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EARTHQUAKE ISSUE NETWORKS IN
BRITISH COLUMBIA AND WASHINGTON STATE**

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Sarah Michaels

Discovering and Analyzing Earthquake Issue Networks in British Columbia and Washington State

Introduction

Geographers see their discipline as bridging the physical and social sciences. Yet, how physical science information gets translated into societal actions remains largely the province of other disciplines. Geographers stand to gain from learning about differing perspectives and differing cases which depict the translation and transformation of physical science information into public policy and also have much to offer in this area.

Geographers have a long and distinguished record in contributing to natural hazards research, a field in which the interplay between physical phenomena and human actions are integrally related. One aspect of this interplay is how natural hazards combine with human generated factors, such as political culture, to shape groups which address public safety. Comparing the dynamics of the groups concerned about earthquakes in two jurisdictions, British Columbia and Washington State, allows us to explore to what extent information exchange is a function of hazards and to what extent this exchange is a function of a particular cultural/political context.

The role of essential national characteristics is revealed through an intercountry comparison (Auty 1991). Jasanoff (1986) anticipates that Canada and the United States would have parallel developments in risk management policies based on similar political systems, a shared scientific tradition and participation in joint decision-making and information exchange. In such large countries these policies must also reflect regional variations in which hazards pose the greatest threats.

The dilemma of how to define regions has long intrigued both physical and human geographers. Physical features and political boundaries are two traditional delimiters. On the one hand, since British Columbia and Washington State are contiguous physically, they share the same source of most earthquakes, the subduction of the Juan da Fuca Plate under the North American Plate. On the other hand, they are discrete, subnational jurisdictions in two nation states. A conception of space which complements traditional definitions of place is

emerging based on "interconnectedness" which can be created through shared knowledge and more narrowly through the exchange of information.

Oliver-Smith (1986) identifies two traditions in the policy orientation of hazards research in geography. The first involves research and monitoring geophysical processes with particular attention to improving prediction and utilizing technology to contain hazards. The second involves community adjustment to the risks posed by particular hazards. This tradition in human geography begins with the early work of White on non-structural approaches to floodplain management. This approach reflects the intellectual influence on White of Barrows, who promoted an understanding of human adjustment to natural environments and a commitment to public service (Platt 1986).

Typically, knowledge is valued in policy making for its contribution to rational decision making. But knowledge serves other functions in policy making. Weiss and Gruber (1984) demonstrate how policy makers value knowledge as a control mechanism in fragmented policy arenas.¹ I argue that the exchange of information is integral to the development and maintenance of links among people who have divergent expertise and interests.

Fragmented policy arenas necessitate that policy makers and implementors build consensus and induce commitment (Weiss and Gruber 1984). To accomplish this requires understanding amongst whom cooperation needs to be forged. An important first step is to identify who is concerned about which different aspect of the central policy issue. A second step is to recognize the existing informational links between them. A third step, which is the focus of this paper and which builds directly from the previous step, is to examine the factors which shape the linkages.

Feldman (1989) shows that information is loosely or anarchically linked to decision making and not tightly or directly connected as is conventionally held. While others such as Weiss and Gruber (1984) have described this feature in organizations dealing with "soft" technologies, such as education, Feldman demonstrated this loose linking in the Department of Energy where the technology is conceived of as being hard and more measurable. This article seeks to extend the concept one step further by illustrating some of the factors which shape the loose or anarchic linkage between information and decision making in

an interorganizational sphere dealing with scientific and technological information.

Hazards research and applications involving knowledge utilization have been influenced by the seven different meanings of research utilization Weiss (1979) has extracted from examining the use of social science in public policy.² Yin and Moore (1985) and Nigg (1988) have both demonstrated the applicability of several of Weiss's (1979) conceptualizations of knowledge utilization to adoption of innovation within the hazards community. Innis (1990) notes two important implications of Weiss's typology. The first is that the meaning of knowledge use needs to be rethought. The second is that all of the uses of research need to be incorporated into the knowledge/policy link. The issue networks approach presented here addresses both these implications.

In contrast to existing models of knowledge utilization, issue networks provide a framework that better fits the community scale at which policy is implemented. Context is recognized as influencing the formation and maturation of issue networks. An issue networks approach to knowledge dissemination describes how information is circulated, both among people who share a concern about a particular aspect of an issue and among a larger number of people who more loosely share a concern about an issue. Such an approach recognizes the diversity of interests, levels of understanding and skills that people bring to a concern.

Issue networks are useful because it is not possible to trace neatly how an idea comes to prominence because the system is generally fragmented, a variety of resources are needed and there is no master controller of the information system (Kingdon 1984, 81). The approach accommodates situations where information generators and translators do not always know their audience. An issue networks approach highlights when and under what circumstances members who have a particular concern seek out people who have different expertise, different linkages or different substantive interests.

This article develops an issue networks approach to understanding information dissemination in the earthquake policy communities of British Columbia and Washington State.³ The similarities and differences between the two communities and their implications are discussed as a means of discovering and analyzing issue networks (Michaels 1990).

Issue Networks, Policy Communities, and Information Webs

At the interface between the macro-scale factors of political economy and culture, and the micro-scale considerations of the individual is a decision making meso-scale. At this scale are found familiar structures of agencies, programs and policies. Less well known, however, are informal structures which operate at this level, such as issue networks.

The conceptual framework of issue networks provides insight into how and why people's interests coalesce around topics, such as earthquakes, which are not necessarily salient to the wider society. An issue network is made up of individuals taking action on a particular aspect of an issue. For example, by addressing one aspect of seismic safety, lifeline engineers designing pipelines to withstand damaging earthquakes form an issue network. An issue network is a voluntary and fluid cluster of people with varying degrees of commitment (Heclo 1978). In the previous example, some lifeline engineers may undertake seismic design projects on an intermittent basis, while for others it may be their primary work activity. An issue network accommodates people with divergent world views. Parents who share a concern about the earthquake safety of their children's schools, for example, may hold different opinions on education.

Policy communities consist of overlapping issue networks. In our case, the Washington State and British Columbia earthquake policy communities are defined by overlapping issue networks centered on substantive issues, such as school safety, and occupation, such as professional engineers (Figure 1). Policy communities involve what may at first appear to be incongruous connections. For example, a linkage between an engineering network and a school safety network existed through a friendship predating either party's earthquake concern.

Information webs are the mechanisms through which information is conveyed within an issue network, between issue networks, within a policy community and beyond a policy community. Familiar forms of information webs include joint ventures, meetings and the popular media.

The nature of issue networks defines what information webs are used. For example, professional engineers represent an issue network of shared occupation within the British Columbia earthquake community. Engineering information

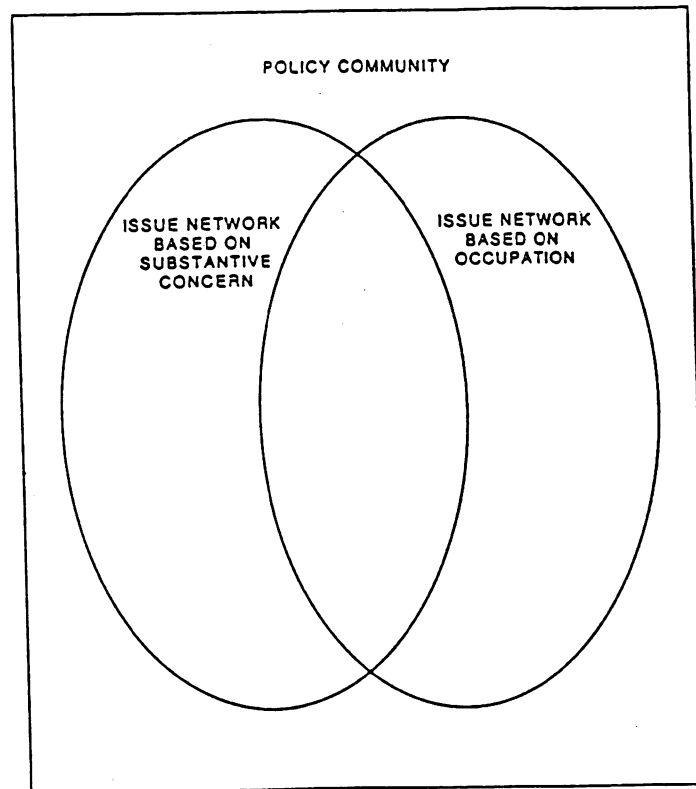


Figure 1
Overlapping issue networks (Michaels 1990, 325)

webs include, but are not limited to: university programs training engineers; the Association of Professional Engineers of British Columbia (APEBC), the profession's licensing authority with which all professional engineers must register; APEBC's publication, the B.C. Engineer; voluntary participation on APEBC committees, and professional societies such as the Canadian Society of Civil Engineers (CSCE).

An issue networks approach places a conceptual emphasis on the process through which policy innovations are incubated. The garbage can model of organizational decision making developed by Cohen, March and Olsen (1972) and elaborated by March and Olsen (1976) postulates that four separate streams - problems, solutions, participants, and opportunities for choice - must converge for policies to be made. An issue networks approach provides insight into the dynamics of each of these streams, particularly the first two which the garbage can model postulates exist independently from one another.

Alesch and Petak (1986) employ the garbage can model to explain the difficulty in implementing earthquake hazard reduction measures in southern California. In this discussion, an issue networks approach is used to understand how and to whom scientific understanding potentially relevant to earthquake mitigation policy is conveyed.

Empirically, an issue networks approach discovers all functional linkages regardless of whether they stem from within organizational hierarchies, formal arrangements between agencies or non-structured, serendipitous liaisons. A comprehensive understanding of how information is conveyed is the result.

Similarities and Differences in the Earthquake Policy Communities of British Columbia and Washington State

To compare the earthquake policy communities in British Columbia and Washington State the similarities and differences between the two earthquake policy communities are laid out. Similarities include the nature of the earthquake threat, what information is disseminated and the composition of issue networks. Experience of damaging earthquakes, political cultural considerations, governmental structures, where government intervenes, commitment of

resources, permeability of formal structures and coalition building shape the differences in the functioning of the two policy communities.

SIMILARITIES

The earthquake threat: The potential for earthquakes in the Cascadia subduction zone is the most important exogenous factor shared by the British Columbia and Washington State earthquake policy communities. It is exogenous to the policy communities because the potential for earthquakes is independent of any actions taken by those within issue networks to address it. Statements about the region's seismic potential are potent rallying points for particular issue networks, such as those which directly address the seismology of the region, and generally for the entire British Columbia and Washington State policy communities.

The source of most earthquakes in British Columbia and Washington State is the subduction of the Juan da Fuca Plate under the North American Plate in the Cascadia subduction zone (Noson, Qamar and Thorsen 1988). This zone, underneath the Pacific Ocean, runs off the coast of North America from Northern California to the Queen Charlotte Islands (Figure 2).

Since the period of extensive settlement of the Puget Sound and southwestern British Columbia represents only a fraction of geological time, it is not accurate to extrapolate future earthquakes based on the felt earthquakes of the last century and a half. Shallow earthquakes such as the 1978 4.6 magnitude Bremerton earthquake have occurred in the region and deep thrust earthquakes such as the 1949 magnitude 7.1 Olympia earthquake and the 1965 magnitude 6.5 earthquake between Seattle and Tacoma have caused damage in the vicinity (Noson, Qamar and Thorsen 1988).

But, there is no human record of interplate earthquakes in the study area which occur where the Juan da Fuca Plate and the North American Plate meet. Subduction earthquakes, however, are potentially the most damaging type of earthquake to effect British Columbia and Washington State. A growing number of scientists think that the Juan de Fuca subduction zone is capable of producing a greater than magnitude 8 earthquake (Monastersky 1990). The prospect for a Cascadia subduction earthquake and the potential devastation which could

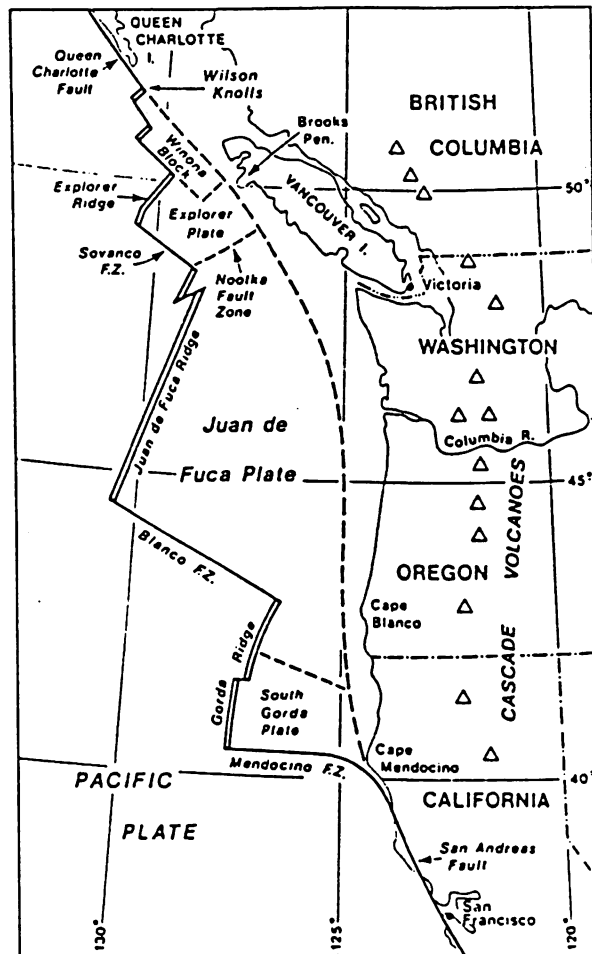


Figure 2
The Cascadia subduction zone (Rogers 1988, 845)

result has stimulated growth of issue networks and the interaction between them.

The recent controversy over the potential for a subduction earthquake in the region generated lively discussions within seismology issue networks. Heaton and Hartzell (1986) are reluctant to speculate about the nature of the earthquake that would occur from the release of the Cascadia subduction zone if indeed it is locked. Yet, they recognize that the issue must be tackled to provide estimates of the shaking and tsunami hazard. The challenge is in whether or not to translate scientific uncertainty into specific policy action, be it the allocation of scarce resources or increased regulation (Monastersky 1990).

Information dissemination within and between issue networks: The same basic information is imparted within the British Columbia and Washington State policy communities on the nature of the threat, new developments in mitigation activities, progress on political initiatives, relevant events and activities beyond the community, and "maintenance information," such as the involvement and phone numbers of network newcomers.

The literature in a field or discipline is an important link between members of the same occupation, especially for researchers and technical consultants, whose vocational necessity it is to keep up with the latest findings. Individuals, however, who read specialized materials outside their area of expertise are rare. Consequently, specialized, technical literature tends to provide an information web within an issue network rather than between issue networks.

Both Canada and the United States use earthquake preparedness mitigation and preparedness documentation created by U.S. federal agencies. For example, Canada has adopted, with modifications, the United States Federal Emergency Management Agency's national catastrophic emergency response plan. Moreover, Canada's approach to seismic zoning is based on work done by the U.S. Geological Survey.

California is the most important source of information for the policy communities in British Columbia and Washington State. Seismologists, engineers, emergency planners and activists all look to California for model programs and insights based on experience. California was a source of information and a yardstick by which to measure accomplishments in British Columbia and Washington State. These comparisons were also accompanied by

recognition of important differences, such as magnitude and duration of potential earthquakes. Given California's national and international leadership in seismic policy, it is not surprising that British Columbia and Washington State issue network participants never mentioned passing on information there. Thus, the role of California within the policy communities of British Columbia and Washington State reveals the weight an external jurisdiction can have, the value placed on knowledge gained through experience, and the acceptance of an unequal exchange of information. The dynamics of information exchange within British Columbia and Washington State policy communities was colored, if not shaped, by access to a larger, more active, better financed, subnational policy community.

Parallel forms of interagency communication were established by the Provincial Emergency Program and the Washington State Division of Emergency Management. In late 1988, the first State Agency Earthquake Task Force meeting was held. Two months later, the first meeting of the British Columbia Seismic Safety Sub-Committee was held. The task force and the subcommittee were both established to develop a coordinated response to the earthquake threat and both consist of agency representatives with a direct role in response. Both were formed from pre-existing provincial/state emergency management committees.⁴

In both British Columbia and Washington State public schools have been the first population subset to be targeted, an endeavor going back much further in Washington State than in British Columbia. School safety in British Columbia became a concern after the 1985 Mexico City earthquake, while in Washington State remedial action was necessitated by damaging earthquakes earlier in the century.

Occupational composition of policy communities: Earthquake policy communities in British Columbia and Washington State have the same occupational structure stemming from similarities in who gets involved, how and why people get involved, and why people stay involved or leave. There are minor differences. For example, there is no British Columbia equivalent to the media reporter in Washington State who has established a reputation with scientists for credible coverage of the earthquake threat.

Implications of similarities: These three similarities - the earthquake threat, how information is disseminated and occupational composition of policy

communities - explains why there is no hard and fast distinction between the earthquake policy community in British Columbia and the one in Washington State. Comparable occupational composition explains why and how the same information is disseminated in the two policy communities. Some issue networks cross jurisdictional boundaries to gain the critical mass they need to function. For example, in seismology the high degree of technical specialization means there are only a small number of issue network participants.

DIFFERENCES

Experience of damaging earthquakes: Far more extensive damage has occurred in Washington State from earthquakes than has occurred in British Columbia. Chimneys broke, plaster cracked and assorted objects were overturned in the magnitude 5.7 Olympia earthquake on November 12, 1939. The 5.5 magnitude earthquake on April 29, 1945, along the western edge of the Cascades near North Bend fractured chimneys and broke a water main. The February 14, 1946, 6.3 magnitude Puget Sound earthquake damaged industrial buildings in the Duwamish River Valley and caused damage at the south end of Elliot Bay as well as fractured Seattle waterfront structures built on pilings (Noson, Qamar and Thorsen 1988).

The deep Puget Sound earthquake of April 13, 1949 with a magnitude of 7.1 between Olympia and Tacoma and the April 29, 1965 earthquake magnitude 6.5 between Tacoma and Seattle are the best documented large earthquakes in Washington State. The 1949 earthquake caused 140 million U.S. dollars damage in 1985 dollars (Thorsen 1986) and caused the deaths of eight people (Drabek *et al.* 1983). Disruption of lifelines was extensive and one estimate puts the number of chimneys requiring repair in northwestern Washington at over 10,000 (Noson, Qamar and Thorsen 1988). It was the region's most devastating earthquake (Thorsen 1986).

The 1965 Seattle-Tacoma earthquake caused seven people to die either by falling debris or heart attack, was felt by persons throughout a 336,700 square kilometer area and resulted in 40 million U.S. dollars damage in 1985 dollars (Drabek *et al.* 1983; Thorsen 1986). Lifelines and almost all waterfront facilities in Seattle were disrupted (Noson, Qamar and Thorsen 1988).

The most severe earthquake in British Columbia, a magnitude 7.2 event on June 23, 1946, occurred in the central Vancouver Island region of the Strait of Georgia, between Powell River and Courtenay (Skermer 1976). It was felt strongly in Victoria, over 140 kilometers away (Milne 1976). The only known death attributable to an earthquake in the province (Skermer 1976) occurred when a wave caused by a slump in the sea bed overturned a small boat. Masonry failure was widespread due mainly to falling chimneys. In general, the earthquake caused only light damage because of the sparse population in the immediate vicinity and the predominance of wood frame low-rise construction (Rogers 1980).

While British Columbia is the most earthquake prone part of Canada, Washington State is not the most earthquake prone part of the United States. Consequently, compared to their counterparts in British Columbia, more earthquake policy community members in Washington State have experienced an earthquake while living in another part of their country, most notably California.

Political culture: There is succinct evidence of greater benevolence and trust Canadians have toward their government than is the case of their counterparts in the United States. Canada's

section 91 of the Constitution Act, 1867 speaks of "peace, order and good government" whereas the United States Declaration of Independence speaks of "life, liberty and the pursuit of happiness."
(Cheffins and Johnson 1986, 151)

While Canadians emphasize good government, United States citizens emphasize individual rights. It is not surprising then that the initiative of establishing an earthquake policy community in British Columbia came out of the public sector, specifically a coalition of the Pacific Geoscience Centre and Emergency Preparedness Canada, while early initiatives in Washington State were by a coalition of independent citizens.

Governmental Structures: The most notable policy factor shaping the environment in which earthquake issue networks operate is governmental structure. The different parliamentary systems determine that citizens have dissimilar means of accessing their elected representatives and of influencing political agendas.

Characteristic of the Canadian parliamentary system is a powerful cabinet to which Canadian legislatures be it at the federal or provincial level, have little independent input (Cheffins and Johnson 1986). Consequently, policy community members gain little by recruiting either government or opposition back benchers to champion earthquake concern. Consequently, APEBC addresses the cabinet when it makes its annual effort to influence the policy direction of the provincial government. In 1977 APEBC campaigned for the province to develop a natural hazards policy and in 1988 they promoted increased provincial action on earthquake mitigation and preparedness.

In each Canadian province cabinet ministers are chosen by the premier from members of the premier's party elected to the legislative assembly. Provincial cabinet ministers head up all ministries. The amateurism of the cabinet members is exacerbated by their selection based on extra-functional criteria such as ethnicity, gender and region and the practice of rotating their substantive responsibilities (Presthus 1977; Presthus and Monopoli 1977). Due to this turnover, it is difficult for policy community members to know who, other than the incumbent of the relevant cabinet positions, to recruit as champions. There is no assurance even of how long the relevant cabinet members will remain in their portfolios or if their next assignment will have any earthquake related content. Shortly after the APEBC delegation presented the Association's annual brief entitled *Seismic Risk in British Columbia* to the provincial cabinet in 1988, a pivotal cabinet member, one with responsibility for the Provincial Emergency Program (PEP), gave up that portfolio. This contributed to delaying the government's response to the brief.

The lack of substantive expertise of cabinet ministers in the parliamentary system enables senior bureaucrats, if they choose, to take a more decisive role in policy making than occurs in the presidential system. This was exemplified in the late 1980s by a PEP director who established a provincial seismic safety sub-committee, sought joint federal-provincial funding to hire an earthquake planner and hosted a symposium on the earthquake threat to the province. Contributing factors to this dynamic of senior bureaucrats as decisive policy makers are the relative ineffectiveness of parliamentary back benchers, weak legislative committees and a deferential political culture which enables permanent deputy

ministers and their direct subordinates to operate autonomously (Presthus 1977; Presthus and Monopoli 1977).

In contrast, the bureaucracy in the presidential system is held in check by the ability of individual legislators working from strong local and state power bases within substantively sophisticated legislative committees to develop considerable power. It makes sense then for earthquake policy community members in the United States to cultivate legislative champions. A long-time activist sought out the Chair of the Washington State House Committee on Energy and Utilities to promote earthquake concern in the Legislature. The politician was targeted because of his engineering background and his previous support of related legislation. The long-time activist arranged for him to attend a meeting of the American Society of Civil Engineers (ASCE) technical committee on lifeline earthquake engineering. She wrote up the questionnaire and identified the respondents for a survey conducted by the Representative to solicit the opinions of experts on the lifeline issue. The long-time activist contributed to writing the bill to create a joint select committee on seismic events. When the bill reached the legislative hearing stage, she and other earthquake policy community members whom she solicited testified at the hearing.

The primary role of senior United States bureaucrats is to execute policy shaped largely by elected officials and political appointees who fill strategic political posts at and below the most senior levels of government. (Presthus and Monopoli 1977). For example, the head of the Washington State Division of Emergency Management was a gubernatorial appointee.

Structural and cultural factors suggest why external interests, be they individual or collective, have been less able to penetrate the parliamentary system than the presidential system. A system of separation of powers provides more points of intervention to outside interests within the presidential system compared to cabinet government with its tendency to centralize power (Presthus 1977). For example, in Washington State there exist elected state executives who have mandates independent of both the Governor and the Legislature. The Department of Natural Resources, Division of Geology and Earth Resources, reports to the independently elected Public Lands Commissioner. Consequently, earthquake policy community members can appeal to a state-wide elected official independent of the Governor.

While the British Columbia Provincial Emergency Program and the Washington State Division of Emergency Management have comparable responsibilities, most notably the lead role in emergency response, differences exist in the mandates of the Provincial Geological Survey Branch and the Washington State Division of Geology and Earth Resources (DGER). The most noteworthy, relevant differences are that DGER is responsible for information dissemination and the inventorying of non-commercial geologic and earth resources while the Provincial Geological Survey Branch is not. This gives DGER an important earthquake policy community role which the Provincial Geological Survey Branch does not have. It makes the Province less of a player than the State in scientific and engineering issue networks.

Where government intervenes: Where and how government chooses to be involved plays a role in how earthquake issue networks function. For example, Canada's country wide building code, the National Building Code of Canada, is revised through an arm of the federal government. In the United States, there is more than one building code and each is the responsibility of a separate, independent organization. This difference results in further discrepancies in the intervention possibilities for British Columbia and Washington State earthquake policy community members. For example, in the revision process of the Uniform Building Code in the United States, municipal building code officials vote on amendments. Their counterparts in Canada do not vote on amendments to the National Building Code of Canada. Paid lobbyists play a greater role in both legislative processes and building code processes in the United States than in Canada.

Most of the basic seismic research for British Columbia takes place within the province at the federally run Pacific Geoscience Centre. In Washington State, researchers in different institutions in other parts of the country contribute a large percentage of relevant research. While in both countries the federal level has the primary responsibility for earth science research, the United States has a more decentralized approach. Seismograph monitoring is done by local research institutions in the United States. For example, the University of Washington monitors seismographs in that state using a mix of state and federal funding. Reflecting the more centralized Canadian approach, the vast majority of seismograph monitoring is done by the Canadian Geological Survey using

federal money. Thus, such institutional differences define a trade off between greater local responsiveness and nation-wide consistency. As relevant for this discussion are the differing implications for information dissemination depending on whether knowledge is created within government or universities. While seismologists working in either institutions rely primarily on refereed publications for presenting their findings, they are subject to different opportunities and constraints. For example, Energy, Mines and Resources Canada adopted a service oriented mandate while research universities emphasize creation of new knowledge.

Regulation of professional engineers also illustrates how government involvement influences the policy environment in which issue networks operate. The British Columbia provincial government has delegated the responsibility of mandatory licensing of professional engineers to an autonomous professional body. The Association of Professional Engineers of British Columbia is able to address government on behalf of all professional engineers in the province. In Washington State licensing of professional engineers is voluntary and directly through the state (Notestine 1990).

Commitment of resources: Resources which enable communication and interaction to take place between and within issue networks depends on funding, and thus on the commitment of government, especially at the federal and provincial or state level to earthquake policies. During the late 1980s, one of the major differences between the earthquake policy communities in British Columbia and Washington State was that the leadership of the Provincial Emergency Program was more supportive of earthquake mitigation and preparedness than was the senior level management of the Washington State Division of Emergency Management. At the same time, the United States federal government, through the National Earthquake Hazards Reduction Program (NEHRP), was supporting a regional assessment of the earthquake threat in Washington. This provided an infusion of research funding which attracted not only federal government researchers but also academics and private consultants to address regional seismic questions. This money expanded and strengthened issue networks by attracting new people and financially supporting a number of already active issue network participants. No comparable, comprehensive federal Canadian program to the NEHRP existed in British Columbia.

Permeability of formal structures: It was easier to become active in the earthquake policy community in Washington State than to do so in British Columbia for two reasons. First, the lack of state leadership meant that there was no formal, authoritative hierarchy. Second, the NEHRP regional meetings are open to all who are able to attend. In contrast, strong authoritative leadership emerged in the British Columbia agency with the mandate to take charge, the Provincial Emergency Program. PEP having designated its key actors provided them with a closed forum for exchanging information amongst them, the 1989 B.C. Crisis Management Symposium.

Coalition Building: In Washington State, earthquake awareness and mitigation have been promoted by a broad-based coalition of independent individuals. In contrast, in British Columbia the Association of Professional Engineers of British Columbia provided a strong pivot for the earthquake policy community. In 1974 in Washington State, and in 1977 in British Columbia, there were drives to establish in each jurisdiction a natural hazards policy. The 1974 Washington State initiative, the Ad Hoc Committee on Geologic Hazards consisted of broad-based representation while the 1977 British Columbia initiative was the sole effort of the APEBC. A decade later the same contrast still existed.

The Washington State Seismic Safety Council was formed in 1985 as an advisory group to the then Department of Emergency Management. The Council grew out of the lobbying efforts by Washington State earthquake policy community members for an independent state-level Seismic Safety Commission. The Council's membership reflected a mix of professionals, agencies and legislative representatives (Washington State Seismic Council 1986) and a range of earthquake policy community participants.

In contrast, the 1988 APEBC brief to the provincial government on the earthquake threat illustrates how engineers not only form their own issue network but shape the British Columbia earthquake policy community through the provision of financial and human resources outside of government. The brief emphasizes a structural approach to mitigation. Six of the recommendations relate to structures, the seventh to exercising emergency response plans (Association of Professional Engineers of the Province of British Columbia 1988).

Implications of differences: The differences outlined above can be put into three categories; first, the occurrence of earthquakes; second, political culture and the

role of government; and third; internal policy community dynamics. The experience of damaging earthquakes in Washington State has meant the earthquake policy community there has had a longer history than in British Columbia. Arguments for mitigation in Washington State can be based more on direct experience than on potential within the region or reliance on analogy with other places. Conversely, earthquakes elsewhere, most notably the 1985 Mexico City earthquake, have proved to be a more important trigger in British Columbia than in Washington State. The 1985 Mexico City earthquake offered up powerful images of disaster, underscoring the public preparedness messages delivered by an array of earthquake issue network members.

Political culture and the role of government reflect broad societal values which play out in concrete terms on specific issues. Government structure determines the ability of policy community members to access and sway political influentials who do not consider earthquake concern their top agenda item. In the United States there are more intervention points for individuals in the government decision making process. This makes possible a diversified, non-government based earthquake policy community in Washington State. In contrast, the public sector has played more of a driving role in British Columbia than in Washington State. The earthquake policy community in British Columbia grew out of the initial initiatives of federal seismologists and emergency planners to promote earthquake mitigation in the province. The commitment of government resources, such as the NEHRP regional assessment, has a direct bearing on shaping policy communities through the establishment of priorities and allocation of funding.

Internal policy community dynamics reflect the opportunities made available in the previous category. For example, delegation of mandatory licensing of professional engineers by the provincial government to an autonomous body, APEBC, created an entity with the credibility to act on its own to promote seismic safety. Membership dues and volunteer efforts enable the Association to lobby the province on issues which APEBC sees as important to its membership. Since APEBC has no direct counterpart in Washington State, coalition building has been a necessity for earthquake policy community members there. At the same time, the greater permeability of formal structures in Washington State

enables non-government earthquake policy community members to play a greater role than in British Columbia.

The earthquake policy community in British Columbia with its strong civil service base and a pivotal professional association generated more activity in the late 1980s than it had previously. In contrast, during the same time frame, the longer existing, more broadly based coalition of the Washington State earthquake policy community did not generate a greater surge of activity than it had earlier in the decade. While the Washington State earthquake policy community has successfully nurtured political agenda setters at the state level, much of their efforts have been thwarted by the lack of gubernatorial commitment. So, while the system of separation of powers provides more intervention points, it also presents more stumbling blocks. Neither of the two earthquake policy communities have had the advantage of strong leadership from elected officials, but both have been strengthened by the participation of seismologists and engineers.

Conclusion

The parallel developments in risk management policy in Canada and the United States which Jasanoff (1986) anticipates are in evidence in seismic safety policy. Described earlier were the examples of national catastrophic emergency response plans and the seismic zoning incorporated into national building codes. But the basis Jasanoff suggests for these parallel developments - similar political systems, a shared scientific tradition and participation in joint decision making and information exchange - do not all hold as similarities in determining how the earthquake policy communities operate in British Columbia and Washington State. While information exchange does lead to comparable dynamics in both earthquake policy communities, the differences in political systems necessitates that the earthquake policy communities employ different tactics to bring their concern to the attention of influential politicians. In sum, the similarities which shape parallel policies do not automatically produce similarities in the earthquake policy communities which shape those policies. Consequently, to look only at policy outcomes would fail to reveal the full extent of the different

means of reaching these outcomes. Doing so would undervalue the importance of the processes necessary to achieve the desired policy outcomes.

An issue networks approach is an innovative means to examine geophysical events in political context because the emphasis is on the linkages which exist between the scientific and policy spheres. It provides a means to understand the perspectives of all those who contribute to an issue regardless of how that contribution is made. Such an approach makes it possible to trace how and where non-scientific factors seep into the generation and dissemination of geophysical understanding and how scientific understanding enters the policy makers' realm. Our understanding of geophysical events is shaped not simply through the research findings generated by the scientific exploration of naturally occurring phenomena but the human created structures in which scientific investigation is carried out and in which the science is linked to mitigation and policy decisions are made and implemented.

Exchanging information is central to creating and reinforcing the connections among people with different expertise and concerns. Consequently, using issue networks is a powerful approach to understanding the contribution of earth science information to earthquake policy in British Columbia and Washington State. This paper sets out a new direction for how geographers can bring a fresh perspective to hazards research using a comparative approach and employing a regional focus. A comparative approach reveals how the differences in two jurisdictions' experience of damaging earthquakes has shaped the distinct evolution of each earthquake policy community. At the same time, the shared prospect of a great subduction earthquake is producing common features in the two policy communities and increasing the dialogue between them. In this study, information based connections reinforce the spatial definition of what constitutes a region. As members of a discipline at the interface of physical and social sciences, it is incumbent on geographers to explore how the history and potential for geophysical events mesh with political context to shape how groups address the prospect of environmental perturbations.

Issue networks provide a means to explore how concepts become refined into implementable measures through the dissemination of ideas to people motivated and able to adapt theoretical constructs to address management concerns. For example, an issue networks approach may prove valuable in exploring how the

philosophy of sustainable development enters into the practice of public agencies responsible for environmental stewardship.

A further test of the utility of the issue networks approach is to address the question, how do issue networks reinforce or undermine spatially defined regions or jurisdictions derived politically? This is a timely question because of the current reconsideration of regional identity in light of such factors as the demands of local populations, advances in communication and the restructuring of the global economy.

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Notes

¹Weiss and Gruber (1984, 227) characterize social policy arenas as being fragmented

Because many levels of government and many units within governments participate in deciding what to do and in doing it, because each participant is accountable to a somewhat different constituency, and because participants have little or no influence over the activities of the others...

²Weiss's seven meanings of research utilization take shape as: (1) The knowledge driven model. Ideas from research stimulate development and utilization. (2) The problem solving model. Policy makers define the problem and either existing or new research is used to address it. (3) The interactive model. Research is pooled with experience, personal judgment and other ideas in such a way it is impossible to distinguish the contributions of research. (4) The political model. Knowledge is used to support an already held position and to persuade others. (5) The tactical model. Research is used not to gain understanding but to demonstrate that action is being taken on a concern. (6) The enlightenment model. Research becomes part of the framework of decision making through the unconscious diffusion of general understanding. (7) Intellectual enterprise. Research is as much influenced by current thinking as influencing it. This footnote draws on Innis (1990).

³Between August 1988 and June 1989 over ninety interviews were conducted in British Columbia and Washington State seeking evidence of earthquake policy communities, issue networks and information webs. Interviewees included seismologists, engineers, emergency preparedness planners, land-use planners, journalists, academics and politicians among others. Documentary evidence of information pathways between geoscience researchers and earthquake mitigation decision makers was also sought out. This included examining publications, correspondence, files, agency statements and reports. This search provided insight into the existing policy and institutional setting and served as an important means of identifying key people to be interviewed.

⁴The parent organization of the task force is the Joint State Agency Liaison meetings. The parent organization of the subcommittee is the Interministry Emergency Preparedness Committee which only came into existence in July, 1988.

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