and/or exposed to dangers, while at the same time provided security for others. Thus, vulnerability seems better explained in terms of social space rather than dangerous events (re., Chapter 2, “vulnerability perspective”).

Ultimately, the province’s social landscape changed and with it, its vulnerability to disaster. Urban sprawl contributed to longer commute distances and times, and thus longer exposure to dangers of the road. The general public’s technological sophistication created high expectation of, and dependence on modern products and services. Rising costs of living in Vancouver pushed some groups into often more vulnerable locations and/or situations. It forced some low-income families into the street (i.e., homeless) or into other communities that are exposed to more dangers and/or have less influence in terms of available resources. Also, an increase of tourists and other visitors brought attention to a “new” form of risk.

In the 1990s, more and more attention was given to the reduction of natural disasters. However, the rapid changes that occurred in the province dictates the need for

constant re-examination of its disaster preparedness in order to compensate for changes in its vulnerability.

CHAPTER 4. CHANGING PATTERNS OF VULNERABILITY: A CASE STUDY OF BRITANNIA BEACH

British Columbia, particularly the Lower Mainland, is a region experiencing rapid urban, economic and demographic growth. The rapid growth involves significant change within British Columbian society and transformations in the province's vulnerability to natural hazards and other risks (re., Chapter 3). This chapter draws on a case study of a disadvantaged community to demonstrate changing patterns of vulnerability and the social processes and context that can produce them. Specifically, it examines the community of Britannia Beach (see map in Figure 4.1 for its location) and the debris flood that coursed along Britannia Creek on 29th August 1991 and resulted in significant damage and financial loss to many residents and businesses in the lower-town. Moreover, this case study exemplifies what Hewitt (1997, 146) referred to as "structural" vulnerabilities, or those that "arise from the fabric of social life rather than hazardous conditions or accidental changes." Even in a developed region such as British Columbia, its social and economic structures produced disadvantaged populations whose opportunities for greater security are restricted.

Britannia Beach was once described as a "showplace" industrial community by the *Vancouver Sun*, but has since experienced significant change in its inhabitants and buildings; some people referred to it as an eyesore in an otherwise scenic setting. Its copper industry ceased production in 1974 and most mine employees migrated elsewhere. The settlement has since become primarily a low- to middle-income, commuter town

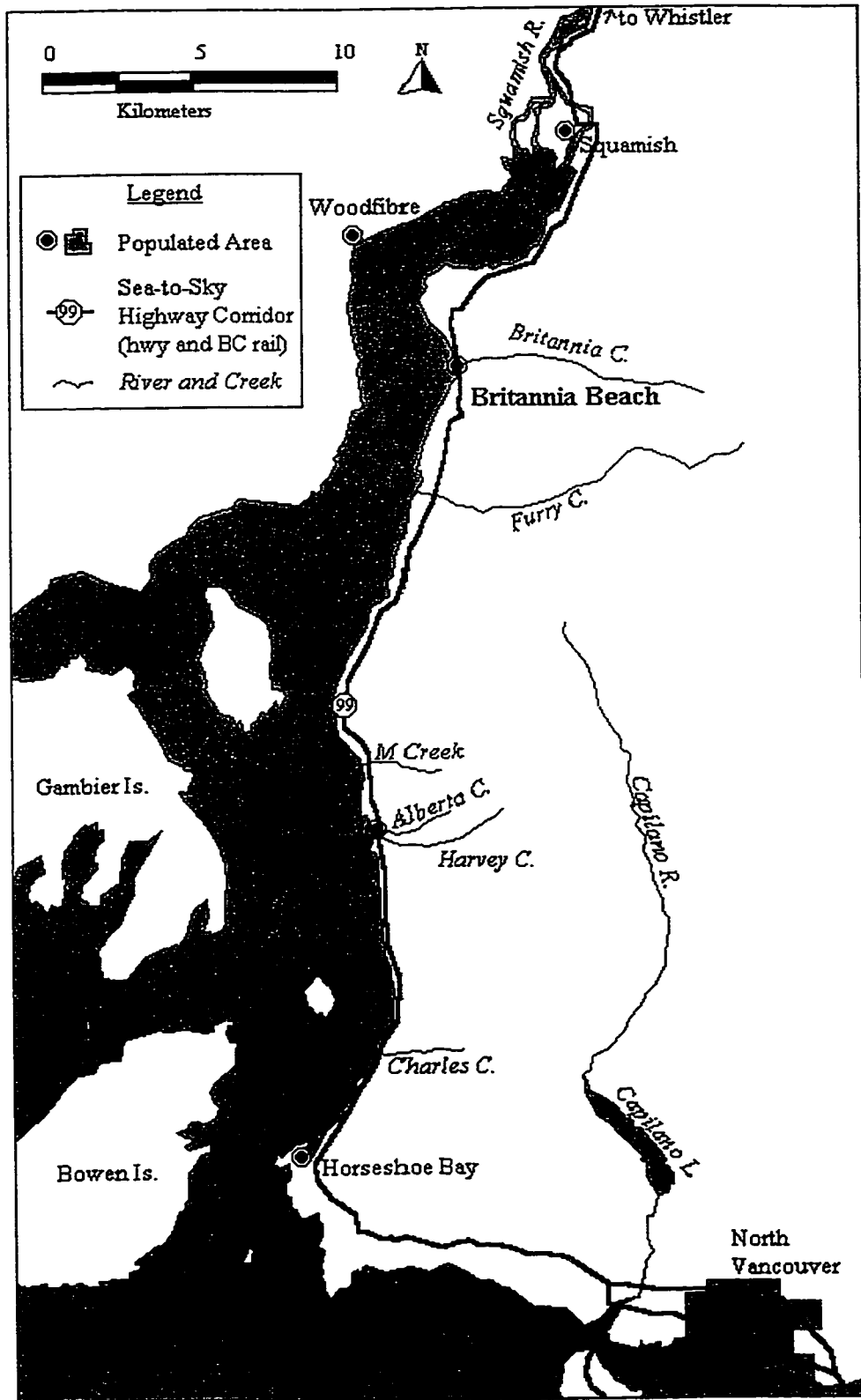


Figure 4.1 Map of Britannia Beach and its Surroundings.

with high resident turnover, and its industrial focus shifted from copper mining to tourism. The main tourist draw is the B.C. Museum of Mining that is housed in old mine buildings and attracts some twenty thousand people during its open season (from May to October). In addition, approximately ten small businesses located adjacent to the Sea-to-Sky Highway offer food and crafts to visitors. These businesses also comprise one of the only service areas (except for fuel since the station was closed following the 1991 flood event) alongside the highway between Horseshoe Bay and Squamish; hence they also service the increasing traffic flow between Vancouver and destinations in the Squamish-Whistler region.

In comparison to other sectors and populations in British Columbia, Britannia Beach is a prime example of a disadvantaged community. Moreover, it is typical of many other individuals, groups and communities in the province for whom vulnerability arises from the same or similar social, economic and political processes. For example, the community possesses little to no political power with only three hundred inhabitants and a non-incorporated status, thus it receives limited government attention and demonstrates a form of powerlessness to influence decisions that affect its own interests. Prior to the 1991 flood event at Britannia Beach, the government took a pro-active approach along the Sea-to-Sky Highway corridor to protect against landslides and floods, yet they did nothing at Britannia Creek. Also, Britannia Beach is located in a historic flood plain and rising living costs in adjacent urban areas, such as Vancouver, forced some people to migrate to the flood-prone town because it was one of few places where they could live on their relatively low incomes. It took a disastrous debris flood to not

only demonstrate but more importantly bring attention to many of the community's vulnerabilities. These are just two examples of social processes that contributed to the community's vulnerability. This chapter also explores other forms of vulnerability such as exposure to hazards through location, disadvantage through dependency and poverty, and structural weaknesses.

It is also important to remember, however, that vulnerability arises with little regard to particular hazards (a debris flood in this case), but rather from the characteristics and activities of everyday life or its transformations. The debris flood was merely one of many dangers, such as automobile accidents, illnesses and severe storms, that normally threaten this vulnerable population.

Geographical Setting

The small community of Britannia Beach is situated some fifty-five kilometres north of Vancouver along the eastern coast of Howe Sound. Other nearby, sizeable communities include Squamish and Whistler to the north, both of which attract large numbers of commuters and tourists from Vancouver and abroad. The town is mainly connected to the rest of the world by the increasingly busy Sea-to-Sky Highway corridor, which runs from Horseshoe Bay, through the lower-town of Britannia Beach, and ends in Pemberton. This corridor services the thousands of tourists heading north from Vancouver to the rock climbing and skiing 'Meccas' of Squamish and Whistler, as well as, the growing number of Vancouver-bound commuters.

Inland from the Howe Sound coast, the topography quickly rises in steep, forested

mountain slopes and, in some locations, vertical bluffs. It is a very rugged section of the Coast range, with many of its peaks, such as nearby Sky Pilot Mountain, rising in excess of two thousand metres above sea level. These mountains are cut into a series of steep ridges by deeply incised creeks flowing east to west, creating an attractive landscape which visitors and inhabitants often describe as “postcard pretty.” James (1929) provided a good, in-depth geological account of Britannia Beach’s local environment, as did Thurber Consultants Ltd. (1983) who also detailed many of the local watersheds’ bedrock and surficial geologies, as well as their potential as sources of natural hazards. In other words, local authorities were well-aware of potential hazards to the region.

With a temperate, maritime climate, the region receives a large amount of precipitation, typically in the form of rain at the lower altitudes and snow at the higher. On occasion this precipitation falls in significant volumes. This water is transported back to the Howe Sound along the many creeks flowing, east to west, down the steep mountain slopes. Historically, these creeks were often the location of natural hazards, such as debris torrents and floods (see Tables 4.1 and 4.2), thus producing zones of high-risk around them. This is evident by driving along the Sea-to-Sky Highway where there are very few stretches of road between Horseshoe Bay and Squamish where either hazard warning signs or protective structures are not visible. It is very concerning to read one of many “debris torrent hazard, no stopping on bridge” signs just prior to crossing a creek.

A History of Natural Hazards and Disasters

The community of Britannia Beach is no stranger to calamity. Since the beach

Table 4.1 Occurrences of Floods and Debris Torrents in Creeks Along the Eastern Coast of Howe Sound Between 1906 and 1983 (from Thurber Consultants Ltd., 1983, 3).

Location (listed south to north)	Flood	Debris Torrent
Disbrow Creek	2 (1931*, 1979)	0
Charles Creek	0	4 (1969, 1972, 1972, 1981)
Turpin Creek	0	1 (1983)
Newman Creek	1 (1982)	3 (1969, 1981, 1983)
Harvey Creek	4 (1969*, 1972, 1973, 1981)	0
Alberta Creek	0	2 (1982, 1983)
Magnesia Creek	1 (1960)	2 (1962, 1979)
M Creek	0	2 (1979, 1981)
Deeks Creek	1 (1972)	0
Kallahne Creek	2 (1960, 1981)	0
Furry Creek	2 (1976/77, 1981)	0
Daisy Creek	1 (1960)	0
Britannia Creek	4 (1906, 1921, 1933, 1963)	0
	Total 18	14

* 1931 and 1969 floods are of uncertain origin.

Table 4.2 Recent Examples of Disastrous Events in or near Creeks Along the Eastern Coast of Howe Sound (compiled from Hungr and Skerman, 1992, Lister et al., 1983, Vancouver Sun and Squamish Times).

Date	Location	Hazard	Description
1981	M Creek	Debris torrent	Debris torrent carried 20,000 m ³ of debris, including boulders one metre in diameter, at 5m/sec. One home and wood trestle highway bridge were destroyed. 9 motorists plunged into the void and died.
1983	Alberta Creek	Debris flow	Debris flow carried 10,000 m ³ of debris in six surges, the largest being 4 meters deep with a peak discharge of 250-350 m ³ /sec. Highway bridge, all culverts and fills, and 3 houses were destroyed, rail bridge and one house damaged, and 2 people died.
1983	Charles Creek	Debris torrent	Debris torrent with a peak discharge of 300 m ³ /sec. 90 ton concrete BC Rail bridge was destroyed.
1990	near Logger's Creek	Rock fall	10,000 m ³ of debris fell and blocked highway 99 for 12 days severing road link between Squamish-Whistler area and Vancouver. 6 emergency workers injured in second slide. Costs incurred totalled \$7M.
1991	Mashiter Creek	Debris flow	20,000 m ³ of debris clogged the creek and damaged the water intake at the dam.
1991	Britannia Creek	Debris flood	Flood carried large quantities of debris and overran a large portion of fan. About 40 families lost homes and livelihoods.
1994	Turpin Creek	Rock slide	Large rock and debris slides extending eight kilometres and closing highway. Blamed on heavy rains.

community's establishment in the first decade of the twentieth century, it has bore witness to many tragedies (see Table 4.3), all of which exemplify the high-risk nature of the local environment. Strong forces act frequently in this environment and others are ready to be released by extreme events or human activity. Exposure to these dangerous agents contribute to the vulnerability of those occupying the area. Moreover, these past tragedies help to place the 29th August, 1991 debris flood into historical context, as well as, begin to help explain the community's existing susceptibility to similar natural phenomena.

In 1903, the Howe Sound Company began plans to develop the rich polymetallic copper deposits located on Britannia Mountain some five kilometres upstream from the beach site at Britannia Creek. To facilitate the mines on the five local claims, which became know as the Britannia Group and included the infamous Jane, a processing mill was constructed at the beach and connected to the mines by two trams and decades later replaced by a switchback railway. Surrounding the mill, a small service community which included harbour facilities, sprang across the creek's fan and on both of sides of the water; the mining community of Britannia Beach was born. In 1905, the first ore was produced from the mines and continued to do so until the their final closures in 1974.

The first of the tragedies to impact the Britannia operations occurred on 21st March 1915. Although the disaster only physically affected the small, mining Camp 1050 in the Jane Basin, its repercussions were felt by the entire operation, from the beach community to its other high-altitude mining camps, and it would be seared into the minds of all Canadians alike. About one hundred thousand cubic metres of rock from above the

Table 4.3 Tragic Events to Strike Britannia.

Date	Event	Dead	Description
1915	Landslide	56	Avalanche from above the mine portal swept through Camp 1050 in the Jane Basin destroying many buildings.
1918	Influenza Epidemic	≅ 40-100	Without proper medical resources, and crowded mining camps, Britannia Beach was hard hit by the pandemic.
1921	Fire	0	Mill No. 2 burned to the ground, limiting mining production for months.
1921	Flood	37	Outburst flood caused by breach of blocked culvert, aided by heavy rainfall, swept away almost fifty houses.
1991	Flood	0	Outburst flood carrying large quantity of debris left about 40 families without a home or livelihood.

mine entrance swept through Camp 1050 and left a three hundred metre swath down the mountainside. The slide buried the mine office, store, rock crusher, tram terminus, bunkhouse, school house, and another half dozen homes under, what one witness described as, “millions of tons of rock, mud, and snow, which in some places were piled 50 feet deep...” (Ramsey, 1967). In its aftermath, fifty-six dead bodies were pulled from the debris and twenty-two other persons were injured. It was Canada’s second largest landslide disaster, after the 1903 Frank slide in Alberta which claimed seventy lives. The area of the landslide remains a source of concern. It was surveyed following the 1991 flood event and a geological engineer commented: “Fortunately, the Jane Basin potential rock avalanche did not release; however, this is still a major threat that needs to be addressed.” (q. F. Baumann in Busch, 1991, 3).

Other landslides have since impacted Britannia Beach. The only landslide to strike the beach community itself, however, occurred in 1957 when a submarine landslide on the edge of the creek’s fan resulted in the collapse of the B.C. Rail line and left a fifty

metre wide chasm. Luckily all of the trains were notified before tragedy ensued. Debris slides are much more frequent on the steep slopes of the upper creek valley. They are often initiated in part by heavy precipitation, and in some locations exaggerated by old logging roads and tree cutting. However, since the final mine closures in 1974 and the abandonment of the high-altitude mining camps, little to no human exposure to these hazards exists. In 1990, for example, the Mount Sheer community (abandoned since 1958 due to corporate consolidation efforts) was overrun by a large debris avalanche. Then again in 1991, a shallow debris avalanche on the northern steep, open slope, triggered by heavy rain, partially buried the abandoned town-site. Even though these events did not directly impact Britannia Beach, they did play a part, as sources of debris, in the 1991 debris flood that devastated the lower-town. In fact, the 1991 event was only one of six separate debris slides identified in a survey of the creek valley conducted shortly after the flood. It was concluded that these slides carried a large quantity of debris into the creek which in turn was transported down to Britannia Beach in the flood.

Other natural hazards have likewise plagued Britannia Beach. In mid-November 1918, the world was in the midst of an influenza pandemic, and the tightly knit community did not escape the reach of the deadly virus. People died like flies in the confined bunkhouses and homes, and little could be done with the limited availability of medical resources. The aerial tramway soon took on a new role as pallbearer; it no longer brought copper down the mountain, but rather the dead bodies of workers who succumbed to the disease. Ramsey (1967) stated that the actual number of people who died during the epidemic at Britannia was not known, however, some estimates range

from forty to over one hundred; such human loss can be devastating to a small community.

The most frequent natural hazard to affect Britannia Beach is flood. Significant flooding of Britannia Creek, which flows through the lower-town, was recorded in 1906, 1921, 1933, 1963 and 1991. Although only two flood events actually resulted in significant damage to the community, they do however illustrate a potential hazard of the area, as well as remind us of the high-risk nature of the local environment.

In terms of death, the most devastating flood occurred on 28th October 1921 and left thirty-seven people dead. Some six kilometres upstream from the community, driftwood collected and plugged a culverted fill underneath of the railway. Unknown to the lookouts, water quickly began to pool behind the blockade. The pooling of water was aided by the heavy rain of which 146 millimetres fell during the twenty-four hour period prior to the disaster. Soon sixty thousand cubic metres of water accumulated and at nine o'clock in the evening, the driftwood barrier could no longer hold the weight of the water.

The fill collapsed and sent a surge of water towards the unsuspecting community some six kilometres downstream, picking up tree and rock debris along the way. Witnesses recalled seeing a wall of water and debris seventy feet wide by three to five feet high bearing down on them, and several minutes later, thirty seven people were dead, fifteen others seriously injured, and more than sixty homes and buildings were destroyed on both sides of the creek. *The Vancouver Province* best summarised the tragedy: "On Friday Britannia was a show place as industrial communities go, with pretty houses set in neat gardens. Today a tangled mass of trees, boulders and the wreckage of homes cut the

village in two.” (q. in Ramsey, 1967, 61-62). A photograph of Britannia Beach in 1921, taken just prior to the flood, is displayed in Figure 4.2. The high density of dwellings and their close proximity to the creek help to explain, in terms of exposure, the pattern of destruction within the community.

Although no deaths occurred, the debris flood on 29th August, 1991 was just as disastrous as the 1921 flood event or perhaps more so in part due to the limited coping capability of many victims. The flood resulted in damage to almost forty dwellings and businesses. In a single surge, around nine-thirty in the evening, the creek overflowed its banks and followed the path of what used to be its old bed (i.e., before it was diverted to provide easier road and rail access). The location where the creek jumped its banks is marked as point of interest number one in Figure 4.3, and its main ‘new’ path is carved in the debris. It swept throughout the town centre, submerging buildings, as well as vehicles

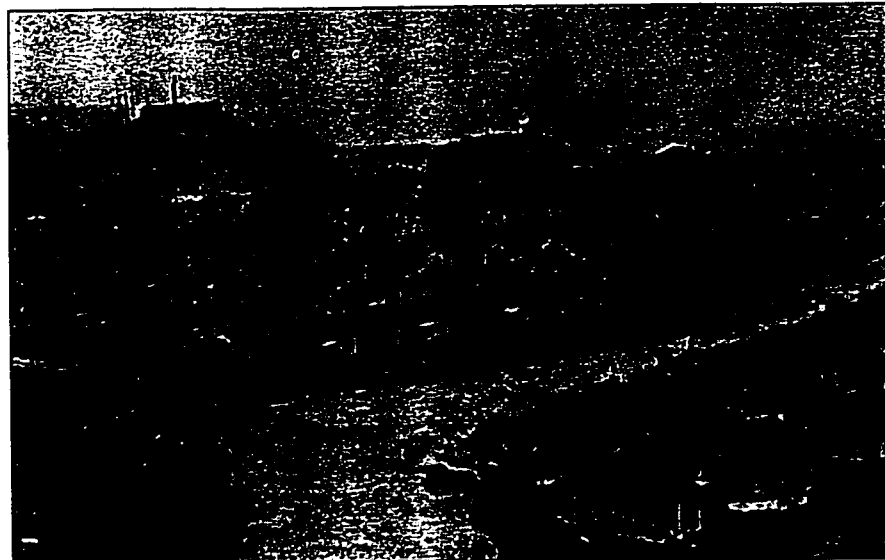


Figure 4.2 Photograph of Britannia Beach in 1921, Prior to Debris Flood (from British Columbia Provincial Archives).



photo courtesy of B.C. Museum of Mining.



photo from B.C. Ministry of Energy, Mines and Petroleum Products, 1993.

Points of Interest:

1. Location where creek jumped its bank. Note the 'new' path of the creek carved in the debris.
2. Debris was two metres in depth in some locations. Many automobiles parked on the road were destroyed by the flood.
3. The Honeymoon Duplexes took the brunt of the debris flood and were heavily damaged. They were deemed uninhabitable. The most northern (left) building later burnt to the ground, while the other three were left to ruin
4. Remains of a destroyed footbridge. It was not rebuilt.
5. Notice the road disappearing under the debris.

Figure 4.3 Debris Flood in Britannia Beach, August 29, 1991.

parked on the main road. Furthermore, both power and telephone line were severed, contributing to the general turmoil. They were only restored several days later. The water also carried large quantities of sand, gravel, cobble and boulder debris, including some boulders the size of "dishwashers", that overran a large portion of the creek's fan,

thus furthering flood damage and leaving creek banks scarred. The debris on the fan, some two metres in depth, stretched out over the town's baseball diamond. Monk (1991) observed a buried pickup truck near the remnants of a batter's cage and commented that it's roof could be mistaken for first base (see point of interest number two in Figure 4.3). As the flood water settled, the low-lying areas of town, including the Sea-to-Sky Highway, were submerged under a metre of water, aided by the elevated BC Rail track embankment which acted as a dike, preventing the water from quickly flowing into Howe Sound. Over the next day the flood water slowly subsided, exposing a community in ruins for everyone to see. One inhabitant commented, "this is the worst flooding I've seen," and like comments were echoed by many of his neighbours.

Interpreting Vulnerability in Britannia Beach

Vulnerability in Britannia Beach seems to be closely tied to power and control, or more specifically, the lack of such. Most inhabitants simply do not possess the economic and political power to control their situations thus restricting their opportunities for greater safety and security. Additionally, changes in the community, particularly those between the mining and post-mining periods, provide interesting examples that compare aspects of vulnerability under different circumstances. This section examines the social, economic and political processes contributing to different forms of vulnerability in Britannia Beach.

Insecurities of Dependency

Every community is a mosaic of personal, social and economic dependencies;

moreover, these dependencies often control and restrict opportunities for greater security. Most people in urban and industrialised populations depend on built infrastructure and wage earnings to live, however, these dependencies are lessened by an individual's other private resources. Britannia Beach provides interesting cases of dependencies, both past and current.

Britannia Beach was generally a self-contained community prior to the flight of its mining industry in 1974. The town property was usually owned and managed by the company that operated the mines at the time. Dwellings were erected and leased to mine employees, and most of the town's businesses existed to meet the needs of workers and their families. A co-operative general store, school and community centre, for example, were organised for and catered to the inhabitants of the town. The mining company acted as a parental figure and looked after the needs of its 'children' (i.e., employees), thus, the community became a cohesive unit. Although strong dependencies still existed, this relationship did provide security for as long as the mines remained profitable; in other words, the company required labourers and thus provided for them (including security). After the flood that destroyed more than sixty buildings in 1921, for example, the Howe Sound Mining Company rebuilt and improved upon lost homes and infrastructure. They greatly contributed to the restoration and improvement of inhabitants' lives. However, it is important to remember that dangers of too much control or dependency exists and as Hewitt (1997, 153) pointed out, "empowerment may be much more critical to reducing the vulnerability of such people than any particular tools, information or regulations to combat a hazard."

With the departure of its mining industry and mine employees in 1974, little to no cohesion remained within Britannia Beach. Residents looked outside of the community for employment and services such as cinemas, supermarkets, and swimming pools. The service sector transformed and mostly catered to tourists and visitors rather than residents who now represent only a small proportion of its clientele. New people and families also migrated to the community because of its relatively low cost of living (i.e., in comparison to Vancouver and other growing metropolitans), however, most drew employment and income from elsewhere.⁸ The 1991 Census, for example, recorded that over eighty percent of people with a usual place of work did so outside Britannia Beach. The population became fragmented and alienated from each other. There was no longer a single authority to organise and control the community, rather many insecure individuals dependant on numerous external entities. It would seem in this case that vulnerability was relatively greater than if control was centralised and in the same local environment with those at risk.

Land Ownership and Tenancy

Davis (1981, 15) stated that land ownership was a core issue of a community's vulnerability. He made this statement in the context of rural poverty and the essential need to make inexpensive land available with the security of tenure to ensure the creation of safe settlements. However, it also reflects important concerns affecting inhabitants of

8 Most people that occupy flood plains do so out of economic constraint. The threat of floods makes the land cheap and thus more affordable to poorer families. This can be considered a form of involuntary vulnerability since a lack of wealth denies them access to live in "safer" communities.

Britannia Beach and their insecurities.

Two groups own the properties that comprise Britannia Beach. In 1979, Anaconda sold their mine property to a real estate company, Copper Beach Estates. One condition of sale, however, was the transfer of sixteen hectares of land to the Britannia Beach Historical Society for the purpose and upkeep of the museum. The property boundary is shown on the map of the lower-town (see Figure 4.4). Both landowners leased portions of their respective properties, mostly old mining buildings for accommodation (e.g., the Honeymoon Duplexes) or land on which to secure mobile homes. The small, independent businesses are likewise located on leased properties along the highway in the lower-town.

Tenancy often creates insecurities in tenants. The use of a rented property is temporary and limited by the conditions of the lease. Moreover, control of the property ultimately remains in the owner's hands, thus a tenant's relationship to the owner is based on a dependency. A tenant's recognition of this lack of control often translates into uncertainty of their future in terms of home and shelter, particularly in the aftermath of disaster when decisions to rebuild or not are often not theirs to make. Following the 1991 flood event, many Britannia Beach residents expressed these fears and uncertainties. One important community figure, for example, commented that she did not "want to see the land owners use this disaster as an excuse to disintegrate the community." (q. Z. Lambert in *Squamish Times*, 1991). Moreover, these fears were actually realised by some residents when they lost their 'leased' homes and were forced to relocate. The four Honeymoon Duplexes (see point of interest number three in Figure 4.3 above), for

example, were heavily damaged by the flood and deemed uninhabitable. Not only did the eight residing families lose many of their possessions, but they also lost their living spaces and were told to find alternative accommodations. The remnants of the northern-

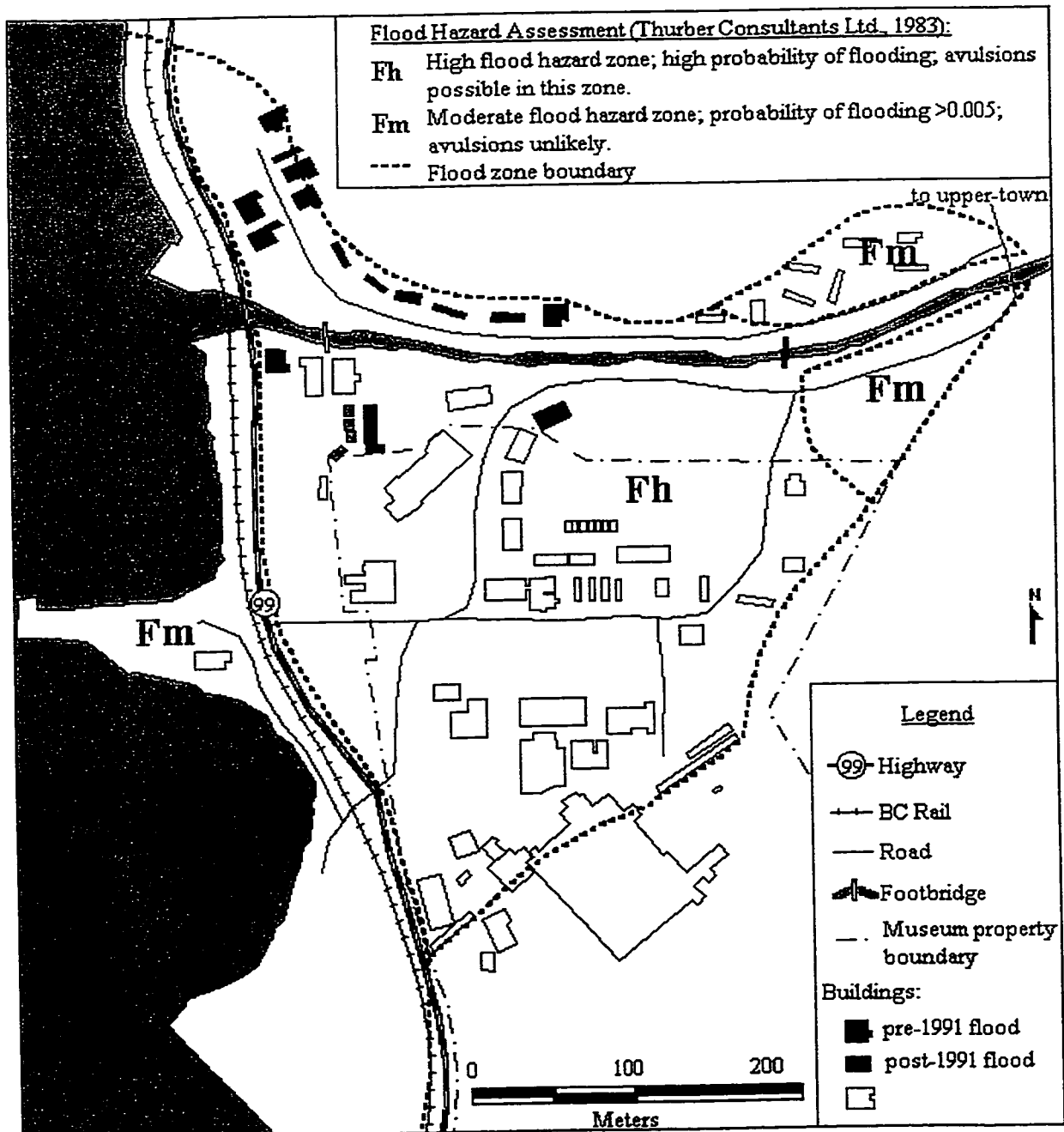


Figure 4.4 Lower-Town of Britannia Beach and Flood Hazard Zones.

most duplex (on Copper Beach Estates property) burned to the ground a few months later, while the remaining three (on museum property) were left vacant and to ruin. In a similar demonstration of control, Copper Beach Estates moved twelve mobile homes from sites along the northern-side of Britannia Creek to a new location in the upper-town.

Residents were given the choice of either moving or face possible eviction. One mobile home owner commented: "I don't like the idea of going up there but it was a case of either going where they [Copper Beach Estates] want us to move or they would evict us." (q. C. Jensen in Booth, 1991, 3)

Copper Beach Estates also had its Britannia Beach property for sale, furthering its tenants' insecurities about their future living spaces. Several prospective buyers showed interest in the property, but their plans of redevelopment and negotiations fell through. K.L. Resort Development, for example, planned to develop one thousand housing lots, a hotel, marina, and possibly a school and recreation centre, and offered to buy two-hundred and sixty hectares for \$12.5 million in August 1992, but the deal failed to materialise. At least some part of this planned development must be located in the flood hazard zone and perhaps this consideration contributed to the deal's failure (or for any other deals' failures as well). Copper Beach Estates even had its own plans to redevelop the site into a golf course resort. These plans demonstrate an uncertainty about the community's future, as well as Copper Beach Estates' intentions and priorities in terms of that future. A situation occurring two months prior to the 1991 flood event further depicts the company's 'real' concerns and priorities. In a letter dated 30th June, 1991, Frank Baumann, a geological engineer, warned the government of a high potential of

avalanches in the upper Britannia Creek watershed and subsequent flooding in the lower-town. In turn, he was accused by Copper Beach Estates of jeopardising a major business deal by going public with this information. A spokesperson wrote: "To make a catastrophic pronouncement at the time of the completion of a 'due diligence' exercise involving a major investment in the Britannia property is fraught with potential accusations depending on how events unfold." (q. D. Cumming in Busch, 1991, 3).

Property management under Copper Beach Estates ownership contrasts with those of previous mining company owners. The community was initially built and well-maintained by its owner to provide adequate accommodation for their mine employees; thus, the main purpose of leasing dwellings was not to generate profit rather to supply living spaces for their labour force. Since a labour force was required to maintain mine production, the tenants (i.e., labour force) felt a sense of relative security in terms of their employment and accommodation, for as long as the mines remained profitable. Thus, the relationship between owner and tenant was somewhat symbiotic. Following the mines' closures and the end of production in 1974, however, this relationship transformed into its current manifestation and the tenants' situations became less secure.

Powerlessness and Political Vulnerability

Certain populations have little to no influence in national, provincial or local policies that govern public resources, including those that affect social security and protection. Moreover, centralised governments, such as in British Columbia, are often surrounded by vulnerable communities. This can be attributed in part to weak and small,

peripheral populations that do not have the political power to influence decision making that affects their own interests.

Britannia Beach is a non-incorporated community and home to three hundred people, only three-quarters of whom were eligible to vote in 1991; hence, the community received limited government attention. Non-incorporated places often fall under the jurisdiction of nearby municipalities or much larger regional districts. In other words, they have no local governments and are small and often insignificant parts of larger electoral bodies. In the context of emergency preparedness and response, provincial policy (1993) delegated responsibility to local governments and the province was to take charge where none existed (as in the case of Britannia Beach). Prior to the enactment of the British Columbia Emergency Program Act in 1993, however, no mandate existed to encourage local organisation and preparedness and some communities were left with none.

The 1991 flood event demonstrated Britannia Beach's poor emergency response co-ordination. In fact, no one seemed responsible for co-ordinating the divided parties (i.e., Copper Beach Estates, Ministry of Transportation and Highways, B.C. Museum of Mining, and Provincial Emergency Program). Early response was chaotic and consisted of the local volunteer fire department and individuals hauling people from their homes, with no outside support. Other response parties did not arrive for up to several days. The division in the relief effort was illustrated when B.C. Rail workers, whose top priority was to re-open their railway, repaired the track embankment before all the flood water was able to escape into the Howe Sound through the gaps. This incident was later hotly

debated in community meetings and still remains a point of contention for some.

Political influence and power often play important roles in the distribution of public resources, including those allocated for the purpose of emergency and disaster preparedness. Unfortunately, the most needy and vulnerable populations do not always receive the most support. As Wilches-Chaux (1992, 34) cynically observed, these people do not have the capacity to become a problem for others or the government and are thus often overlooked and ignored.

A detailed study (Thurber Consultants Ltd., 1983) of flood and debris torrent hazards in watersheds along the Sea-to-Sky Highway was conducted for the Ministry of Transportation and Highways in 1983. It ran “design” flood and debris torrent scenarios in each of the creeks and identified resultant hazard zones and rated bridge performances. In Britannia Beach, a “design” flood of 268 m³/s produced significant flooding in the lower-town (see flood hazard zones illustrated above in Figure 4.4), damaged both the rail and highway bridges, and destroyed two pedestrian crossings and the steel bridge leading to the upper-town. Ironically, the 1991 flood event bore close resemblance to the predicted high flood hazard zone (actual flood extended only half as far south as modelled). With this knowledge, the government chose to ignore the potential for a flood disaster at Britannia Beach. They did, however, manage to take a pro-active approach elsewhere along the Sea-to-Sky Highway to protect against landslides and floods. The most sophisticated structures in the region, for example, were constructed in the vicinity of Lions Bay which is, not surprisingly, an affluent community. A large debris retention basin was constructed at Charles Creek to protect the highway, railway and expensive

homes below it on the creek's fan. A similar structure was also built at Harvey Creek with a debris retention capacity of 70,000 m³ (see photograph in Figure 4.5).

It is ironic that during disasters, public attention focuses on the victims and politicians tend to make promises that they cannot or will not keep. But, once the event is over and conditions are returned to normal, these promises often lose weight and the public "money barrel" empties elsewhere. Days after the 1991 flood event at Britannia Beach, the province's Premiere arrived by helicopter and promised the residents aid. The Provincial Emergency Program initially supported the victims, however, once order was restored to the community, no further support was given to it to prevent future disasters.

Economic Level and Recoverability

The *Vancouver Sun* described the population of Britannia Beach as mostly comprised of "pensioners and middle-to-low income families." This description was



Figure 4.5 Upcreek View of Debris Flow Retention Dam at Harvey Creek, Lions Bay (from Evans and Savigny, 1994, 276).

partially reinforced by the 1991 Census that reported a median household income of slightly above thirty thousand dollars in Britannia Beach, and thus many people lived in relative poverty. The newspaper's reference to "pensioners", however, was somewhat misleading since only twenty-five people made up the population of those sixty-five years or older.

A low income household is often associated with a vulnerable household. But, sometimes the "poorest" are not always the most vulnerable. In some cases they may have obtained a level of flexibility from living in constant conditions of crisis that allows them to avoid or better adapt in times of crisis. However, as Wildavsky (1988) concluded, "'richer is safer' because wealth gives access to the 'general resources upon which our safety mostly depends.'" (q. in Hewitt, 1997, 147). In other words, poor households are commonly disadvantaged and limited in their opportunities for greater security by their low financial means. For instance, one cannot expect the poor to invest in protecting their dwellings against infrequent hazards because typically their priorities lie in economic survival. This point is reinforced in the case of Britannia Beach where many people commented that they were unable to obtain or afford the security provided by flood insurance.

A lack of financial resources also tends to decrease a victim's ability to cope with and recover from disaster. Poorer populations tend to teeter on the edge of economic survival, expending almost all of their financial means to remain so; hence, they have little to no money left in reserve for times of unexpected need. Therefore, when victims lose all or a portion of their properties, such as during a flood, many low income victims

simply cannot afford to fully recover their prior lifestyles. Moreover, even if victims are able to recover their losses, they are often left with no or less financial security and thus are in a more vulnerable situation than they were before the disaster struck. In Britannia Beach, Lynne Cook, for example, took eight years to turn an old bus into a thriving diner, the Mountain Woman, and the 1991 flood event only took a few minutes to wash it away. She later commented: "I'm devastated, I don't have insurance and I'm a single parent. This was my last big weekend to make money before school starts" (q. in Young, 1991, F1). With the daunting task of rebuilding her livelihood and the loss of the additional "big weekend" money, the disaster left her and her family in a precarious financial situation.

Economic status can greatly affect the means and choices available to a household that will make it more or less vulnerable to a host of dangers. Hewitt (1997, 153) cited this as an instance of a "reproduction of vulnerability." A low-income family, for example, is limited in their choice of residence. They may be restricted to reside in a community of little political influence; their financial means may force them to choose tenancy rather than ownership of their living space or prevent adequate upkeep of their property. In this instance, vulnerability is positively reinforced.

Built Structures

The 1991 debris flood event's largest impact on Britannia Beach was luckily not in terms of death or injury but rather occurred through the damage to and destruction of dwellings and other structures; thus some discussion of the community's built structures

and their vulnerability is necessary. Social characteristics and processes can significantly affect a community's buildings; thus, they likewise contribute to a household's weakness and thus exposure to dangers.

Britannia Beach contains almost one hundred and fifty structures, however, these can generally be divided into two distinct regions: upper- and lower-town. The lower-town mostly consists of the remains of the old mining community. Most of the buildings were constructed before 1960 and are in a state of disrepair. Moreover, the structures are made of wood, and are thus more susceptible to deterioration, warping and fire, than modern brick homes. The buildings are now used as storage facilities and house small businesses, residents and a museum. Old mobile homes are also located along the northern shore of the creek. The upper-town, on the northern slope, is home to most of the community's residents who live in 'newer' mobile homes. In fact, prior to the relocation of twelve older mobile homes from the northern shore of the creek in 1991, residents paid \$10,000 above market value for their homes on the premise that only new trailers were accepted in the upper-town. This area is outside of the flood hazard zone and is not at risk from the creek.

The social characteristics and situations of occupants can significantly affect buildings. As described earlier, most expenditures in low-income households (such as in Britannia Beach) are often allocated towards their economic survival and meeting their daily needs. They typically do not have enough income or resources left to invest in protecting their dwellings against infrequent hazards. In other words, investment in their dwellings is mostly limited to essential maintenance only. Another characteristic that

greatly affects Britannia Beach's buildings is tenancy and the uncertainty that stems from it. Tenants generally do not invest in leased property, but rather in assets they can easily take with them such as televisions and other appliances. Moreover, owners tend to minimise spending in their properties since they are run as businesses and thus attempt to maximise profits. In Britannia Beach, this minimal spending was reinforced by the fact that property owned by Copper Beach Estates was for sale and that most plans of its re-development involved the removal of existing buildings. The end result of these characteristics was a community of marginal and vulnerable dwellings and structures.

The Service Sector and the B.C. Museum of Mining

Following the abandonment of its mining industry in 1974, business plans were developed to stimulate industrial growth in Britannia Beach. As outlined by Mullan (1992), most studies centred around the B.C. Museum of Mining which opened its doors to the public in 1975. One study (Simons (International) Ltd., 1980), for example, proposed the development of a "historic mining community" theme park at Britannia Beach. Interestingly, it recognised the potential threat of flooding as an area of concern for any development in the community. The museum has since focused its program on developing a living heritage site with an overall theme of "a day in the life of a coastal resource community" (Anderson, 1995). In 1988, the concentrator complex was made a National Historic Site and the entire operation received a British Columbia Provincial Landmark designation three years later. The museum became the centrepiece for increasing local tourism and the industrial focus of Britannia Beach slowly shifted from

an once-rich mining resource to a well-regarded heritage resource.

The “new” industry of Britannia Beach also included numerous small businesses that offered varying crafts and food to visitors. However, a significant proportion of their clientele consisted of the twenty thousand people per year that visited the museum during its open season. In other words, many of the businesses were dependant on the continuous flow of museum visitors and thus on the museum itself. Furthermore, for many of these businesses, there was only a small margin between profit and loss. In other words, losses amounting in thousands of dollars to one particular business, for whatever reason (e.g., damage from flooding, and decline in customers), could mean the end of a business that had struggled for years to become profitable. Therefore, many of these businesses were vulnerable in part due to their dependence on the museum, as well as their limited options and resources in times of loss.

The B.C. Museum of Mining was also severely affected by the 1991 flood event. Although only a few of its buildings were actually damaged, the flood significantly hindered its long range vision and plans of development. In fact, Sherry Elchuk, the museum curator, indicated that the museum had still not fully recovered from the 1991 flood during a 1998 conversation. Perhaps the most devastating of the flood’s impacts on the museum was the loss of revenue. The museum closed for the remainder of the 1991 season (including Labour Day weekend), shortening it by more than a month. Thus, the museum lost its admission revenues during this period. Also, as previously mentioned, the museum-owned Honeymoon Duplexes were also damaged in the flood and deemed uninhabitable. Thus, the museum permanently lost a significant source of rent revenue,

furthering its economic restrictions.

The time of day and week that a disaster occurs at identifies another important concern in Britannia Beach. Daytime and weekend disasters introduce a new element to the situation. During the day, especially on weekends, numerous visitors are present in the community and as previously discussed (re., Chapter 3) represent another vulnerable population. Moreover, visitors can make up a significant proportion of the population during the week when both children and commuters are away at school and work respectively. The introduction of vulnerable visitors, who generally behave differently in disasters than residents, creates difficulty in emergency planning and preparedness. The 1991 flood event occurred in the evening and thus no tourists were present.

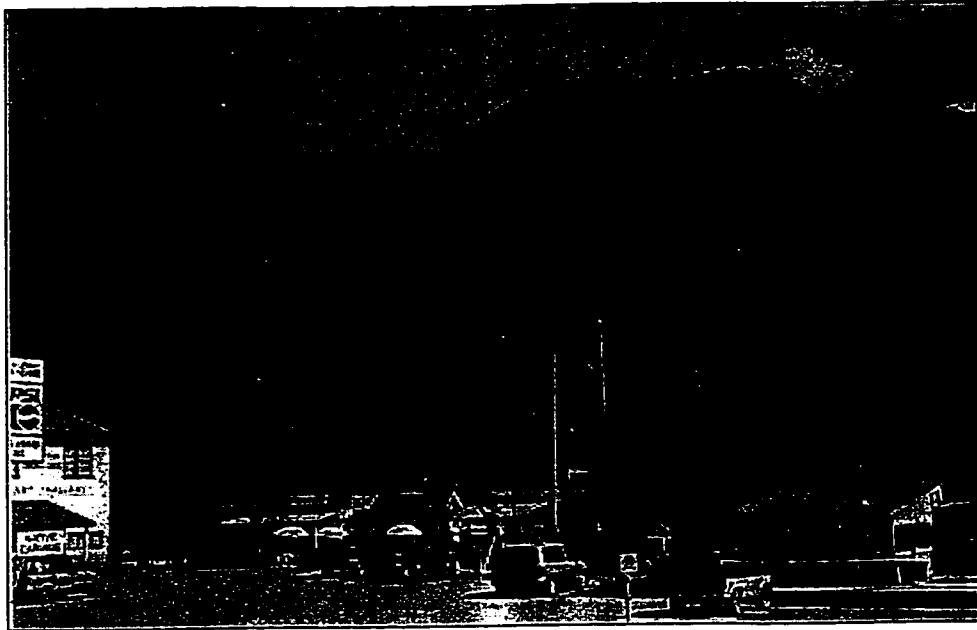
Britannia Beach in 1998

Since the 1991 flood event, some effort was undertaken to reduce exposure to flood hazards, however, it was limited to quick fixes and easy answers. Copper Beach Estates, for example, forcefully moved twelve mobile homes on its properties along the northern shore of the creek to a new location in the “safer” upper-town. They also evicted their tenants from the Honeymoon Duplex. These tenant removals did reduce exposure to flood hazards, however, they did little to address the underlying issue (i.e., their inability to cope with crisis). Floods merely represented one of numerous events that endanger this population.

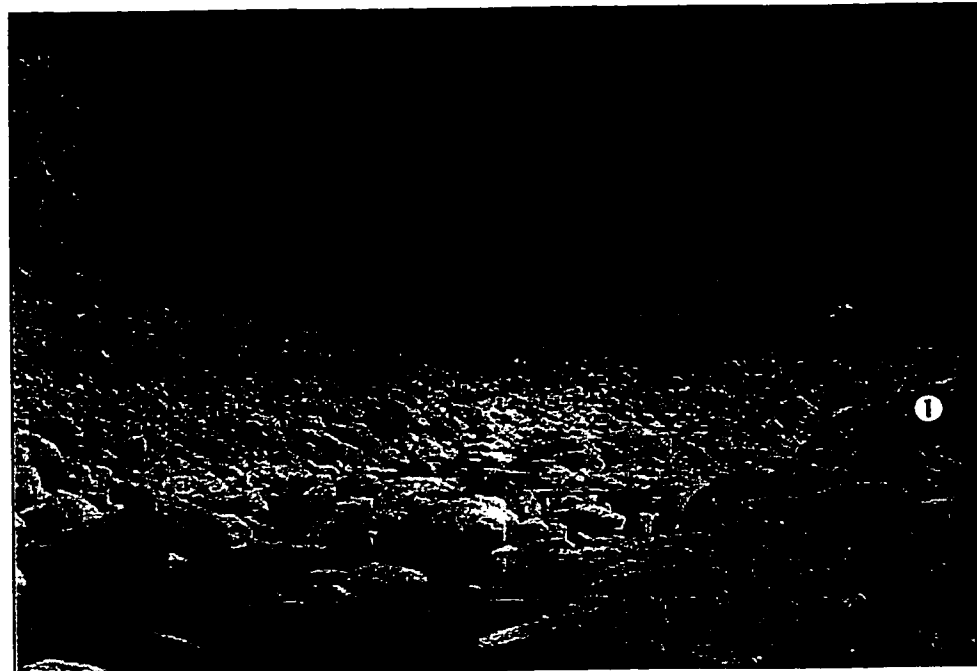
The recent business development in the lower-town is disturbing. The landowners removed residents from the flood zone to protect them from future flood

events, yet at the same time allowed small businesses to open in the same area. Since the 1991 flood event, five new businesses (including the re-built Mountain Woman) were constructed adjacent to the highway on the south shore of the creek. However, they are small, wood buildings (that resemble market stalls) and seem structurally weak (see photograph in Figure 4.6a). The additional businesses compliment the existing ones and offer visitors a greater diversity of crafts and food. Furthermore, this collection of service oriented businesses acts as a point of congregation for visitors; thus, not only are the businesses exposed to the threat of future floods, but the visitors (and their vehicles) are as well.

In the aftermath of the 1991 flood event, the authorities attempted to modify the natural event to protect the inhabitants from future recurrences. Britannia Creek was dredged and most of the choking debris removed. Once the creek and community returned to normal, however, Britannia Beach lost the public's attention and little else was done to prevent future flood disasters. A 1998 observation revealed that debris has since re-deposited on the creek bed, returning it to pre-1991 levels. The photograph in Figure 4.6b illustrates the collection of debris at the point where the creek jumped its bank in 1991 (i.e., to the right). In other words, the creek level rose and the recurrence of the 1991 flood event is probable if nothing is done to prevent it.



a) New small businesses opened along the highway, however, they are located in the high flood hazard zone.



b) Debris has reaccumulated on the creek bottom, returning it to pre-1991 levels. The creek jumped its banks at the location marked 1 in the 1991 debris flood event.

Figure 4.6 Britannia Beach in 1998.

Chapter Summary

Britannia Beach is a prime example of a disadvantaged town and its forms of vulnerability are typical of other vulnerable individuals, groups, and communities in British Columbia. It is situated in a historic flood plain and thus exposed to numerous hazards. Moreover, its long history of disasters demonstrates the risks associated with occupying this location. The town and its occupants' vulnerability seem tied to a lack of power and control over decisions that affect their own interests. Moreover, control lies outside of the local environment since most people work and depend on services outside the community. Land tenancy and poverty of occupants contribute to their insecurities and affect maintenance of built structures. The community is small and non-incorporated and thus receives little political attention, including expenditures on emergency and safety measures. The most needy and vulnerable populations often do not receive the most support. The service and tourist industries also place additional visitors at risk. These forms of vulnerability are not limited to Britannia Beach. The same social, economic and political processes also contribute to the vulnerabilities of other individuals, groups and communities in the province.

This chapter also demonstrates that communities are dynamic and experience continual social and structural change. These changes take place, on a base level, to both the community's buildings and their occupants. They may include the bettering (i.e., repair) or continued deterioration of old buildings, or merely take the form of a turnover in occupancy. Moreover, the cause for change may vary from the impact of broad macro-

forces, such as world commodity markets and expanding urbanisation, to simply the desire to improve a building's safety. For whatever reason, changes to structures and their occupants may result in either a reduction or improvement to their safety. As Davis and Aysan (1992, 11) concluded, "the issue, therefore, concerns the necessity for risk assessment to be regarded as a continual process to cope with such changing patterns of vulnerability."

CHAPTER 5. SUMMARY AND CONCLUSION

The main objectives of this research have been to: (1) examine the vulnerability to natural disasters of British Columbia's people and communities, and (2) demonstrate how socioeconomic order and processes can create or exacerbate different forms of vulnerability in some groups. These objectives were addressed by applying existing vulnerability theories (re., Chapter 2) to British Columbia's social landscape, including how we describe vulnerable individuals, groups and sectors, the forms of vulnerability that affect them, and the forces that contribute to their condition. Moreover, descriptions are supported by a case history of disastrous events and individual situations. The results seem to vindicate the emphasis of existing theories on aspects of social spaces (i.e., socioeconomic order and relationships, technological advances, etc.) and their relationships to disaster, and seemingly less on the distribution or occurrence of dangerous events.

A review of the natural disaster research specific to British Columbia showed it to be limited in focus. Most of the research tends to examine single locations, processes, strategies, or disastrous events. Although this body of literature provides a wealth of provincial case material (which lends a great deal of support to this study), for the most part, it fails to consider the province's vulnerability to natural disasters or bind the material into a comprehensive interpretation of risks.

British Columbia's natural features and associated resources, in part, prescribed the evolution of, and relationships between its communities, and many of its

socioeconomic processes are likewise tied to the extraction and movement of natural resources. Vancouver constitutes a market for particular goods produced in the rest of the province such as agricultural and forest products, ores and minerals, and speciality manufactures, however, more important are its roles as a gateway and transshipment point in moving hinterland products to export markets, and as a managerial and service centre. Consequently, power and prestige are concentrated in Vancouver, which is aided by its favourable geographic location, while economic ties extend outwards ensuring centralised control. Moreover, regional disparities exist and some research argued that they are actually increasing.

British Columbia's geographic and economic positions closely tie the province to the "newly industrial economies" of the Pacific Rim. Their relationships created strong links that facilitated the movement of goods, capital, and people between these countries, and thus provided a vehicle for the province's rapid social transformation and change. Although British Columbia significantly benefited from the rise of these Pacific Rim nations in the last few decades, it is likewise anchored to them in their periods of decline. This became evident when the Yen devalued and stock markets crashed in 1998. The province now braces for a major recession and for the first time in years, more people left British Columbia for other parts of Canada than arrived to it.

British Columbia's recent prosperity and growth are double edged. Although available resources and provincial living standards increased, their allocation and distribution were not homogenous. In fact, they widened the social gaps and regional differentiation between Vancouver and the rest of the province. This left some groups

disadvantaged, powerless, unprotected, and/or exposed to dangers, while at the same time provided security and comfort to others.

Although the technology and expertise to alleviate most disasters exist, the resources to implement them are limited. A large proportion of these resources are used in Vancouver due to its concentration of people, political and corporate power and urban development, thus placing further constraints on the resources available to other communities. Furthermore, investments in particular locations often occur only after disastrous events happen.

Several issues of vulnerability that pertain to peripheral resource communities in British Columbia include:

1. The continuance of many peripheral resource communities solely depends on natural resource extraction. Stability in such communities is often suspect since their sole supporting industries are mobile, and controlled by unstable world market prices and availability of the remaining resources that they extract (e.g., abandonment of Kitsault in 1982). Future instability often limits investment in social security and protection.
2. The province's economic and political power lie in its urban regions and is most concentrated in Vancouver. Surrounding communities and populations therefore tend to have little to no influence on national, provincial or local policies and organisations that affect their own interests and govern public resources, including those allocated to social security and protection (e.g., authorities overlooked Britannia Beach for protective works along the Sea-to-Sky Highway Corridor).
3. Resource extraction often leads to the deterioration of the physical landscape being exploited. This can affect the occurrence and magnitude of dangerous events, and thus exposure to them. The harvesting of forests on mountain slopes and river banks, for example, can contribute to future slope failure and flooding

respectively, as can mining lead to rock slides and falls.

Continued interest by Pacific Rim investors contributed to rising real estate prices and living costs in Vancouver since its markets were considerably 'undervalued' in comparison with those such as Hong Kong and Tokyo. In turn, this resulted in the disappearance of cheap land and sent many people seeking less expensive accommodation elsewhere. However, this often resulted in some groups living in more vulnerable locations or situations:

1. For some people on the verge of poverty and homelessness, especially in Vancouver's "inner-city", this high living cost forced them into the streets and/or to become involved in illegal activities such as prostitution and drug trafficking and use. These groups are often disadvantaged, exposed to numerous natural and social risks, unprotected, and lack "real" political representation.
2. Many people resided further from their work places. This placed more people in vehicles for longer periods of time, and thus increased their exposure to the chronic risks and hazards of the road. This is of particular concern in road and rail corridors through mountainous environments such as the Sea-to-Sky Highway that experienced numerous landslides, debris floods, and increased traffic volume. More than one thousand Provincial Emergency Program responses to motor vehicle incidents in 1997/98 (more than five times 1989/90) reflect increasing risks of the road.
3. Many low- to middle-income households migrated to satellite and other communities which in themselves are often more vulnerable (see vulnerability issues of peripheral resource communities above). Some affluent households, who have the freedom of relatively few limitations, likewise migrated from "the city life" to "smaller" but dangerous locations with spectacular views (e.g., Lions Bay).

4. Even for those people that remained in Vancouver, higher living costs meant less resources available for other non-essential expenditures (including protection such as earthquake and flood insurance).

Other aspects and issues that contribute to vulnerability in some individuals, groups, or sectors in British Columbia include:

1. Dependencies often control and restrict opportunities for greater security. Most people in the province depend on built infrastructure and wage earnings to live and thus are dependent on their “normal” functioning.
2. Tenancy often creates insecurities in tenants. The use of a rented property is temporary and limited by the conditions of a lease. Moreover, control of the property ultimately remains in the owner’s hands, thus a tenant’s relationship to the owner is based on a dependency (as above). A tenant’s recognition of this lack of control often translates into uncertainty of their future in terms of home and shelter, particularly in the aftermath of disaster when decisions to rebuild or not are often not theirs to make. As well, tenancy often minimises investment in the rented property, including its upkeep and protective structures.
3. Poor households are commonly disadvantaged and limited in their opportunities for greater security by their low financial means. In contrast, wealth gives access to the general resources upon which our safety mostly depends.

The general public’s technological sophistication and demand in British Columbia led to its increased dependence on new innovations, services, and infrastructure. The loss of such items can adversely affect and impede normal routine and thus produce a breakdown in its social processes and interactions (i.e., condition of disaster). Also, the complexity and organisation of such items create greater difficulty in identifying areas of problem and thus to protect against their occurrence. As well, the general public has a

high expectation of, and demand for a safe environment which is not always fulfilled.

Tourists and visitors represent another vulnerable group in British Columbia and as their numbers continue to increase, so do concerns for their safety and protection from danger. The province's emergency and disaster planning primarily focus on the needs of permanent residents. As tourism increasingly becomes a significant component of the province's development, its role and requirements must also be incorporated into the planning process.

In British Columbia, much time and capital has been invested in reducing vulnerability to disaster, especially in the 1990s, when its efforts coincided with a global attempt to reduce natural disasters, i.e., the United Nations International Decade for Natural Disaster Reduction. Yet, even though the province has made significant strides in preparing for disaster, some issues impede and limit its endeavours, while other new concerns arise with change in the province's social landscape.

Much effort has gone into preparing British Columbia for disasters, however, most of this is directed towards response, and its co-ordination, to particular hazards and hazardous conditions. Even though this thesis illustrated only a few of these efforts, such as Lions Gate Hospital's evacuation plan and the fire water pumping system in Vancouver, they are indicative of many other ongoing projects across the province. Not to take away from the value of these efforts since they aim to protect some people and communities and reduce conditions of disaster, however, they do reflect a limited approach directed towards modifying hazardous agents or people's exposure to them. This thesis demonstrated that vulnerability is more than just exposure to hazards, but

rather also incorporates notions such as powerlessness, frailty and disadvantage. In recent years, this “vulnerability perspective” has gained some acceptance, however, research, policies and planning in the most influential organisations predominantly remain directed towards particular hazards or hazardous conditions, and responses in terms of these agents. Initiatives for significant change must be aimed and implemented at this level.

Effective risk reduction and disaster mitigation seem most dependant on the provision of security and, more importantly, empowerment to the more vulnerable individuals, groups and communities in British Columbia. Even though knowledgeable government agencies and organisations control disaster mitigation, they must have some understanding of how socioeconomic processes and forces operate at local levels and where the risks apply. In other words, social understanding must start within communities and filter up to effect significant change and better help the “vulnerable.” This approach empowers people and communities, and provides them with the means to influence decisions that affect their own interests.

Regular public discussions and meetings between leaders, authorities, and residents can produce social understanding, including vulnerability and risk, at the local level. Wilches-Chaux (1992) developed a good tool for communities to use that suggested eleven points of view in which to discuss and explore their own vulnerabilities.

This forum can also provide good lines of communication between a community and its controlling authorities, as well as within itself. It is also very important that communication works both ways in the form of an exchange of knowledge. The province

needs to develop and encourage such forums in every community and, more importantly, effectively use the knowledge and experiences they produce.

This thesis also demonstrated that change in the social landscape is inevitable and, for whatever reason, may result in either a reduction or improvement of safety for individuals, groups and communities. Therefore, it is essential that disaster preparedness and planning in the province be regarded as a continual process to compensate for, and cope with such changes in vulnerability.

APPENDIX: SAMPLE OF DISASTROUS EVENTS IN B.C., 1990-1995

Date	Location	Hazard Description	Comments
(a) Disasters			
11/09/90	Sayward	Salmon River flooded 1.2m, at one point rose 10cm per 15min; second flood on 23-Nov, water raised 8cm higher; third flood on 02-Dec, 1m of flood water recorded.	In 1 st flood, 2 bridges destroyed, many buildings damaged (est. in \$Ms), and 92 people rescued. In 2 nd flood, 50 people evacuated and more buildings damaged. 300 forestry workers' jobs interrupted. In 3 rd flood (3-Dec), 39 people removed from homes and 90 people left stranded in Sayward. Counselling offered to victims.
02/05/91	Merritt	1" of rain in 5h period, ice broke on Coldwater River and jammed, caused flood.	100+ residents (110 registered through Red Cross alone) evacuated from low-lying homes. Water wells contaminated. Several homes destroyed in trailer courts. Damage estimated in \$100,000s. "Water pushed his house over, the house was ruined"; "Home looked like it was hit by a tornado... floor was separated from walls."
10/09/91	New Aiyansh	Nass River flooded, some areas over 2m deep. Flooding exceeded previous record (1961) and receded 17-Oct.	Flooding effected the communities of Greenville, Canyon City, and New Aiyansh. 14-Oct-91, flooding cut off native community of New Aiyansh. 1,000+ natives without fresh food supplies, access to schools and flood disruptive to jobs (livelihoods). Supplies airlifted into needy communities.
07/20/94	Penticton	5,500ha fire, originated in Ellis Canyon. Contained 07-Aug, but burned for months.	3,000+ people evacuated on 25-Jul-94 as shifting winds blew fire toward subdivisions. Poor communications resulted in residents given 15m to leave. 18 homes (16 in Carmi Heights and 2 in Penticton) destroyed. Several firefighters suffered minor injuries. Residents returned 27-Jul-94.
08/04/94	Salmon Arm	Hail stones size of eggs and winds 80km/h. Very localised and only 15-20 minutes.	1,000 homes and businesses, and 1,200 vehicles (50 considered total loss) damaged. \$10,225,000 in insurance payouts.
06/06/95	Fernie	Torrential rains, water level rose 1m on June 6, and flooded Fernie under 2m of water.	36 homes damaged, 2 road and 1 rail bridges and 5km of Hwy 3 washed out. 702 people in Fernie and 100 in Sparwood evacuated on 6-Jun. Emergency crews and volunteers sand bagged banks of Elk River and Coal Creek. Chlorine used to prevent contamination of water supply. \$11M in payouts.

Date	Location	Hazard Description	Comments
(b) Emergencies			
02/23/90	Vancouver Harbour	Thick fog.	Grainship and Polish fishing vessel collided spilling 40,000L of diesel oil. Largest spill in Vancouver harbour in 17 years. 1,000 birds coated with oil, 100s died. Pollution affected 1.5km shore and 1ha water. Cleanup cost \$250,000. \$1.2M posted to cover incurred costs.
06/11/90	Enderby-Mabel Road (at Fall Creek)	Mudslide stripped 3m of topsoil and made v-shape cut in trees. Some places measured 1.5m deep in mud.	8km of road washed out, 4 homes and 4 vehicles destroyed, and 30+ people rescued. 3 people killed when house destroyed. Slide "shattered the house moving it 100."
12/17/90	Vancouver	Winds recorded at 76km/h at Vancouver Airport and 115km/h at Hope.	Dock destroyed on North Shore Waterfront. Two 20m trees fell on house and caved in roof and cracked walls. Power lost to 50,000-60,000 homes in GVR and Sunshine Coast. Costs to hydro in excess of \$1M.
06/01/92	Cape Mudge 10, Kullet Bay Reserve, Babine 6	Cluster epidemic of Tuberculosis (one person gets disease and spreads it to people in immediate circle).	40 cases of TB affecting young people and adults reported in three native reserves. Final figures expected 100+ cases. Poor nutrition, overcrowding, and socio-economic factors make natives more prone. TB centres set up in each community.
12/01/93	Saanich	Meningitis-Meningococemia outbreak caused by bacteria group C.	8 cases reported in three month period. 7 cases in Saanich residents aged 13 to 19, where 3 died (two 18 year-old girls and one 14 year-old boy). Mass vaccination was initiated and aimed at immunizing 29,000 people aged 13 to 19.
10/01/95	Capilano Reservoir	40,000m ³ of clay silt slid into reservoir. Slides are frequent but this large (1 in 10 years).	Slide created gray plume in water. Drinking water to GVR became cloudy and unsafe to drink. Water is prone to waterborne disease and defeats sterilizing effects of chlorine. \$250,000 spent to repair damage to slope. Not enough water for Vancouver and people told to boil before drinking. Re-opened 17-Nov because water was better than Seymour Lake which was closed for same condition.
11/17/95	Lower Mainland	Winds at 120km/h.	Power lost to 50,000 homes (costing \$100,000s). J. Ingram of Surrey, "my Chevy van was behind the building, now the whole building in behind my van." 5 lives lost in accident, possibly weather related. Winds destroyed unfinished home in Abbotsford.

Date	Location	Hazard Description	Comments
(c) Accidents			
09/27/90	180 km SE of Cape St. James	Storm with gale force winds of up to 80km/h (40 knots), 3m waves, and choppy.	22m tuna boat from San Diego sank. 1 passenger survived and 4 were missing presumed dead.
03/12/91	Bugaboo Mountain	Slab avalanche (3.5), 80m wide and 50-60cm deep.	Heliski party of 14 caught in avalanche. 9 skiers died, and 1 was injured. 4 companions survived by skiing amongst the trees. The party consisted of tourists from France, Britain, Germany, and Spain. In terms of death, the "disaster" was the worst heliski-involved incident in history.
05/05/92	Kyuquot	2 year-old, 27kg female cougar attacked child. Autopsy showed it was desperate for food.	An 8 year-old boy was killed. The victim was sitting in the school playground with other children. The cougar rushed from the woods and snatched boy. The cougar was shot by school custodian.
01/07/93	Richmond	Ice flows on Fraser River.	3 vessels in the Shelter Island Marina had their hulls crushed. No injuries were reported, but a young girl fell into the water when ice impacted with boat.
09/27/95	8km NW of Campbell River	Fog and zero visibility.	Single engine Turbo Otter crashed in forest. Western Straights Air Charter carrying 9 employees of Tsibass Construction Ltd. after 14-day shift at logging camp. 8 dead and 2 injured.
10/22/95	Hope	Van-sized boulders fell on highway.	Several cars were hit at the edge of the slide. 3 people were slightly injured. Clean up crews had rocks cleared by 23-Oct-95 and highway was re-opened.

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