Framing the Issue of Climate Change: The Beliefs of Canadian Environmental Non-government Organizations and the Energy Industry

by

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ABSTRACT

Previous studies surveying beliefs of climate change frequently focused on the public and experts in order to improve decision-making and communication. These studies were developed using a social demographics framework and a mental models approach. This study is informed by social-constructionism. From this perspective, the issue of human-induced climate change is not defined by indisputable objective conditions on changes in climate system alone but is "constructed" by a subjective process of dialogue involving various groups as claims-makers. These groups have different "worldviews" or frameworks of assumptions and priorities that influence how they discover, interpret, define and solve an issue. These differences may lead to contested positions on whether the issue is dangerous and requires remedial action.

This study audits the climate change beliefs and environmental values of two social groups or "claims-makers" -- ENGOs and energy-related industry – to understand their framing of the issue of climate change. A framework of key themes and associated attributes or factors was developed to guide the survey instrument design and data analysis. The themes are socio-demographic characteristics, environmental values, awareness of and knowledge on climate change, responsibility for action and information needs. Statistically significant differences were found between the two groups.

ENGOs have a strong ecological worldview while the energy industry exhibited orientations ranging from ecological to anthropocentric. These groups are polarized in their beliefs on technology as a beneficial solution. Energy industry respondents have strong beliefs in the capabilities of science and technology and human ingenuity to deal with ecological problems.

The ENGOs and energy industry respondents had the same length of exposure to the issue and similar frequency of exposure to climate change information; they are considered

equally aware. ENGOs have a greater belief that climate change will occur – some reported that it is already happening. The energy industry is ambivalent. Some respondents focussed on the "natural" processes of climate change and questioned whether human-caused climate change is real.

Sea level rise, drought and flooding emerged as most likely threats common to both groups. But, climate change was not perceived as personally dangerous. Both groups thought that the negative impacts of climate change were more likely to occur elsewhere and to someone else rather than to themselves. The energy industry reported that there would be 'no effect" to most economic sectors. ENGOs and energy industry respondents differed significantly in their assignment of responsibility for action: individuals are most responsible from an energy industry perspective while ENGOs think industry is primarily responsible.

An audit of the beliefs and values of ENGOs and the energy industry contributes to understanding these claims-makers' positions and the strategic implications of agreement and disagreement in developing and implementing policy on the climate change issue.

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CHAPTER 1

INTRODUCTION

> *"Seppuku: ritual suicide with honor. Kyoto: economic suicide by ignorance. That's right, economic suicide through ignorance of facts. And Canadians should know the facts of climate change before it's too late...In the past 18 years the earth has actually cooled slightly, not warmed as we've been repeatedly warned. But don't take our word for it. Ask the scientists. Check the data. The numbers don't lie...Imposing severe 'remedies' will likely be misdirected, ineffective, unproductive and economically damaging...Make no mistake; Canadians will lose jobs and be forced to absorb huge cost increases to heat and light their homes, their business, schools and hospitals. The question is: Why would we do this to ourselves? Let's be sensible...Are we, as a nation, ready to fall on a sword of ignorance, fear, and politics for this uncertain issue? Think about it. Ask the questions. Demand the answers...before it's too late."* (The Coal Association of Canada, 1997).

> *"Health professionals and scientists warn of new infectious diseases. Global warming's biggest threat to Canada may also be the smallest...The Asian Tiger mosquitoes which transmit dengue fever have already moved from Florida to the Canadian border in the last 10 years... Canadians are now travelling to malarial areas and bringing the disease home with them...global warming could create the right conditions for malaria in Canada ... preventing global warming itself is the most effective way to stop these new infectious diseases from spreading into Canada...And the Royal Society of Canada has concluded that Canada can achieve 20 per cent cuts [in emissions] by 2010 with net economic benefits...We know the cause of global warming. We know how to prevent it and, by doing so, how to prevent serious threats to human health. This knowledge compels us to act."* (David Suzuki Foundation, 1997).

These quotes from advertisements in a key Canadian national newspaper illustrate some of the contested terrain in framing the climate change issue (Kalbfleisch, 1994). These differences derive, in part, from uncertainties and competing certainties on scientific facts. But they may also occur because of disparate frameworks or "worldviews" that affect beliefs on the certainty of, risks from and responses to human-induced climate change. Where social, political or environmental issues are contentious, competing social groups or "claims-makers" interact to shape definitions of the problem and influence policy outcomes. Here the Coal Association of Canada, an energy industry association and the Suzuki Foundation, an environmental non-government organization (ENGO), illustrate distinct claims on climate change just prior to the Kyoto Protocol negotiation in December 1997.

Scientific experts are another important claims-making group. Scientists involved with the Intergovernmental Panel on Climate Change (IPCC) reported that "...the balance of evidence suggests a discernible human influence on the climate system" (IPCC, 1996d, 22) after carefully reviewing the scientific literature on climate change. Yet, there is still debate internationally, nationally and locally on future greenhouse gas emissions and concentrations; their impact on the climate system; impacts on social, economic and ecological systems; the societal responses that are required and their costs and benefits; and the urgency for action.

Recent theoretical developments in sociology suggest that social problems evolve in a process by which claims-makers determine whether an issue is "dangerous" and requires remedial action. This approach developed from Blumer, who felt that social problems were products of a process of collective definition instead of quantifiable, objective conditions (Blumer, 1971, 298). The issue of human-induced climate change is not defined by indisputable objective conditions on changes in climate system alone but by a subjective process of dialogue involving claims-making by scientists/researchers, industry, ENGOs, the media, governments and the public.

From this perspective, the climate change issue is negotiated through a process of problem conceptualization from different frameworks. Individuals and groups have different "worldviews" or frameworks of assumptions and priorities that provide the backdrop for how they discover, interpret, define and solve an issue. These rationalities are not necessarily preferable over one another, but since they are different they may lead to contested positions on the issue.

Fischhoff and Furby (1983, 191) outlined the need to understand the "mental world" of participants involved in the climate change issue to develop a cooperative response. They described how the conceptual "frameworks" of various groups is limited and cultures have

different ways of perceiving and understanding the climate change issue. These differences influence worldviews and affect basic assumptions, the interpretation of facts, judging of certainty, identifying of solutions and action options, defining priorities and anticipating and resolving conflicts. A survey eliciting information on climate change knowledge and beliefs would contribute to understanding the claims-makers' positions.

Hilgartner and Bosk (1988) developed a conceptual model where public attention is assumed to be a scarce resource that is allocated through competition in a system of public arenas. A network of social groups competes in these arenas to promote and control particular problems or even different ways of seeing the 'same' problem. Statements about social, environmental, political problems from claims-making groups have a specific interpretation of reality from a plurality of possibilities. "Which 'reality' comes to dominate public discourse has profound implications for the future of the ...problem, for the interest groups involved, and for policy" (Hilgartner, and Bosk, 1988, 58).

Ungar (1994, 289) suggested that since political discourse is not neutral, research using survey instruments to describe beliefs and opinions on environmental issues should tap into and present the positions of different claims-makers instead of framing the issues in objective and neutral ways as in standard polling practices. Thereby, the contested positions and relationships in the political debate can be revealed. Polling information on the public can mesh with positions in the political debate. This study audits the climate change beliefs of two social groups or "claims-makers" -- ENGOs and energy-related industry - to understand their framing of the issue of climate change.

Successful handling of a controversial environmental issue such as climate change involves considering the preferences and beliefs of key groups that have a stake in the outcome of the issue when formulating response strategies (Freeman, 1984, in West *et al.*, 1992, 112). An

audit of key social groups can improve understanding of the strategic implications of patterns of agreement and disagreement (West *et al.*, 1992) which may aid in consensus building and successful implementation of policy in this contested "arena".

1.1 Choice of Claims-making Groups

Previous studies surveying beliefs of climate change frequently focused on the lay public and experts. Understanding the level of awareness, the perceptions, and conceptualizations of climate change of these groups was used to improve communication on climate change (Bell, 1994; Changnon *et al.*, 1992; Harrison *et al.*, 1996; Henderson-Sellers, 1990; Jaeger *et al.*, 1993; Kempton, 1991a,b; Löfstedt, 1992; 1993; Read *et al.*, 1994; Slade, 1990; Staats *et al.*, 1996). This study is unique in that it focuses on two social groups, ENGOs and the energy-related industry who are key to claims-making on climate change. These groups communicate to develop public awareness and understanding, and negotiate to set political agendas on the climate change issue. In the only published study using similar groups, Kempton and Craig (1993) interviewed European environmental policy makers (government, scientist, multinational representatives, and ENGOs) to elicit their views, motivations and values on promoting strong action on climate change.

Through a survey instrument, this study will try to ascertain if there are similarities and differences in climate change awareness, knowledge, information needs, and belief in responsibility for action between the two groups. In addition to climate change questions, the survey explores how the groups view their relationship to nature and the environment and science and technology (Fischhoff and Furby, 1983, 191). These underlying "worldviews" guide relationships and help define goals. For example, different social conceptions of nature translate to or impact on the practice of environmental stewardship or management and affect strategies for human development (Colby, 1989, 5).

The two social groups are expected to have different ecological "worldviews", climate change beliefs, and claims-making positions. The ENGO focus is protecting the environment; they will have a lower tolerance for the threat of human-caused climate change. The "evidence" that science has presented to date is convincing. They are likely to exhibit more certainty on climate change occurring, expect more risks due to climate change and advocate mitigation (reduction of greenhouse gases) to "fix" climate change. For the energy industry, the science has too many uncertainties. There are serious misgivings because action on climate change has serious implications for their business interests. The energy-related industry representatives will question the certainty of climate change and associated impacts. By choosing two groups, energy industry and ENGOs, with potentially divergent climate change beliefs and environmental values, significant differences may be revealed.

1.2 Goals and Objectives of the Study

The purpose of this study is to explore the human dimension of the climate change issue - beliefs, values, worldviews and actions of people or groups involved in the issue rather than following a natural science perspective of detecting climatic changes or modelling climate system responses.

The objects of the study are to:

- Audit the beliefs on climate change of ENGOs and the energy industry through a survey instrument;
- Audit the environmental values of ENGOs and the energy industry; and
- Ascertain the nature of the underlying beliefs and environmental values and determine whether there are differences and similarities between the two groups that may guide the framing of the climate change issue and their claims-making.

1.3 Thesis Overview

Chapter two reviews literature in a number of thematic areas relevant to the study. Research on human dimensions of climate change is briefly surveyed for context. Theories relevant to the study of attitudes, beliefs and values are presented. Paradigms and worldviews are described. The environmental sociology literature on social movements and environmental orientation is used to develop the measures for determining environmental values and associated worldviews of respondents. The concept of claims-makers and their roles in the process of negotiating climate change as an environmental issue are developed from social constructionism theory. A review of studies on climate change attitudes, beliefs and knowledge guided the development of the survey instrument, its analysis and the conceptual framework for comparing the beliefs of the two groups.

In Chapter three, methods used in the study are outlined. The questions and their purpose with respect to the framework considering the respondents' climate change awareness, knowledge, responsibility for action, and information needs are described. Methods for data analysis are outlined.

Results from the survey instrument are presented in Chapter four. The framework considering the respondents' climate change awareness, knowledge, responsibility for action, and information needs is used to compare the claims-making groups. The environmental values and the worldviews of ENGOs and industry groups are analysed and compared to their climate change beliefs. The contribution of the study to understanding Canadian beliefs on climate change is presented in the fifth chapter. Future research needs are also described. The survey instrument used in the study to obtain the primary data is found in Appendix A (the back pocket).

CHAPTER 2

LITERATURE REVIEW

2.1 Human Dimensions of Climate Change

Initially, climate change due to an "enhanced greenhouse effect" was not framed as a human-caused problem related to behaviours, choices and negotiation within social systems (e.g., economic development, energy consumption and land use change) but as a physical problem caused by changing atmospheric chemistry altering the radiation balance of the climate system (Boulding, 1983). Research focused on "defining the physical problem" by modelling the global climate system to project climatic changes and detecting the atmospheric chemistry and climate changes (Boer *et al.*, 1992; Hansen *et al.*, 1983; 1984; IPCC, 1990a; Manabe and Wetherald, 1975; 1987; McFarlane *et al.*, 1992; Schlesinger and Zhao, 1988). Early social science contributions reflected this orientation. However, contributions have been made in emission scenario development, economic and social assessment in climate impact studies, limitation and adaptation strategy development and costing (IPCC, 1990b; 1991; 1992).

Once climate impact assessment advanced beyond doubling of carbon dioxide ($2xCO_2$) implications, socio-economic scenarios were required to underpin the greenhouse gas and aerosol emission scenarios used in climate modelling. Projections of population growth, economic development, and energy use and mix were developed into six IPCC IS92 emission scenarios (Leggett *et al.*, 1992). The four new IPCC SRES "scenario families" have progressed beyond "projections" to "futures visions". They incorporate societal choices on divergent tendencies such as strong economic or strong environmental values and increasing globalization or regionalization. The scenarios include demographic (low to high growth), economic (dematerialization, income equity), political (globalization or local focus), technology (new, efficient technology, clean technology), and societal (environmental, social, economic

sustainability, personal wealth focus) futures (IPCC-TGCIA, 1999). Now, climate change modelling is framed within societal decision-making contexts.

Early climate change impact assessments focused on "first order" biophysical impacts and incorporated little evaluation of the economic and social implications (IPCC, 1990b; Kates *et al.*, 1985). Hazards-influenced research on climate variability and extremes, societal vulnerability and resilience, and mechanisms for adjustment informed climate change impact assessments (Burton *et al.*, 1993; Warrick and Riebsame, 1983). For example, in agricultural impact assessment, ideas on identifying potential adaptation strategies or human responses to climate change emerged. The goal was not to develop strategies for action on climate change impacts but to improve the assessment of net impacts (Parry and Carter, 1988; Smit, 1993; Smit and Smithers, 1996). Education and public information for common understanding and the translation of scientific knowledge for decision-making and policy making emerged as important concerns from the impact assessment community. These topics become particularly important when recognizing the need for human behavioural change in addition to technological solutions (Chen *et al.*, 1983; IPCC, 1991).

In their 1983 chapter "Psychological dimensions of climatic change", Fischhoff and Furby outline questions on the human dimension of climate change that are germane today and provide guidance for this thesis. Survey instruments and other methods can be used to find out:

- Various groups' understanding of climate change facts. How much do they know? What are their areas of weakness? How is competence developed?
- How can values be elicited to inform the debate? What are the groups' value assumptions? What world outlooks do they represent and what are the interests they favour?
- Where are potential conflicts?

- What do people know and think of climate risk?
- What information do people want?

Answers to many of these questions will help in the decision-making process as people cope with the uncertainty, risk and competing claims of climate change.

Natural science researchers involved in climate change studies were sensitive to the fact that their work should inform policy but should not be policy prescriptive. This reflects the "rational" view of the natural sciences. It is pertinent when establishing climate change as an environmental problem but is no longer relevant when research is required to help formulate and implement solutions. Risk perception, decision-making with uncertainty, equity and distributive issues and sustainability become important. However, the social construction of climate change risk and decision-making associated with it has received little attention (Rayner and Malone, 1998a,b). Löfstedt (1995, 83) observed "[t]he technological fix and the dangers of studying lifestyles arguments ignore the reality that most environmental problems may be considered to be socially constructed and in order to properly combat them intrinsic knowledge of people's understanding of certain environmental problems are required". Attitudes, beliefs and values related to climate change and its risks and the social feasibility of implementing mitigation and adaptation responses are important areas of research. Dialogue between science and climate change policy-makers is essential for development of international and national climate change strategies; however, stakeholders/citizens (or those who will be affected by the impacts) need to be incorporated into the dialogue on policy decisions. Social science can bridge the gap between public opinion and expert debates. Kasemir *et al.* (2000) outline a number of social science perspectives that are being developed including constructivist-realist debate, ecological determinism and socio-cultural autonomy, knowledge framing, and social science methodologies to facilitate participation and democratize environmental research.

2.2 Beliefs, Attitudes, Values, Worldviews and Paradigms

2.2.1 Beliefs, Attitudes and Values

Beliefs are cognitive; they reflect a person's thoughts about an object or situation and their judgments about the likelihood of events or relationships. They are characterized by centrality - importance in the person's belief system and by intensity - how strongly it is held. "Primitive beliefs" are central to a belief system; they are deeply held, rarely questioned and are key determinants of behaviour (Gray, 1985 in Gooch, 1995, 516). These beliefs are formed through direct contact with objects of belief or unquestioned external authority. "Derived beliefs" are built up from basic underlying beliefs (Oskamp, 1991). A person's beliefs are not completely logical or rational but people's beliefs are based on ideas and concepts which seem to "go together" comfortably from their subjective viewpoints rather than being derived by strict deductive logic. Inconsistencies or contradictions, "dissonance", can be avoided by denial, redefining concepts or other cognitive mechanisms or refusing to think about the conflict. People strive for belief consistency (Ajzen and Fishbein, 1980, 23).

Attitudes are intrinsically evaluative in orientation and involve positive or negative feelings and/or emotions toward an attitude object. They are affective (emotion-laden). A person's attitudes are the result of past experiences (both vicarious and actual). Attitudes represent a readiness to respond in a favourable or unfavourable manner to a particular class of objects or situations. Attitudes function to help in understanding and knowing. Many attitudes help understand our world and make sense of occurrences around us; they provide consistency and clarity in explanation and interpretation of events. Attitudes also provide a factually truthful picture of the world but it is one that is meaningful and understandable to the particular individual who holds them.

A value is an important life-goal, societal condition, or mode of conduct desired by a person and defines their standards in life. It encompasses broad abstract concepts such as peace, happiness etc., and also more concrete items such as money, or material possessions. Values are an end or a goal to strive for rather than a method or process to achieve it.

Theoretical concepts such as beliefs, attitudes and values are important in exploring motivation, ideological positions, cognition, and behaviour (Mohai, 1985). At the individual level these concepts are used for eliciting and describing environmental concern and modelling attitude-behaviour relationships (Ajzen and Fishbein, 1977; 1980). When aggregated as shared beliefs, values and attitudes for general groups (publics) the result is what is termed a "social paradigm" or a "worldview" (Gooch, 1995, 514). These publics and their "worldview" have important roles in democratic discourse and public policy development (Oskamp, 1991).

2.2.2 Paradigms and Worldviews

Kuhn (1970, 174) used the concept paradigm to describe changes in scientific worldviews. The term paradigm describes "...a group's way of looking at the world, its' entire constellation of beliefs, values, techniques and so on..." Paradigms have been extended to the socio-cultural level and applied to societal perceptions of the relationship between society and the physical environment; for example, to demonstrate the emergence of an environmental movement (Pirages, 1977, 6 in Dunlop and Van Liere, 1984, 1013). Samdahl and Robertson (1989, 79) thought that these ideological belief systems may be the most pervasive source for generating environmental concern.

Paradigms are "logics" or "mental models" that are composed of beliefs, attitudes, values, concepts, perceptions and practices that are widely shared within a community and which form a self-consistent worldview that is an implicit, social construction of reality. Paradigms influence perceptions of and beliefs about how the world works physically, socially,

economically and politically and also guide and legitimatize courses of action (Cotgrove, 1982; Milbrath, 1989; Perlmutter and Trist, 1986 in Milbrath, 1989). The description by Cotgrove (1982, 26-27,33, 82, 88) illustrates the concept of paradigm.

> *"Paradigms then provide maps of what the world is believed to be like. They constitute guidelines for identifying and solving problems. Above all, paradigms provide the framework of meaning within which "facts" and experiences acquire significance and can be interpreted.*
>
> *Paradigms are not only beliefs about what the world is like and guides to action; they also serve the purpose of legitimating or justifying courses of action. That is to say, they function as ideologies. Hence, conflicts over what constitutes the paradigm by which action should be guided and judged to be reasonable is itself a part of the political process. The struggle to universalize a paradigm is part of a struggle for power. ...protagonists to the debate approach issues from different cultural contexts, which generate different and conflicting implicit meanings....What is sensible from one point of view is nonsense from another. It is the implicit, self-evident, taken-for-granted character of paradigms which clogs the channels of communication."*

Society plays a crucial role in knowledge development, in development of beliefs about how the world works and in value clarification, which ultimately develop into "paradigms" or ways of perceiving the world - "worldviews". When people agree about an object/phenomenon/action, they say they are dealing with it objectively; it may be more accurate to say they are achieving inter-subjectivity - they have reasonably similar beliefs (Milbrath, 1989). These people have a common worldview. When disagreements arise between groups, they often grow out of differences in commonly held values and beliefs. But belief and value structures take many forms; they grow and change with time, and in this interchange paradigmatic change enables humans to contest and adapt to a wide range of circumstances (Milbrath, 1989, 58).

A dominant social paradigm (DSP) is society's dominant, though not universal, belief structure that organizes individuals or, collectively, societies', perceptions and interpretations of the world (Pirages, 1977, 6 in Dunlap and Van Liere, 1984). This worldview consisting of a collection of norms, beliefs, values, and habits guides expectations and behaviour (Gooch 1995). At times these paradigms "shift" because of crucial challenges to the worldview through

an individual's conflicting cognitions - "dissonance" and disillusionment with the prevailing worldview's ability to explain and lead to fruitful interaction in the world. Fundamental reorganization in beliefs and values occur (Gooch, 1995).

Some researchers in sociology suggest there is a fundament paradigm shift underway in how humans perceive and interact with the environment. The DSP is being replaced by the "New Environmental Paradigm or New Ecological Paradigm" (NEP) (Bengston, 1994; Buttel, 1987; Catton, and Dunlop, 1978; 1980; Dunlap and Van Liere, 1978; 1984). The western DSP, developed during the Industrial Revolution, has an anthropocentric worldview while the NEP is an ecological worldview (Albrecht *et al.*, 1982).

The DSP-NEP cleavage in beliefs and values with different worldviews offers one means of comparing two groups, ENGOs and energy industry representatives and their knowledge of and beliefs related to human-caused global climate change. The audit of ENGOs and energy industry beliefs in this thesis may help understand the positions, advocacy and framings of two groups involved in the climate change discourse. It is an effort at "...mapping contested positions..." (Ungar, 1994, 298). Comparing beliefs, knowledge, and attitudes of stakeholder groups assists in the process of developing strategy. Often the degree of congruence in views of stakeholder groups influences policy choices and success of policy implementation. Even if there is consensus among stakeholder groups on policy goals there are often important differences in the mechanisms of how to attain these goals. Patterns of agreement and disagreement are important in negotiating risk and developing and implementing policy. "Attitude audits" provide strategic information (West *et al.*, 1992).

2.3 The Human-Environment Relationship

A theme in literature on environmental problems suggests that the root of the ecological crisis stems from society's traditional values, beliefs and ideologies - the DSP (Catton and

Dunlap, 1978, 1980; Dunlap and Van Liere, 1984; Gooch 1995). Environmental problems arise because the DSP, developed in an era of abundance, may no longer be applicable in an era with growing recognition of ecological constraints. The emerging environmental movement calls for adoption of an alternative set of beliefs, values and lifestyles to secure a more harmonious relationship between humankind and nature (Albrecht *et al.*, 1982). Sociological theory suggests that a societal value system may become maladaptive if the conditions facing the society change (Dunlap and Van Liere, 1984, 1014). A more ecologically sustainable society needs a paradigmatic shift from the DSP to an "ecological worldview" (Dunlap and Van Liere, 1984).

The fundamental shift to ecological values challenges the DSP attitudes, values and beliefs through which many in industrialized societies view the world (Dunlap and Van Liere, 1978, 1984; Milbrath, 1989). The DSP emphasizes economic growth, control of nature, faith in science and technology, ample reserves of natural resources, the substitutability of resources, commitment to limited government, emphasis on individualism and a dominant role for experts in decision making. The NEP is best captured by the "spaceship Earth" metaphor. This worldview includes sustainable development, limits to growth, harmony with nature, skepticism toward scientific and technological fixes, finite natural resources, limits to substitution, and strong emphasis on public involvement in decision making (Albrecht *et al.*, 1982; Bengston, 1994, 515; Dunlap and Van Liere, 1984, 1015; Milbrath, 1989, 119).

The DSP includes the belief that humans are separate from and dominate nature. The Dominant Western Worldview (DWW) extends this assumption to beliefs in the inevitability of human progress and in technology as the vehicle of progress. Technology is the key to human domination over nature and affords protection from natural catastrophes (even those from technology) (Arcury *et al.*, 1986). Since the social sciences developed during DWW some researchers feel that there is a paradigmatic bias and Catton and Dunlap (1978; 1980) refer to the

DWW's influence on social theory as Human Exemptionalism Paradigm (HEP). In the NEP, humans are equal members of the natural world (ecocentric) rather than being distinct from nature and exempt from natural laws (anthropocentric). The belief of inevitable human domination of nature through use of technology is changing to understanding limits imposed by nature and using them to provide a framework for living within.

Dunlap and Van Liere (1978, 1984) operationalized the NEP and developed a scale to measure individual environmental worldview for the range DSP (or DWW/HEP) to NEP. The 12-item NEP scale included broad issues such as limits to growth, humankind's relationship with nature, economic development and the environment, and balance of nature to test public acceptance of the NEP. Early attempts at constructing scales to measure environmental attitudes/concern were not very successful since they used a large number of questions and often focused on specific aspects of environmental issues (e.g. overpopulation, pollution or energy). Van Liere and Dunlap (1980) reviewed the empirical evidence for hypothesized relationships between demographic and social variables and environmental concern. Although age, education and political ideology were consistently, but moderately, associated with environmental concern, they found limited success in explaining the social bases of environmental concern but thought cognitive determinants may prove more fruitful. Samdahl and Robertson (1989) also reported that underlying ideological belief structures (e.g. NEP) may be more informative than demographics.

The NEP explores "primitive beliefs" (Gebhardt and Lindsey 1995; Gooch, 1995), or more generic environmental dispositions (Albrecht *et al.*, 1982). The NEP scale is designed to measure the extent to which people accept premises of the NEP as compared to DSP (Albrecht *et al.*, 1982) in a Likert scale of agreement or disagreement with statements. The use of the NEP is appealing because it has been subjected to systematic testing for reliability and validity

(Albrecht *et al.*, 1982, 40; Dunlap and Van Liere, 1978; 1984). Dunlop and Van Liere (1978) tested for response consistency, the extent to which several individual attitude items can be treated as an internally consistent and unidimensional attitude scale. While Dunlap and Van Liere (1978) found the scale to be unidimensional, Albrecht *et al.* 1982 found that the NEP had three distinct attitudinal domains "balance of nature", "limits to growth" and "man over nature". Distinguishing between domains is important because people can hold multiple perspectives and identify to varying degrees with different orientations toward the environment (Gebhardt and Lindsey, 1995). There is a possibility of a mixed response; people can endorse some elements of NEP and reject others (Dunlap and Van Liere 1984; Albrecht *et al.*, 1982).

The NEP has been used in a number of studies. It has been used to survey general environmental attitudes (Blaikie, 1992; Gebhardt and Lindsey, 1995; Noe and Snow, 1990). The NEP was the metric for ecological worldview that was combined with sociodemographic factors to analyse knowledge of environmental problems in the general public or interest groups (Arcury 1990; Arcury *et al.*, 1986; Gooch, 1995; Steger *et al.*, 1989; Stern *et al.*, 1995). Researchers have tested the scale's unidimensionality (Albrecht *et al.*, 1982; Geller and Lasley, 1985; Noe and Snow, 1990) and applied it as a variable in environmental behaviour modelling (Mohai, 1985; Samdahl and Robertson, 1989; Steel, 1996).

2.4 Social Constructionist Context

> *"Competing ideas about nature...and about equity...inform climate change policy debates at all levels, from the family hearth to the international negotiation of the Framework Convention on Climate Change (FCCC). The message that emerges...is that, rather than being obstacles to be overcome, the uneasy coexistence of different conceptions of natural vulnerability and societal fairness is a source of resilience and the key to the institutional plurality that actually enables us to apprehend and adapt to our ever-changing circumstances...[T]he risk terrain is contested, and ... progress lies not in our choosing one position on that terrain and then rejecting those that are in contention with it, but in recognizing and understanding all these positions and then finding ways of negotiating constructively between them"* (Thompson and Raynor, 1998b, 143, 144).

Traditionally many environmental problems have been defined from the objectivist perspective where science is perceived as objective, rational, value-neutral and apolitical. In this paradigm, environmental risk was a quantifiable, objective, physical entity that existed independently of humans who assess it and experience its effects (Kalbfleisch, 1992; Thompson and Raynor, 1998a, b). Social constructionism proposes that environmental problems, risks and solutions are ultimately socially assembled through a dynamic process of definition, articulation, legitimization and action or 'claims-making' (Spector and Kitsuse, 1977; Hannigan, 1995; Thompson and Raynor, 1998a, b). The different values, beliefs and goals of claims-makers mean that there can be several legitimate conceptions of any risk at one time. The fates of potential environmental problems are governed not only by their objective natures but also by a highly selective process in which they compete with one another for public attention and societal resources (Hilgartner and Bosk, 1988, 57).

The social constructionism can be useful as a theoretical position and an analytical tool as well (Best 1989b in Hannigan, 1995, 34). Three foci can be applied to studying problems from this perspective: the nature of the claims, the claims-makers and the claims-making process (Hannigan, 1995). Through a survey instrument to obtain information on climate change beliefs and environmental values, this thesis distinguishes between two types of claims-makers, ENGOs and energy industry representatives, while investigating their climate change claims and their position in claims making.

2.4.1 The Claims

Rhetoric is the deliberate use of language to persuade. Grounds, warrants, and conclusions are the three principal components of rhetorical statements. Grounds are the basic facts or data that shape the claims-making discourse. There are three elements. First, definitions set the boundaries or domain of the problem; they give an orientation and serve as a guide to

interpretation. Citing examples, such as defining victims, make it easier for publics to identify with affected people or regions. Lastly, numeric estimates are appraisals of the magnitude of the problem so that its importance and potential for growth can be established. Warrants are justifications for action developed from arguments based on the historical past, morality and basic rights and freedoms. Conclusions define the action needed to alleviate or eradicate the social problem. In the early stages of claims making when groups are polarized and activists less experienced, rhetoric based on values or morality can be effective. However, when groups are more sophisticated, informed and action-oriented in later stages of the claims-making process, rhetoric of rationality is more successful. For example, the concrete, personal benefits of action are detailed in policy agendas.

2.4.2 The Claims-makers

Claims-makers can be affiliated to specific organizations, social movements, professions or interest groups and they assume the important role of constructing social problems. The medical professionals, engineers, scientists, politicians, public interest groups, law firms, civil servants and the media can undertake these roles (Best, 1989; Kitsuse *et al.*, 1984). In the process of articulating claims, these people can represent their own interests or those of third parties. Their beliefs and values are important in defining the claims and the claims-making process.

2.4.3 The Claims-making Process

> Weiner (1981 in Hannigan, 1995, 41) "... *depicted the collective definition of social problems as a continually ricocheting interaction among three sub-processes: animating the problem (establishing turf rights, developing constituencies, funneling advice and imparting skills and information); legitimating the problem (borrowing expertise and prestige, redefining its scope such as from a moral to a legal question, building respectability, maintaining a separate identity); and demonstrating the problem (competing for attention, combining for strength, i.e. forging alliance with other claims-makers, selecting supportive data, convincing opposing ideologists, enlarging the bounds of responsibility). These are overlapping rather than sequential processes which together result in a 'pubic arena' being built around a social problem.*"

Debates on risks take place in the 'contested terrain' of public arenas such as the courts, news media, social action groups, research community, governments, and interest groups where these social problems are framed and grow. In these institutions, the social problems are discussed, selected, defined, framed, dramatized, packaged, and presented to the public. But the public space for these problems is limited at the institutional and individual level thereby leading to competition. Ungar (1994) recommended that researchers should map the contested positions of advocacy groups; this research tries to understand the contested terrain between ENGOs and energy-related business elites.

Hilgartner and Bosk (1988) developed a conceptual model that described 'arenas' where potential social problems compete for attention, legitimacy and societal resources and where the ideas of importance and a problem are 'essentially contested' concepts. The 'arenas' are used to depict the evolution of problem definition and to examine the effect of those arenas on the evolution of social problems and the actors who are claims-makers. Public attention is assumed to be a scarce resource that is allocated through competition in a system of public arenas. Factors that are important to successful competition include: 1) drama, 2) 'gatekeepers' that control the flow of messages to audiences, 3) institutions and social networks and their influence and the interrelationships where problems are framed and publicly presented, and 4) agenda setting. Through these processes the collective definition of concern is developed but only a limited number of problems can become dominant because of system carrying capacity. There is a network of social groups who compete to promote and control particular problems. Research questions of interest include what are the rival claims of claims-makers and what are the concerns and interests of the claims-makers (Hannigan, 1995, 37).

2.4.4 Strategies of Social Actors

> *"...[C]ompetition between* [policy elites], *counties and corporations is no longer confined to products and technologies, but now also involves 'visions of the world or the future' (i.e. explanations of environmental phenomenal and scenarios for economic development) – which are products of complex mixes of individual beliefs, social rules, policies, administrative regulations and institutions. Possibilities for developing technologies, markets and comparative advantages increasingly depend on possession of the winning 'vision' as do possibilities for achieving long-lasting influence on political decisions. Competition now includes tactics such as attribution of causes and responsibilities, estimation of the relative importance on issues; and techniques for shaping images of future costs" (Godard, 1992, 243).*

Scientific understanding of global environmental risks is generally sufficient to formulate contingencies but it is not sufficient to provide definitive portrayals of causes and effects. As a result scientific controversies develop. In the past they have been contested in the scientific arena with known rules and a limited number of participants. Increasingly, scientific controversies are making it onto the public agenda via the mass media. There are many more claims-makers participating in the dialogue since they realize that the environmental situation may affect their interests. More interpretations and more interest groups are drawn into the debates. Through this process, environmental risks are being constructed socially rather than through direct experience and science rationality. Epistemic communities are a network of experts who share beliefs about cause-and-effect relationships and who hold common values about preferred public action. Under conditions of scientific controversy, (and uncertainty) several epistemic communities compete with one another, for example, ENGOs and the energy industry (Godard, 1992, 242).

2.5 Understanding Beliefs on Climate Change

Surveys have explored climate change perceptions, opinions, knowledge, understanding, beliefs and determinants of action. These studies have been developed using various perspectives including a social demographics framework, information flow from natural sciences

to laypersons, and a mental models approach. Socio-cultural processes are being incorporated into climate perception and attitude research (Bulkeley, 2000) but concepts such as claims-makers and claims-making from social constructionism theory have not been used as the framing for a study. An overview of research approaches is provided here but specific research results are discussed in the context of the findings of this study in Chapter 4.

Among the most studied with respect to climate change beliefs have been the general public (Bostrom *et al.*, 1995; Berk and Schulman, 1995; Krosnick and Visser, 1997; Krosnick *et al.*, 1998; 2000; Rebetez, 1996), educated lay people (Henderson-Sellers, 1990; Read *et al.*, 1994), experts/scientists (Bray and von Storch, 1999; Changnon *et al.*, 1992; Slade, 1990) and students (Gowda *et al.*, 1997; McDaniels *et al.*, 1996; Bulkeley, 2000). ENGOs and energy industry representatives are surveyed in this thesis to contribute climate change perspectives of important groups participating in the policy debate.

Sampling methods in previous studies have ranged from opportunity samples (Löfstedt, 1992; 1993; Read *et al.*, 1994), self-selection (Henderson-Sellers, 1990; Mortsch *et al.*, 2000) and random sampling (Bord *et al.*, 1998; Jaeger *et al.*, 1993; Staats *et al.*, 1996). Many of the sampling frames are small particularly those which have relied on focus groups.

Various cross-national studies have investigated the publics of Russia, Uruguay, Bulgaria, Sweden, UK, USA, Austria, NZ, Australia, Germany, Portugal, Brazil, Mexico, Netherlands and Switzerland with respect to climate change usually these have been small-scale studies. Dunlap (1998) reported results of one of the few large-scale surveys of lay publics in six nations (Canada, US, Mexico, Brazil, Portugal and Russia). In Canada, there have been few studies. McDaniels *et al.* (1996) explored student perceptions of ecological risks due to global environmental change and Mortsch *et al.* (2000) surveyed participants in the Canada Country Study (CCS) for beliefs of an "informed" group. Numerous polls and focus groups have been conducted for the opinions

of the Canadian public on environmental issues including climate change (Cheney, 1998; Environics Research Group Ltd., 1998; Fenech, 1992; Lagacé, 1997; Pollara, 1998; Synergistics, 1992); Canadian business executives have been surveyed (COMPAS, 1998).

Researchers use surveys with structured and open-ended questions, interviews and focus groups to collect primary data. Some use focus groups to develop survey instruments (O'Connor *et al.*, 1997); others use an interview or focus group for more detailed follow-up after a survey (Bulkeley, 2000; Harrison *et al.*, 1996; Henderson-Sellers, 1990) while others rely entirely on focus groups (Kasemir *et al.*, 2000).

Empirical qualitative studies are common. Kempton (1991a,b) conducted ethnographic interviews on how ordinary US citizens conceptualize global climate change and make value judgements about it; lay results were contrasted with experts. Harrison *et al.* (1996) compared environmental knowledge and pro-environmental behaviour in a cross-cultural study of publics in UK and Netherlands. Löfstedt (1992, 1993) conducted interviews for climate perceptions in Austria and Sweden. Bulkeley (2000) used focus groups for detailed follow-up with Australian students subsequent to questionnaires administered to students and parents. Bostrom *et al.* (1994) used mental model interviews. Kasemir *et al.* (2000) used focus groups in several European cities as a participatory technique to elicit citizens' perspectives on climate change and energy use as part of the Urban Lifestyles, Sustainability and Integrated Environmental Assessment (ULYSSES) project.

Many studies apply the "information deficit model" of public understanding and action. The public needs to be given more knowledge about environmental problems/risks to ensure that they take action (Bulkeley, 2000, 316). Scientifically determined risks of climate change have to be communicated to lay audiences for appropriate action or sanctioning of policies. A barrier

to action is lack of understanding of the causes of climate change (Bostrom *et al.*, 1994; Löfstedt, 1991; 1995; Read *et al.*, 1994)

Climate change survey results have been used to improve the design of communication and public awareness strategies (Gonzalez and da Silveira, 1997; Henderson-Sellers). Stamm *et al.* (2000) addressed public understanding of global warming as a mass communication problem. The study explored media contributions to public understanding, the public's climate change knowledge, salience of the issue and respondents willingness to support policy initiatives to deal with global warming. Influence on public of media has been explored through their discourse (Bell, 1994) or assessing effectiveness of a mass media campaign or media event in changing opinions and/or behaviour (Krosnick *et al.*, 2000; Staats *et al.*, 1996). Staats *et al.* (1996) evaluated the effectiveness (pre- and post- surveys) of a Dutch mass media campaign on climate change that tried to motivate behaviour change. Krosnick *et al.* (1998; 2000) found the 1997 US campaign on climate change made no discernible influence on overall national public opinion but found changes in beliefs and attitudes depending on political affiliation (Democrat or Republican).

Most research on attitudes about climate change focuses on how people think about climate change rather than their behavioural intentions. Jaeger *et al.* (1993) focused on perceptions, concern and action on climatic change and tried to predict environmental action. O'Connor *et al.* (1997; 1998a,b; 1999a,b) used measures of knowledge and environmental orientation to predict risk perception of climate change and willingness to sacrifice (denoted by agreement with doing certain things) in students and the general public.

2.6 Summary

The literature review explored various themes. The "human" component of climate change research has been overshadowed by a natural sciences focus but as the climate change

issue evolves from problem definition to problem solving the social sciences become more relevant. Concepts such as beliefs, values, paradigms and worldviews help explain the mental world of people. Particularly relevant is the literature on environmental movements and measurement of environmental concern as a means of differentiating between groups based on worldviews. Social constructionism provides a useful perspective that environmental problems are not necessarily derived from objective physical conditions alone but also develop through social discourse. The climate change issue is not the sole domain of "experts" who transfer knowledge of risks and solutions to publics. Other social groups, claims-makers, contest and negotiate if the environmental issue is real, identifiable and intrinsically harmful. Empirical studies on climate change beliefs focused on lay publics, experts and students often using the "information deficit model". The underlying beliefs of key groups involved in climate change discourse as claims-makers have not been explored. This has informed the design of the empirical study described in the following chapter.

CHAPTER 3

RESEARCH METHODOLOGY

ENGOs and energy-related industry representatives are audited through a survey instrument composed of structured questions. The elements in the survey are not used for predictive modelling but are used to describe and better understand the climate change beliefs of two key groups. The survey questions explore the underlying environmental values and climate change beliefs and knowledge that influence the discourse between these different claims-making groups in constructing the 'risk' of climate change. Are there similarities; are there differences between the groups? Ungar (1994, 298) provided direction for this research by recommending the use of survey instruments to describe beliefs and opinions on environmental issues in order to present the positions of different claims-making groups. He argued that since political discourse is not neutral, the "contested terrain" of claims-making on an environmental issue (e.g., climate change) should be described so that lay people and policy-makers could see themselves in relationship to the issue and the ideas and positions that have been articulated.

3.1. Design of the Survey Instrument

The climate change portion of the survey instrument was developed from the Mid Atlantic Regional Assessment (MARA) and the Canada Country Study (CCS) questionnaires. An empirical case study of different beliefs on acid rain between Canadians and Americans reported by Steger *et al.* (1989) provided survey questions for environmental attitudes (NEP), preservationist-developmentalist identification and trust in science and technology.

In the U.S. National Assessment, the MARA developed a national survey that has been applied in climate change perception studies (Bord *et al.*, 1997; 1998, 2000; O'Connor *et al.*, 1997; 1998a,b; 1999a,b). This questionnaire was developed through a series of focus groups and pretested with 668 students and 106 adults (Bord *et al.*, 1997; O'Connor *et al.*, 1999a,b). It was

used in a pre- and post-workshop analysis for MARA and in a national survey of the general public (Bord *et al.*, 1998; Fisher *et al.*, 1997).

In 1997, the MARA pre- and post-survey instruments were modified for the CCS application (Mortsch *et al.*, 2000). The goal of the CCS research was to understand the beliefs of an "informed" group consisting of government scientists, academics, industry representatives and stakeholders that participated in the CCS. The survey was designed to provide information on awareness, understanding and action on climate change and contribute to climate change communication between experts and the public. Eight questions from the MARA surveys were retained; some were altered to reflect the Canadian context and idioms. Additional questions on frequency and length of exposure to the climate change issue, knowledge of climate change, climate change information needs, and perceptions on responsibility for action were developed or used from the literature (Henderson Sellers, 1990; Read *et al.*, 1994). Arcury *et al.* (1986) recommended that estimates of respondents' knowledge of environmental problems be developed using questions with right and wrong answers rather than using self-reported estimates of knowledge. In this survey IPCC documents were used to determine answers for the causes of climate change knowledge question but the necessary simplicity and lack of ambiguousness in the questions make them open to interpretation.

These modified survey instruments were pre-tested on a small opportunity sample of Environment Canada staff and changes were made to improve clarity and flow. Two hundred and thirty-nine English and French pre- and post-symposium questionnaires were sent out; 95 people responded to the pre-symposium survey and 87 people responded to the post-symposium survey. Some questions in this survey were modified from the "lessons learned" from the CCS survey.

For this study, a few questions that addressed types of action to respond to climate change were removed from the CCS pre- and post-survey. The remaining questions from the pre- and post-symposium questionnaire were combined into one instrument. Questions on environmental values (New Environmental Paradigm (NEP), developmentalist-preservationist identification and science and technology orientation) were incorporated from the literature (Steger *et al.*, 1989). The framework outlined in Table 3.1 describes the key themes and associated attributes or factors that were used to develop the questions and guide data analysis.

3.1.1 Characteristics of the Group

Social and Demographic Attributes

The demographic information collected serves to 'define' the respondents surveyed and compare this group with other samples and surveys. In previous research, environmental concerns seem to be more widespread among women than men; this may be due to gender-specific value orientations (Samdahl and Robertson, 1989). Education may increase scientific literacy since people are more likely to have been exposed to scientific concepts making it easier to gather and understand science-based information about current environmental issues (Jaeger *et al.*, 1993).

Environmental Values

This survey uses questions that provide insight into environmental goals (as in the CCS) plus additional questions to determine the environmental values of the respondents; the latter are used as a method to differentiation between ENGOs and industry representatives.

New Ecological Paradigm (NEP) Questions. For this survey a subset of six of the original twelve NEP questions were used (Dunlap and Van Liere, 1978). Steger *et al.* (1989), Arcury *et al.* (1986), Steel (1996) and Continental Group (1982 in Steger *et al.*, 1989) have also used the shortened 6-question version and reported results that were virtually identical as the 12-

Table 3.1 Framework for Surveying Respondents on Climate Change

Characteristics of the Group

Theme	Attribute	Question
social & demographic	• sex	• Q14
	• age	• Q15
	• education	• Q16
	• employment	• Q17
	• place of residence	• Q18
environmental values	• New Ecological Paradigm (NEP)	• Q10
	• trust/distrust in science and technology	• Q11
	• preservationist-developmentalist identification	• Q13
	• most important environmental goals	• Q12a, b
awareness of issue	• length of exposure	• Q1a
	• frequency of exposure to information	• Q1b Q1c
	• perceived risk	• Q2a
	• certainty of climate change	• Q1c, Q4
	• agreement amongst experts	• Q7

Components of Outcomes

Theme	Factor	Question
knowledge of issue	• causes of climate change	• Q5
	• impacts of climate change or perception of risk	• Q2b, 2c, Q3
	• extremes link to climate change	• Q9
	• mitigation and adaptation options	• None
action on climate change	• who is responsible for action	• Q6
	• need for action	• Q4
	• preference for mitigation or adaptation	• None
	• regulatory or voluntary measures	• None
	• certainty of need for action	• Q4
	• type of action (long-term and short-term)	• None
	• types of action by Federal government, provincial government and individuals	• None
climate change information needs	• Needs:	
	◦ atmospheric science	• Q1d
	◦ detection of trends	• Q1d
	◦ impacts	• Q1d
	◦ adaptation strategies	• Q1d
	◦ mitigation strategies	• Q1d
	• self-disclosure on how well informed	• Q8

question version. Use of the NEP questions is appealing since it has been systematically tested for reliability and validity (Dunlap and Van Liere, 1978). Albrecht *et al.* (1982) found that the scale was reliable but not unidimensional; there are three dimensions: balance of nature, limits to growth and man over nature (see Table 3.2).

Table 3.2 List of NEP Questions

	Question	Dimension
10a	The balance of nature is very delicate and easily upset by human activities	Balance of Nature
10b	The Earth is like a spaceship with only limited room and resources	Limits to Growth
10c	Plants and animals do not exist primarily for human use	Man over Nature
10d	Modifying the environment for human use seldom causes serious problems	Balance of Nature
10e	There are no limits to growth for nations like Canada	Limits to Growth
10f	Humankind was created to rule over the rest of nature	Man over Nature

Attitudes Toward Science and Technology. In the ecological paradigm, researchers have hypothesized that distrust of science and technology is a pro-environmental position (Albrecht, 1982; Arcury, 1986; Geller and Lasley, 1985; Milbrath, 1989). Respondents were asked whether they agreed or disagreed with the statements listed in Table 3.3. A five-point Likert scale that ranged from "strongly agree" to "strongly disagree" was used (Steger *et al.*, 1989). The answers were summed (with an inverse weighting for the first question) to develop an indicator of attitude toward science and technology. A high score (11 to 15) suggests skepticism for the capabilities of science and technology to address environmental concerns and resource management issues; a low score (3 to 7) suggests the opposite.

Table 3.3 Attitudes Toward Science and Technology

	Question	Weighting
11a	Technology will solve problems from shortages of natural resources	SA (1) and SD (5)
11b	People would be better off if they lived a more simple life without so much technology	SA (5) and SD (1)
11c	Future scientific research is more likely to cause problems than to find solutions	SA (5) and SD (1)

Preservationist-Developmentalist Identification. Respondents had to choose, which of the statements listed in Table 3.4 most closely reflects their opinion. Each statement tries to capture the range from a strong preservationist to a strong developmentalist perspective (Steger *et al.*, 1989). This identification will be used to test differences between ENGO and energy-related industry worldviews on how much to preserve natural resources as opposed to utilize them for economic growth.

Awareness of the Issue of Climate Change

A series of questions were used to determine the frequency and length of contact respondents have had with the issue of climate change and assess their beliefs on the perceived urgency and certainty of climate change. Questions on the certainty of climate change and informedness were adapted from an Australian survey (Henderson-Sellers, 1990). Frequency of contact with the issue was included to determine how often respondents deal with the issue of climate change (not just simply whether or not they had heard of it).

3.1.2 Components of Outcomes

Knowledge of the Climate Change Issue

Respondents were asked to indicate whether various causes (including pollution/emissions, aerosol spray, driving cars, chemical pesticides, coal and oil use and tropical

Table 3.4 Preservationist-Developmentalist Survey Questions

	Statement	Identification
13a	The only consideration in deciding what to do with natural resources and the environment should be what will contribute most to the growth of the economy	Strong Developmentalist
13b	The growth of the economy should be the most important but not the only consideration in deciding what to do with natural resources and the environment	Developmentalist
13c	Protection of the environment and the growth of the economy should be given equal consideration in deciding what to do with the environment and resources	Moderate
13d	Protection of the environment is the most important but not the only consideration in deciding what to do with natural resources	Preservationist
13e	The only consideration in deciding what to do with natural resources should be the preservation of the environment	Strong Preservationist

forest destruction) were a major cause of climate change, minor cause, or not a cause of climate change. This question assesses knowledge of the causes of climate change, and includes incorrect causes to determine if confusion and misinformation exist. If beliefs are false, then a knowledge-based problem exists that will need to be addressed through public education or other methods. This question was adapted from Read *et. al* (1994) and Henderson-Sellers (1990). Other questions included in this section addressed the linkage between climate change and extreme events, the potential increase in global temperature due to climate change and the impacts of climate change.

Action on Climate Change

One question tried to determine respondents' beliefs on who is responsible for action. This question measures attribution of responsibility for climate change action and will provide information on whether "doing something about climate change" is a government, individual, business, researcher or ENGO responsibility.

Climate Change Information Needs

Respondents were asked to disclose how well informed they felt about climate change or atmospheric processes, impacts or consequences of climate change, adaptations to respond to climate change, limitation strategies to reduce or slow climate change, and detection of climate change. This question also gives us an idea of how informed the respondents perceive they are. Another question identified seven climate change information categories, e.g. scientific background, strategies for adapting to climate change, social and economic impacts and respondents were invited to grade the level of additional information required on a scale from 'no more' to 'much more' information. This question was adapted from Henderson-Sellers (1990).

3. 2 Sampling ENGO and Energy-related Industry Groups

Participants for the study were recruited from environmental non-governmental organizations (ENGOs) or energy-related industries. Membership lists on Internet sites for key industry and ENGO associations were used to develop the distribution list for the survey. Canadian contact people and their addresses were abstracted from the organizations' Internet contact information. The mailing lists from the First Climate Change Communication conference (June 1998) and the report by Andrey and Hachey (1995) were also used for relevant ENGO and energy-related industry representatives.

3.2.1 Energy-related Industry Groups

One hundred and eighty-eight names with Canadian addresses were compiled from the Canadian Association of Petroleum Producers, Petroleum Communication Foundation, The Coal Association of Canada, Action By Canadians on Climate Change, and the Voluntary Challenge and Registry Inc. into a list of energy industry contacts. The preferred contacts were Health, Safety and Environment, Community Liaison or Communication representatives as these people were most likely to be responsible for environmental issues. In many junior exploration companies, the Vice-President of Operations, Lands and Contracts, or Production were chosen based on their described areas of responsibility.

Canadian Association of Petroleum Producers (CAPP)

Regular membership in CAPP includes companies whose activities focus on exploration, development and production of natural gas, natural gas liquids, crude oil, synthetic crude oil, bitumen and elemental sulphur anywhere in Canada. While there are Associate memberships, these companies were not included in the survey since they provide the transportation, distribution, marketing, and financial infrastructure for the petroleum industry.

Petroleum Communication Foundation (PCF)

The Petroleum Communication Foundation (PCF) is a national non-profit organization that creates awareness and understanding of the Canadian petroleum industry. Membership in the PCF is open to any Canadian-based firm that is actively engaged in the Canadian petroleum industry.

The Coal Association of Canada (CAC)

The CAC represents companies that explore for, mine, use and transport coal. Members included in the survey are coal producers, coal-using electric utilities, and railroads (Canadian National and Canadian Pacific)

Action By Canadians on Climate Change (ABC Program)

The Energy Council of Canada (with funding from the Climate Change Action Fund) created ABC, a national-level public education and action program designed to encourage Canadians to reduce their personal greenhouse gas emissions. The goal is to engage individual citizens starting with employees of participating organizations.

Voluntary Challenge and Registry Inc. (VCR)

VCR is a corporation designed to encourage private and public sector organizations to voluntarily limit their net greenhouse gas emissions. Organizations register Action Plans and Progress Reports that document their greenhouse gas emission reduction activities. Industry Sectors from the Registry included in the mailing are: Alternative and Renewable Energy, Industry Associations, Electric Utilities, Oil, Gas and Coal, Integrated Oil and Gas, Natural Gas Distribution Transportation and Pipelines, and Upstream Oil and Gas.

3.2.2 Environmental Non-Governmental Organizations (ENGOs)

Environmental organizations listed on Internet directories from the International Climate Action Network – Canadian organizations, Canadian Climate Action Network (CANet), Canadian Environmental Network and Green Communities were compiled into the ENGO mailing list consisting of 135 groups.

The Climate Action Network (CAN)

CAN is a global network of Non-Governmental Organizations (NGOs) working to promote government and individual action on climate change; it is the umbrella NGO in international climate change negotiations. Canadian members of CAN were included in the mailing list.

Climate Action Network (CANet)

CANet is a network of environmental organizations and individuals concerned about climate change who work together to provide alternatives for the Canadian energy future to individuals and governments.

Canadian Environmental Network (CEN)

CEN facilitates public interest group communication, networking and activity on environmental legislation, policies and programs.

The Green Communities Association (GCA)

The GCA is a non-profit, community-based, organization that brings environmental solutions to homes, businesses, institutions, and governments. It promotes energy and water savings, waste reduction, and pollution prevention through "Home Visits" to assess these factors and recommend improvements.

3.3 Administering the Survey

Once the survey package received ethics approval through the Office of Research Ethics, it was sent out to 135 ENGOs and 188 industry representatives on November 2, 2000. A covering letter introduced the purpose and content of the survey instrument. Respondents were informed that participation in the survey was voluntary and that confidentiality was ensured since the questionnaire was anonymous. The instrument took approximately 20 minutes to complete. Respondents were asked to return the questionnaire in the enclosed addressed and stamped envelope as soon as possible.

A total of 323 questionnaires were mailed. Nineteen were returned as non-deliverable. The addresses were reviewed and 8 questionnaires were resent to corrected addresses on November 27, 2000. Also, on the same day reminder post cards were sent to respondents

(except to those who were known to have responded by providing addresses for receiving the survey results).

3.4 Data Analysis

The objective is to compare the beliefs of energy industry respondents versus ENGOs with respect to the framework outlined in Table 3.1 and the measures describe earlier. A series of statistical tests are used. Percent frequencies in cross-tabulations with chi-squared statistics and means with *t* tests are the primary statistics used to evaluate the survey data (Dawes and Smith, 1985). Factor analysis and reliability analysis were performed on the NEP and science and technology scales. The Statistical Package for the Social Sciences (SPSS) Version 10.0 was the software utilized for these analyses.

3.5 Summary of the Research Procedure

The research involves primary data collection through a survey instrument administered to ENGOs and energy industry representatives through the mail. The data analysis involves establishing whether there are significant differences in the two groups based on their characteristics, knowledge and beliefs. The subsequent chapter analyses the survey results.

CHAPTER 4

SURVEY RESULTS

Analysis of the survey results uses the framework developed in Chapter 3. The ENGOs and energy industry responses are compared using six themes: socio-demographic characteristics, environmental values, awareness of the climate change issue, knowledge of the issue, action on climate change and climate change information needs.

4.1 ENGO and Energy Industry Responses

Three hundred and twenty-three climate change surveys were sent out; 135 went to ENGOs and 188 to energy industry organizations in Canada. The overall response rate was 39% with a higher response rate for ENGOs than industry (see Table 4.1). The energy industry sample reflects the predominance of men in the sector. Within the energy industry, the response rate was lower for men (30% of 154) than for women (44% of 34). The ENGO group had an evenly balanced number of males and females on the mailing list; they had a similar response rate.

Table 4.1 Response Rate for the Energy Industry and ENGOs

	Energy Industry	ENGOs
Number of surveys sent out	188	135
Number of surveys returned – incorrect address	8	3
Sampling frame	180	132
Number of surveys returned - completed	57	65
Response rate (%)	32	49

About two-thirds of energy industry surveys were sent to Alberta, the primary location of the oil, gas and coal industry in Canada. The response rate was 27%. The second largest number (35/180) was located in Ontario. Their response rate was 46%. More than half ENGO

surveys were sent to Ontario (74/132) with BC and Quebec a distant second and third. The response rates were 49%, 43% and 33%, respectively.

4.2 Respondent Profiles

Energy industry respondents are primarily male (81%). It is a highly educated group with 88% possessing a post-secondary degree; 59% have a graduate or professional degree. The majority resides in Alberta (56%) with Ontario (28%) and then BC (7%) the next highest (see Table 4.2). Respondents from the ENGO group are also highly educated with 32% having an undergraduate degree and 57% a graduate or professional degree. Males and females are evenly represented. The majority of respondents are from Ontario (55%) with BC and Quebec the next highest representation (6% each).

Table 4.2 Provincial Breakdown of Energy Industry and ENGO Respondents (%)

Province	Energy Industry	ENGO
Alberta	56	3
British Columbia	7	9
Manitoba	0	6
New Brunswick	0	5
Newfoundland	0	2
Nova Scotia	2	2
Northwest Territories	2	3
Nunavut	0	0
Ontario	28	55
Prince Edward Island	0	3
Quebec	2	6
Saskatchewan	3	5
Yukon	0	2
Total %	100	101*
N	57	65

* rounding

Education is an important factor influencing the ability to understand science-based information about climate change (Jaeger *et al.*, 1993). However, education does not automatically lead to correct views and information. One survey found that even the well educated (94% of respondents had a university level education and 70% had at least some graduate study) held misconceptions about climate change, particularly about causes of change and personal actions that contribute to the problem (Bostrom *et al.*, 1994).

The ENGO sample had a high proportion of respondents 45 years or younger (59%) while the energy industry had a higher proportion older than 45 years (65%). The highest percent, 33%, of ENGO respondents were in the age group "36-45 years" while the highest percent of energy industry respondents were "46 to 55 years" (44%). Neither group had any respondents "under 25 years". Females were generally younger than males. For example, 36% of female respondents were in the "25 to 35 years" age group while males had 9%. The most frequent age for male respondents was "46 to 55 years" (46%) and "36 to 45 years" was most frequent for females (39%).

Energy industry respondents were subdivided into 11 industry categories. Upstream oil and gas firms involved in exploration and development were the largest group in the survey mailing but the response rate was low. Upstream oil and gas, coal, and integrate oil companies are represented by the largest proportion of respondents (Table 4.3).

In summary, the groups differ on age, gender distribution and place of residence. The energy industry can be characterized as an older, male-dominated, highly educated group located primarily in Alberta. The ENGO group is younger, equally represented by both sexes, highly educated and based in Ontario.

Table 4.3 Response by Energy Industry Category

Industry Category	Sampling frame	Surveys returned - completed	Response rate (%)
Upstream oil and gas	56	13	23
Drilling	8	0	0
Natural gas	7	2	29
Integrated oil company	27	8	30
Oil and gas transportation and pipeline	10	6	60
Coal	18	9	50
Industry association	24	6	25
Electric utility	20	6	30
Transportation	4	1	25
Alternative and renewable energy	3	2	67
Other	3	1	33
Total - energy industry	180	57	32

4.3 Environmental Values

4.3.1 New Ecological Paradigm (NEP)

Dominant Social Paradigm (DSP) and New Ecological Paradigm (NEP) were developed to depict the cleavage in beliefs and values around the human-environment relationship. The six statements used to measure NEP and DSP orientation are listed in Table 4.4. Agreement with some statements (1, 3, 5) and disagreement with others (statements 2, 4, 6) reflect pro-NEP orientation. More than 90% of the ENGO respondents endorsed each of the pro-NEP statements demonstrating a strong environmental orientation (Table 4.4). Pro-NEP concepts were not held as widely by energy industry respondents (44 to 67%). They had a wider range in environmental beliefs. Energy industry respondents were neutral on whether "the balance of nature is very delicate and easily upset by human activities". Since many of the respondents (56%) are directly involved in the resource extraction industry (see Table 4.3), they may have a

more utilitarian orientation to the natural environment (Van Liere and Dunlop, 1980) and believe in a more resilient natural system.

In order to use the NEP scale as a measure of overall environmental orientation one has to test if responses to the six individual statements can be treated as internally consistent and if they measure only one attitudinal domain. A principal components factor analysis (varimax rotation) of the six NEP items produced one dimension. The NEP tested unidimensional. The scale exhibited good reliability with a Cronbach α of 0.8259.

The NEP scale was developed by summing the respondents' answers to the six statements. A useful, albeit arbitrary division would be a low total score (6 - 15) suggests an acceptance of DSP; a score from 16 to 20 is neutral; and a high total score (21 - 30) indicates a pro-NEP orientation. The average NEP scale response for ENGOs (27.8) differs significantly from the energy industry (22.3) response (see Table 4.4). ENGOs, on average, have a strong NEP orientation (26 to 30); there were no DSP orientations. The ENGOs demonstrate a strong ecological worldview. The energy industry had a wider breadth of orientations ranging from strong NEP to neutral and including DSP but there were no strong DSP orientations.

O'Connor *et al.* (1997) in a climate change survey of college students reported a NEP scale of 23.7. In a comparative analysis of acid rain perspectives of Canadian and US public and activists, Steger *et al.* (1989) found lower mean NEP scores for the Ontario public (24.2) than the Ontario activists (26.6). The scores of Michigan respondents were slightly lower (activists 25.8 and general public 23.3). In comparison, the ENGOs in this survey demonstrate a strong pro-NEP orientation; the energy industry respondents are less pro-NEP than the ENGOs as well as the general public.

Table 4.4 Energy Industry and ENGO Responses to NEP Statements

NEP Statements	Social Group	Agree (%)[1]	Disagree (%)[1]	Mean [2]	SD	*t* test	p	N
Balance of Nature								
1. The balance of nature is very delicate and easily upset by human activities	Energy Industry	43.9	38.6	3.12	1.34	-6.417[3]	<0.001	57
	ENGOs	90.5	3.2	4.41	0.75			63
2. Modifying the environment for human use seldom causes serious problems	Energy Industry	22.8	54.4	3.53	1.26	-4.592[3]	<0.001	57
	ENGOs	6.3	92.1	4.46	0.93			63
Limits to Growth								
3. The earth is like a spaceship with only limited room and resources	Energy Industry	66.7	21.1	3.81	1.32	-4.184[3]	<0.001	57
	ENGOs	93.7	4.8	4.65	0.81			63
4. There are no limits to growth for nations like Canada	Energy Industry	15.8	66.7	3.84	1.16	-4.184[3]	<0.001	57
	ENGOs	4.9	93.4	4.66	0.93			61
Man over Nature								
5. Plants and animals do not exist primarily for human use	Energy Industry	57.1	19.6	3.75	1.30	-5.314[3]	<0.001	56
	ENGOs	96.8	1.6	4.75	0.57			63
6. Humankind was created to rule over the rest of nature	Energy Industry	12.7	67.3	4.05	1.21	-4.213[3]	<0.001	55
	ENGOs	1.6	93.7	4.83	0.66			63
NEP Scale	Energy Industry	-	-	22.3	5.40	-6.934[3]	<0.001	55
	ENGOs	-	-	27.8	2.49			61

[1] 5-item Likert scale collapsed into agree, neutral, and disagree

[2] means computed after reverse scoring of statements 2, 4, and 6

[3] equal variances not assumed; separate-variance *t* test used

4.3.2 Trust in Science and Technology

Those holding an ecological worldview are generally skeptical about the success of science and technology in solving ecological problems (e.g. resource scarcity, preventing disasters) and the benefits to society. Those with an anthropocentric worldview believe science and technology is a great benefit to humans (Milbrath, 1989); have faith in the problem-solving abilities of science and technology (Albrecht *et al.*, 1982); and see technology a vehicle for progress and mechanism for averting disasters (natural and man-made) (Arcury *et al.*, 1986).

The three statements used to assess belief in science and technology are listed in Table 4.5; agreement with statement 1 and disagreement with statements 2 and 3 indicate a trust in science and technology. The scores for the three statements were summed for a distrust in science and technology scale. A low score (3 to 7) suggests belief in the benefits of science and technology while a high score (11 to 15) suggests distrust of science and technology.

ENGOs and energy industry respondents are polarized in their beliefs on technology as a solution to resource scarcity and as a benefit to quality of life (Table 4.5). A large majority of the energy industry supported the statement that science provides solutions to problems. ENGOs were less convinced about the benefits. The scale measuring distrust in science and technology was reasonably unidimensional (principal components factor analysis, varimax rotation) with reliability which was fairly low (Cronbach $\alpha = 0.6882$) nevertheless approaching acceptability. The small sample size renders the results largely preliminary; still it was decided to use the scale. In comparing the two groups, there was a statistically significant difference in their mean response on the scale. Energy industry respondents had a belief in the benefits of science and technology (mean score 6.6). The ENGOs' mean score of 10.4 was in the middle of the possible range between 5 and 15, therefore suggesting a neutral orientation on behalf of ENGOs.

Table 4.5 ENGO and Energy Industry Distrust in Science and Technology

Statements	Social Group	Agree (%)[1]	Disagree (%)[1]	Mean [2]	SD	*t* test [3,4,5]	N
1. Technology will solve problems from shortages of natural resources	Energy Industry	63.2	28.1	2.5	1.2	-6.39	57
	ENGOs	19.4	72.6	4.0	1.2		62
2. People would be better off if they lived a more simple life without so much technology	Energy Industry	14.0	64.9	2.2	1.1	-8.29	57
	ENGOs	66.1	11.3	3.9	1.0		62
3. Future scientific research is more likely to cause problems than to find solutions	Energy Industry	3.5	80.7	1.8	0.9	-4.24	57
	ENGOs	16.1	46.8	2.6	1.1		62
Scale - Distrust in science and technology	Energy Industry	-	-	6.6	2.4	-8.95	57
	ENGOs	-	-	10.4	2.3		62

[1] 5-item Likert scale collapsed into agree, neutral, and disagree
[2] means computed after reverse scoring of statement 1
[3] $p<0.001$
[4] equal variances assumed; pooled-variance *t* test used
[5] $df=117$

4.3.3 Preservationist-Developmentalist Identification

A majority of ENGOs (76%) identified as "preservationist" by agreeing with the statement "protection of the environment is the most important but not the only consideration in deciding what to do with natural resources." Seventy percent of the energy industry respondents had a "moderate" orientation. Equal consideration would be given to protection of the environment and growth of the economy in deciding what to do with the environment and resources. No respondents were "strong developmentalist" supporting "the only consideration in deciding what to do with natural resources and the environment should be what will contribute most to the growth of the economy". The preservationist-developmentalist mean score of 3.95 for ENGOs is statistically different from the mean response of 3.00 for energy industry respondents ($t=9.501$, $p<0.001$). Steger *et al.* (1989) reported similar preservationist-developmentalist identification for Ontario (3.89) and Michigan (3.78) activists on acid rain.

4.4 Awareness of Climate Change

4.4.1 Length of Exposure to the Climate Change Issue

Recent scientific discussion on climate change was initiated in the mid 1970's when one of the first $2xCO_2$ "enhanced" greenhouse gas forcing experiments with a General Circulation Model (GCM) was published by Manabe and Wetherald (1975) although earlier work by Svante Arthenius explored calculations relating CO_2 concentrations and the surface temperature of the earth in 1896 (Kowalok, 1993). The World Climate Conference in 1979 was one of the earliest events that identified human-caused climate change as an environmental issue requiring research and government policy. Scientists were alerting governments to the issue. Popular media coverage of the issue is recent. It began with the 1988 Changing Atmosphere Conference in Toronto. The key conference statement was "humankind has begun an unintentional experiment with the climate system". In the same year, Dr. James Hansen testified before Congress that global warming had begun. These critical events coincided with a severe drought that helped create a "social scare". Global warming became a "celebrity" social problem through significant media coverage; however, intensity has waned (Ungar, 1992). The releases in 1990, 1996 and 2001 of IPCC climate change assessment reports creates debate on their scientific conclusions, which draws media attention. Signing of the Framework Convention on Climate Change (FCCC) in 1995 legally enshrined climate change as a global environmental issue requiring action. Meetings that relate to the FCCC such as the 1997 Kyoto Protocol negotiations generate a great deal of media attention. Different claims-making groups compete for dominance in the framing of the climate change issue and the urgency for action.

The duration of time that respondents have known about the issue of climate change reflects their exposure to the issue and provides an estimate of time available for them to accumulate knowledge and develop beliefs on the issue. The survey results indicate that there is

no appreciable difference in the duration of exposure of ENGOs and energy industry respondents (*t* test of means was not significant).

The survey was administered in the fall of 2000. Most respondents have known about the issue for six years or more (see Table 4.6) in which they would have been able to hear or read about key events in the evolution of the climate change issue described above.

4.4.2 Frequency of Exposure to Climate Change Information

Not only is it important to know how long respondents have been aware of climate change, but *how frequently* they see, hear, or read something about it. How often do respondents deal with the information on climate change not just simply whether they hear of it or not. Someone could have known about climate change for twenty years but only have contact with it once every few months, while another person with the same length of exposure could have had daily contact with the issue. Clearly, knowledge of climate change is affected by frequency of exposure.

Table 4.6 Years Respondents Have Known About Climate Change

Years knowing...	Energy Industry (%)	ENGO (%)
less than 1 year (1)	-	1.6
1-2 years (2)	1.8	-
3-5 years (3)	17.5	14.1
6-10 years (4)	43.9	45.3
11-20 years (5)	31.6	31.3
more than 20 years (6)	5.3	7.8
mean	4.21[1]	4.28[1]
SD	0.9	0.9
N	57	64

[1] *t* test = -0.436, p=0.664 (not significant)

In this survey, about 60% of the respondents in both groups received climate change information several times a week or more (see Table 4.7). There is no significant difference between the mean frequency of exposure of ENGOs and energy industry (*t* test was not significant). Due to frequent exposure to climate change, the respondents can be considered well aware of the climate change issue. By way of comparison, over 80% of respondents in a survey of the "informed" from the CCS had contact daily or several times a week with climate change information (Mortsch *et al.*, 2000, A1-20).

Table 4.7 Frequency of Exposure to Climate Change

How often do you see, hear, or read something about climate change...	Energy Industry (%)	ENGO (%)
never seen, heard or read anything about climate change	-	-
a few times a year	5.3	1.5
once a month	12.3	6.2
several times a month	12.3	18.5
once a week	8.8	12.3
several times a week	17.5	30.8
daily	43.9	30.8
N	57	65

4.4.3. Certainty of Climate Change

Respondents were asked "How certain, or uncertain, are you that climate change will occur?" Their choices included: "climate change is certain to occur"(1), climate change is likely to occur"(2), "climate change may occur"(3), "climate change is unlikely to occur"(4), and "climate change will not or cannot occur" (5). This question on certainty (or perceived risk) of climate change highlighted differences in beliefs of ENGOs and energy industry respondents and elicited a large number of comments. There is a significant difference in the mean responses for energy industry (2.14) and ENGOs (1.08) (t test$=8.3$, $p<0.001$).

There is a consensus among ENGOs that climate change is "certain to occur" (93.5%). Six respondents, all ENGOs, wrote in the margin of the survey instrument that climate change is occurring. None believe that climate change is "unlikely to occur" or "will not or cannot occur". Energy industry respondents reported a wider range of beliefs on the certainty of climate change varying from climate change is "certain to occur" (28.9%), "likely to occur" (33.9%), and "may occur" (32.1%). A small percentage, 5.4%, believes that climate change is "unlikely to occur".

Some energy industry respondents inserted comments on natural versus human-caused climate change in the survey. Natural climate change (or variability) is an ongoing process due to changes in solar energy, orbital patterns, the Earth's tilt for example. This survey instrument did not explicitly define climate change and distinguish between human-caused climate change (which was the interest of this research) and natural climate change. Some energy industry respondents objected that climate change was real. Comments in these cases included:

- Historically speaking climate is changing.
- This is a stupid question. Climate change has always occurred over 4-5 billion years.
- Climate change occurs naturally. Think you mean man-induce change and answered accordingly.
- Climate change over what period - maybe 100,000 years; 60,000,000 years but not 10 or 50 years.
- Climate change is a natural process and the human contribution remains highly uncertain.

- Climate change is inherent (in geological record). Debatable whether climate change is man-made or natural. Climate changed throughout Earth's history and will continue.
- Climate changes constantly and there is no "normal" year. Variability is a certainty; past 100-year history may/may not reflect snapshot of "normal" temperature.
- Climate change in comparison to what? Very difficult to answer, as climate change is an ongoing process that began when the earth was formed. Earth's climate is never static.

A review of other surveys that included questions on the certainty of climate change found a strong belief that it would occur. Henderson-Sellers (1990, 79-80) reports that Australians' responses to the "truth" of climate change show a clear belief that it will occur. Choosing from the options of "certain to occur", "probable but not proven", "likely to occur", "unlikely to occur" or "will not occur", none of the respondents chose the latter two categories, and a majority (62%) felt that the greenhouse effect was certain to occur. However, these respondents were participating in climate change meetings. In the same survey, when asked, 'How likely do you think it is that human actions changed global climate?' 37% were certain about the change, and 61% thought that a change was at least 'somewhat likely.' A US national poll in 1998 found that 77% of respondents believed that climate change was a serious problem and only 9% did not believe climate change would occur (Mellman Group, 1998,1). Fifty percent thought it was a current, not just future, threat. In surveys of atmospheric scientists in 1982 another in 1992, Changnon *et al.*, (1992, 1623) found a rise from 20% to 50% in those that believed the evidence of a change in climate was convincing. The survey of CCS participants (authors, contributors or interested decision-makers, policy-makers) found that over 80% of

respondents thought that climate change is "certain to occur" or "likely to occur". Seventeen percent thought that climate change was "probable but not proven". In a 1998 survey of senior Canadian business executives, about one-in-five thought climate change is not really a problem at all but 69% thought it is a problem; 23 % thought it was very serious (COMPAS, 1998, 4).

4.4.4 Risk of Climate Change

The question "how likely do you think it is that the Earth's average annual temperature will increase by 1.5° Celsius within the next 50 years?" was included as another test of the certainty of climate change and an assessment of the respondents' perception of risk due to climate change (O'Connor *et al.*, 1999a,b). The description of climate change was more precise, quantitative and bounded. The amount of temperature change and the timing of the change were specified.

There was general correspondence between the groups' responses for the previously discussed question and this question. But, respondents were less certain about the likelihood of a precisely defined change in climate. The "very likely" response dropped by almost 30% for ENGOs and decreased by about 25% for the energy industry respondents (Table 4.8).

This "precise" climate change question was used in other studies. In a survey of the general public in the Northern Great Plains, Simanton (1998, 135) reported that 46% of respondents thought it was likely that the "Earth's average temperature would increase by 3 degrees F within 50 years". Thirty-eight percent thought it was unlikely (mean = 3.077). In the CCS survey, 78% of respondents thought a "1.5 degree C increase in the next 50 years" was likely and 9% thought it unlikely (Mortsch *et al.*, 2000, A1-21).

Table 4.8 Likelihood of a 1.5°C Temperature Increase in the Next 50 Years.

A 1.5°C increase in the next 50 years is...	Energy Industry (%)	ENGO (%)
very likely (5)	5.5	64.6
somewhat likely (4)	27.3	24.6
unsure (3)	40.0	7.7
somewhat unlikely (2)	18.2	1.5
very unlikely (1)	9.1	1.5
Mean[1]	3.02	4.49
N	55	65

[1] t test = -8.687, $p < 0.001$

4.4.5 "Contested" Statements on Climate Change Issues

Important topics that often emerge in "contested" dialogue on climate change were developed into seven statements (Table 4.9). Paired opposing statements were used to require respondents to choose a position. There could be no hedging. Some questions were more difficult for respondents to answer. For example, eight of 57 (14%) of the energy industry respondents did not answer the question "the economic costs to reduce greenhouse gas emissions are too high/are not too high to justify action". Whereas the question "there is/is not enough scientific information about global climate change to take steps to adapt to changes in climate" had a high number of missing values for ENGOs (8/65 or 12.3%).

The majority of energy industry and ENGO respondents agreed with two statements:

- if global change occurs, we should be concerned now for future generations; and
- we do not know enough to effectively deal with problems that will result from climate change.

Table 4.9 Responses to Paired "Contested" Statements on Climate Change

Statements	Energy Industry (%)	ENGO (%)	χ^2	p
There is not enough scientific information about global climate change to be concerned.	43.4	-	34.1	<0.001
There is enough scientific information about global climate change to be concerned.	56.6	100.0		
If global climate change occurs, it will be too far in the future for me to be concerned.	13.0	-	Failed[1]	
If global climate change occurs, we should be concerned now for future generations.	87.0	100.0		
We know enough to effectively deal with problems that will result from climate change.	23.6	34.4	1.643	0.2
We do not know enough to effectively deal with problems that will result from climate change.	76.4	65.6		
There is not enough scientific information about global climate change to take steps to reduce greenhouse gas emissions.	40.7	-	32.05	<0.001
There is enough scientific information about global climate change to take steps to reduce greenhouse gas emissions.	59.3	100.0		
The economic costs to reduce greenhouse gas emissions are too high to justify action.	42.9	-	33.25	<0.001
The economic costs to reduce greenhouse gas emissions are not too high to justify action.	57.1	100.0		
Human ingenuity can offset most negative effects of global climate change.	57.7	11.3	27.78	<0.001
Human ingenuity cannot offset most negative effects of global climate change.	42.3	88.7		
There is not enough scientific information about global climate change to take steps to adapt to changes in climate.	48.1	29.8	3.92	0.048
There is enough scientific information about global climate change to take steps to adapt to changes in climate.	51.9	70.2		

[1] >20% of cells expected count less than 5 – test failed

All ENGOs agreed with four statements:

- there is enough scientific information about global climate change to be concerned;
- if global climate change occurs, we should be concerned now for future generations;
- there is enough scientific information to reduce greenhouse gases; and
- the economic costs to reduce greenhouse gas emissions are not too high to justify action.

However, there were significant differences in the groups' responses for the remaining five statements (see Table 4.9). The energy industry was more optimistic that human ingenuity would overcome negative impacts of climate change. Forty percent or more of energy industry respondents questioned the scientific information substantiating concern about climate change and guiding decision-making on mitigation and adaptation; this many also thought the economic costs were too high to justify greenhouse gas reduction. Yet, more than 50% had beliefs similar to ENGOs.

4.4.6 Consensus of Experts on Climate Change

Survey participants were asked to evaluate their perception of the level of agreement or disagreement between experts on the direction and causes of climate change. The largest percentage of energy industry respondents thought there was serious disagreement among experts whereas ENGOs thought there was agreement (Table 4.10). A comparison of the mean responses for industry (3.7) and ENGOs (2.6) indicated a significant difference in the means (t test = 5.33, $p<0.001$).

Table 4.10 Perception of Experts' Consensus (%)

	Total Agreement (1)		Neutral (3)		Serious Disagreement (5)
Energy Industry	1.8	19.6	19.6	26.8	32.1
ENGO	6.3	55.6	14.3	19.0	4.8

4.5 Knowledge of Climate Change

4.5.1 Causes of Climate Change

Awareness of climate change does not imply understanding of its underlying causes. Many misunderstand that the fundamental cause of climate change is rising CO_2 concentrations and fossil fuel combustion is the major contributor to increasing CO_2 concentrations. Even among those who consider themselves concerned about the risks of climate change there was a poor understanding of the basic science of the issue (Jaeger *et al.*, 1993). A study of lay people in Sweden found that "although 92% of the citizens questioned had heard of the greenhouse effect, most were unaware of the causes, consequences, and reduction measures" (Löfstedt, 1991, 322).

Numerous studies of knowledge of climate change causes have focused on the public to determine correspondence with knowledge of experts (Kempton, 1991 a,b; Löfstedt, 1991; 1992; 1993; McDaniels *et al.*, 1996; Read *et al.*, 1994). In multiple-choice questions on the causes of climate change, Read *et al.* (1994, 975) found that clearing tropical rain forests and deforestation were believed to be the top two causes of climate change, followed by aerosol spray cans, and then fossil fuels. Ozone in cities, the Antarctic ozone hole and toxic wastes were also, incorrectly, believed to be other causes of climate change. In a series of Swedish surveys, responses to causes of 'the greenhouse effect' were emissions (40%), CFC's (27%), fossil fuels

(14%), and ozone layer (12%); nineteen percent indicated that they did not know the causes (Löfstedt, 1991, 323). In an Australian survey of a people concerned by climate change, the majority of respondents (approximately 90%) were confident, correctly, that cars, deforestation, and coal-fired power stations were causes of climate change (Henderson-Sellers, 1990, 75-76). More than half the respondents incorrectly identified Styrofoam packaging and refrigeration as causes.

A series of questions developed by Bord *et al.* (1998) and O'Connor *et al.* (1997; 1998a,b) were used to assess ENGO and energy industry representatives' knowledge of climate change. In the design, incorrect causes of climate change were incorporated into a list with correct causes to determine whether respondents would distinguish between them correctly.

For the incorrect causes of climate change, more energy industry representatives identified them as incorrect than ENGOs (Table 4.11). There was a significant difference between the two groups in identifying nuclear power generation and use of chemicals to destroy pests as incorrect causes. But there was no significant difference in identifying depletion of the ozone in the upper atmosphere as a cause. ENGOs were more inclined to attribute all of the items on the list as a cause of climate change. It is unlikely that is may be due to response set bias (items of similar structure and sequentially located tended to be answered in the same way). It is more likely a high perceived risk for climate change. O'Connor *et al.* (1997, 134) reported gender differences in knowledge of incorrect causes of climate change. Females and males identify correct causes equally well but women were more likely to check the incorrect causes. An inaccurate, expanded view of what causes climate change correlated with high perceived risk of climate change (O'Connor *et al.*, 1997, 136). This study also found that females were more likely to choose the incorrect causes.

Table 4.11 Causes of Climate Change

Causes of climate change	Social Group	Not a cause	Minor cause	Major cause	χ^2
Correct Causes					
Pollution/emissions from business and industry.	Energy Industry	9.3	46.3	44.4	failed
	ENGO	-	4.6	95.4	
People driving their cars.	Energy Industry	5.5	29.1	65.5	failed
	ENGO	-	1.5	98.5	
Tropical forest destruction.	Energy Industry	9.3	46.3	44.4	failed
	ENGO	-	18.5	81.5	
Use of coal and oil by utilities.	Energy Industry	10.9	36.4	52.7	failed
	ENGO	1.6	1.6	96.8	
Home heating and cooling.	Energy Industry	16.4	52.7	30.9	24.382[1]
	ENGO	-	29.7	70.3	
Incorrect Causes					
Depletion of the ozone in the upper atmosphere.	Energy Industry	45.3	26.4	28.3	not signif.
	ENGO	36.9	24.6	36.9	
Nuclear power generation.	Energy Industry	85.7	10.7	3.6	9.785[2]
	ENGO	60.3	25.4	14.3	
Use of chemicals to destroy insect pests.	Energy Industry	57.4	33.3	9.3	5.486[3]
	ENGO	38.7	38.7	22.6	

[1] $p<0.001$; [2] $p=0.008$; [3] $p=0.064$

Similar knowledge questions from three other surveys provide context for these results. For the incorrect causes of climate change, in a 1997 US poll, nuclear power was correctly identified as "not a cause" by 15% of respondents while 35% thought it was a major cause and 23% a minor cause; 25% don't know enough to say. For aerosol sprays 36% thought it was a major cause, 39% a minor cause, 6% not a cause, and 17% don't know enough to say. In the 1997 general public survey by Bord *et al.* (1998, 79), 63% identified depletion of ozone in the upper atmosphere as a major cause (25% a minor cause); 27% identified chemicals to destroy pests; 25% attributed use of aerosol cans and 21% nuclear power. In a college student sample,

74% indicated depletion of the ozone as a major cause, 25% aerosol cans, 19% chemicals to destroy pests and 18% nuclear power (O'Connor *et al.*, 1997, 133). For the CCS survey, only 15% of respondents identified depletion of ozone in the upper atmosphere as a major cause (but 40% a minor cause), 5% the use of chemical to destroy pests, and none identified nuclear power as a major cause (Mortsch *et al.*, 2000, A1-24).

Misconceptions about the link between the thinning ozone layer and climate change are a common thread throughout many climate change perception studies in the US (Bostrom *et al.*, 1994; Kempton, 1991a,b), Sweden (Löfstedt, 1991; 1992), Austria (Löfstedt, 1993) and Australia (Henderson-Sellers, 1990). Although ozone depletion does play a role in climate change, it is not the direct link that many people believe (i.e. that the ozone hole contributes to warming).

In the identification of correct causes of climate change there are differences between the general public, students and an informed CCS group. In the Gallop poll, automobile exhaust was considered a cause by 85% of respondents (Immerwahr, 1999, 30). The CCS respondents are knowledgeable about climate change; all identified pollution from business and industry and use of coal and oil by utilities as causes of climate change. More than 95% identified home heating and cooling, deforestation, and driving as causes. The general public from the Bord *et al.* (1998, 79) survey identified pollution/emissions from business (69%), 64% tropical forest destruction, 49% driving cars as major causes. Fewer identified use of coal and oil by utilities (44%) and heating and cooling homes (13%).

4.5.2 Impacts of Climate Change

Estimate of Temperature Increase in 50 Years

Respondents were asked what they thought the most likely temperature change would be over the next 50 years, a decrease, virtually no change, an increase or do not know. ENGOs strongly endorsed an increase (95%). While the majority (55%) of energy industry respondents

thought that there would be an increase another 26% did not know and 18% believed there would be no change. One respondent thought there would be a decrease. The between-group differences were statistically significant ($\chi^2 = 25.38, p<0.001$).

If the respondents indicted a decrease or increase in temperature they were asked to indicate a range for the temperature change. Some respondents only provided one estimate of temperature change. That number was included in both the lower and upper range. ENGOs perceived a greater risk of temperature increase than energy industry respondents (see Table 4.12). In the IPCC (1996a) second assessment report that was current during the survey, the projected global temperature increase was 1.5 to 4.5 degrees C. The ENGO range for temperature increase is similar to the expert projection but the energy industry increase is more conservative.

Table 4.12 Lower and Upper Range of Temperature Change Over the Next 50 Years

Temperature increase	Energy Industry (%)	ENGO (%)
Lower Range		
Mean change (°C)[1]	1.0	1.7
SD	0.6	1.2
Mode (°C)	1.0	1.0
Upper Range		
Mean change (°C)[2]	2.0	3.7
SD	1.3	2.1
Mode (°C)	1.0	3.0
N	44	59

[1] Equal variance assumed, t test = -2.842, p=0.006
[2] Equal variance not assumed, t test = -4.599, p<0.001

Impacts of an Increase of 1.5°C Over the Next 50 Years

Respondents had to rate the likelihood (very likely (5) and very unlikely (1)) of negative impacts if the global temperature were to increase by 1.5°C over the next 50 years (see Table

4.13). The statements were written to contrast beliefs on the severity of impacts globally (e.g., many places will), in Canada, and personally (e.g., the region where I live or my).

Both ENGO and energy industry respondents think that the negative impacts of climate change were more likely to occur elsewhere and to someone else (e.g., many places, many people) rather than to them personally or in the region where they live. This pattern occurred for most impacts (serious diseases, drought, floods, food shortages and living standards). Bord *et al.* (1998) and Mortsch *et al.* (2000) reported similar results. Respondents apparently separate the general and specific threats or societal and personal implications of climate change. An issue raised by these responses is if people do not perceive that climate change affects them directly, do they feel it is not salient and risky and therefore feel less motivated to act?

Energy industry respondents believed that there would be less likelihood of climate change impacts than ENGOs; all mean responses are significantly different (Table 4.13). Starvation and food shortages, serious diseases, and standard of living decreases would be unlikely from the energy industry perspective. Sea level rise and more droughts and floods emerged as the most likely threats in both groups. ENGOs thought that there would be more environmental refugees and an increased requirement for financial aid to poorer countries.

Energy industry respondents thought people were adaptable to small increases in temperature (86%). ENGOs were less certain of adaptability (51%). However, in the CCS survey, over 60% of respondents were skeptical of adaptability and thought that it was unlikely that people could adapt to small changes in temperature (Mortsch *et al.*, 2000, A1-21).

Economic Impacts

Respondents were ask to determine how much of an economic effect, if any, they thought global climate change would have on a series of activities that are important to the economy. The responses on a 5-item scale ranged from "very negative effect" (1) to "no effect"

Table 4.13 Impacts of a 1.5° Celsius Increase Over the Next 50 years

Impacts	Social Group	Unlikely (%)[1]	Likely (%)[1]	Mean	SD	*t* test	df	N
People can adapt to small changes in temperature	Energy Industry	-	85.7	4.3	0.7	5.196 [2,3]	104	56
	ENGOs	23.0	50.8	3.4	1.1			61
Many people's standard of living will decrease	Energy Industry	42.9	21.4	2.7	1.2	-5.905 [2,4]	117	56
	ENGOs	9.5	73.0	3.9	1.1			63
My standard of living will decrease	Energy Industry	67.9	10.7	2.1	1.1	-4.946[2,4]	114	56
	ENGOs	33.3	46.7	3.1	1.2			60
Starvation and food shortages will occur in **much of the world**	Energy Industry	52.7	23.6	2.6	1.3	-6.513[2,3]	104	55
	ENGOs	8.1	77.4	4.0	1.0			62
Starvation and food shortages will occur in **Canada**	Energy Industry	84.2	5.3	1.7	1.0	-4.901[2,4]	116	57
	ENGOs	50.8	23.0	2.6	1.0			61
Serious disease will increase in **Canada**	Energy Industry	65.5	23.6	2.2	1.4	-5.662[2,3]	101	55
	ENGOs	23.3	56.7	3.5	1.0			60
My chances of suffering from a serious disease will increase	Energy Industry	65.5	16.4	2.2	1.3	-4.788[2,4]	114	55
	ENGOs	29.5	47.5	3.3	1.2			61
Many places will experience more frequent droughts	Energy Industry	33.9	55.4	3.3	1.2	-5.01[2,3]	102	56
	ENGOs	4.8	87.3	4.3	0.9			63
The region where I live will experience more frequent droughts	Energy Industry	50.9	23.6	2.6	1.2	-4.656[2,4]	116	55
	ENGOs	15.9	60.3	3.5	1.1			63

Table 4.13 cont. Impacts of a 1.5° Celsius Increase Over the Next 50 years.

Impacts	Social Group	Unlikely (%)[1]	Likely (%)[1]	Mean	SD	*t* test	df	N
Many places will experience more frequent floods	Energy Industry	30.9	40.0	3.2	1.1	-6.087[2,3]	103	55
	ENGOs	6.3	87.3	4.3	0.9			63
The region where I live will experience more frequent floods	Energy Industry	67.3	7.3	2.1	1.0	-7.579[2,4]	115	55
	ENGOs	16.1	54.8	3.6	1.1			62
Richer countries will have to make large donations of financial aid to poorer countries	Energy Industry	30.4	35.7	3.1	1.2	-4.95[2,4]	115	56
	ENGOs	8.2	80.3	4.1	1.0			61
The number of **global** environmental refugees will increase	Energy Industry	36.4	36.4	3.0	1.3	-6.58[2,3]	97	55
	ENGOs	4.8	87.1	4.3	0.9			62
Many coastal areas will experience a sea level rise	Energy Industry	14.5	60.0	3.6	1.0	-5.117[2,4]	116	55
	ENGOs	3.2	90.5	4.5	0.9			63

[1] 5-item Likert scale collapsed into likely, neutral, and unlikely
[2] $p<0.001$
[3] equal variances not assumed; separate variance *t* test used
[4] equal variances assumed; pooled-variance *t* test used

(3) to "very positive effect" (5). ENGOs and energy industry responses are statistically different (Table 4.14). ENGOs perceive a more negative economic effect than the energy industry. All activities from their perspective experience a negative impact. Energy industry respondents thought climate change had "no effect" on five activities agriculture, tourism and recreation, transportation, manufacturing and forestry. The insurance industry was most affected from energy industry perspective and ENGOs' thought commercial fishing was most affected. No activities were positively influenced by climate change.

4.6 Action on Climate Change

The question "to what extent do you believe the following groups are responsible for doing something about climate change?" tries to measure attribution of responsibility for action. Are the solutions government, individual, industry, ENGO or scientist/expert responsibility? Who is perceived to be most responsible?

Environics International (1999) reported on the Canadian public's response to "who is most responsible for protecting the environment". For the period 1987 to 1998, Canadians thought that individuals had the most responsibility (24 - 51%%, maximum in 1994); federal government were the next responsible (19 -32 %); and provincial and private industry had the lowest responsibility (less than 10%). The CCS respondents thought that industry/business (76%) and the federal (82%) and provincial (71%) governments were "very responsible' for action on climate change. Individuals were assigned the next "very responsible" role by over 59 percent of the respondents. Often climate change is portrayed as such a complex environmental problem that individuals cannot make a contribution.

Table 4.14 Economic Impacts of Climate Change on Canada

Sector	Social Group	Mean	SD	*t* test	N
Commercial fishing	Energy Industry	2.6	0.8	8.55[1]	53
	ENGO	1.5	0.6		58
Recreational fishing	Energy Industry	2.7	0.7	6.59[1]	53
	ENGO	1.8	0.7		57
Forestry	Energy Industry	3.2	0.9	9.59[1]	52
	ENGO	1.7	0.6		57
Human health	Energy Industry	2.7	0.8	5.87[1]	53
	ENGO	1.9	0.7		60
Insurance industry	Energy Industry	2.4	0.8	2.93[2]	54
	ENGO	1.9	1.1		59
Tourism and Recreation	Energy Industry	3.2	0.8	6.68[1]	54
	ENGO	2.2	0.8		59
Infrastructure (e.g. roads, bridges, reservoirs and dams)	Energy Industry	2.7	0.8	6.26[1]	54
	ENGO	1.8	0.7		60
Agriculture	Energy Industry	3.0	1.0	7.89[1]	53
	ENGO	1.7	0.8		60
Electric utilities	Energy Industry	2.8	0.9	2.59[3]	52
	ENGO	2.3	1.1		57
Transportation (shipping, trucking, air and rail)	Energy Industry	2.9	0.7	4.48[1]	54
	ENGO	2.2	0.9		56
Public water supplies	Energy Industry	2.7	0.8	6.82[1]	54
	ENGO	1.7	0.8		60
Manufacturing	Energy Industry	2.9	0.70	2.85[4]	54
	ENGO	2.5	0.9		55

[1] $p < 0.001$ [2] $p = 0.004$ [3] $p = 0.011$ [4] $p = 0.005$

ENGOs and energy industry respondents differed significantly in their mean rating for "not responsible" (1) to "very responsible" (5) for action on climate change for the seven groups (see Table 4.15). Individuals were most responsible for action from an energy industry perspective. Federal and provincial governments followed closely. Environmental groups had the least responsibility. Industry was the most responsible for action from an ENGO perspective.

Table 4.15 Responsibility for Action on Climate Change

Responsible Group	Social Group	Mean	SD	*t* test
Industry/business	Energy Industry	3.7	1.1	-6.831[1]
	ENGO	4.9	0.6	
Federal government	Energy Industry	4.0	1.1	-5.126[1]
	ENGO	4.8	0.7	
Provincial government	Energy Industry	3.9	1.1	-4.569[1]
	ENGO	4.8	0.8	
Municipal government	Energy Industry	3.6	1.2	-4.883[1]
	ENGO	4.6	0.8	
Individuals	Energy Industry	4.1	1.1	-2.804[2]
	ENGO	4.6	0.7	
Environmental groups	Energy Industry	3.2	1.4	-6.56[1]
	ENGO	4.6	0.7	
Scientists/researchers	Energy Industry	3.7	1.2	-4.109[1]
	ENGO	4.6	0.8	

[1] $p<0.001$ [2] $p=0.006$

4.7 Climate Change Information

4.7.1 How Well Informed Are Respondents?

Respondents were queried about how well informed they were on five aspects of climate change. They were to assess their level of knowledge and provide a self-disclosed assessment of informedness. Their responses provide guidance for research and communication.

There is no statistically significant difference between how well informed ENGOs and the energy industry think they are on these topics (Table 4.16). The results are reported as mean scores for a 5-point scale ranging from "not at all informed" (1) to "very well informed". The two groups reported a high level of informedness on all topics but felt the most informed on impacts or consequences of climate change and strategies to reduce or slow climate change (mitigation).

Table 4.16 How Well Informed Respondents Believe They Are (Mean and (Standard Deviation))

Topics	Industry	ENGOs	*t* test	p
Atmospheric processes related to climate change	3.5 (1.0)	3.5 (1.1)	0.018[1]	0.986
Impacts or consequences of climate change	3.9 (0.9)	4.0 (0.8)	-0.925[1]	0.357
Human responses to climate change (adaptation)	3.4 (1.0)	3.2 (1.0)	1.042[1]	0.3
Strategies to reduce or slow climate change (mitigation)	4.0 (1.2)	3.9 (0.9)	0.224[2]	0.823
Detection of climate change	3.4 (1.0)	3.3 (1.0)	0.465[1]	0.643

[1] equal variances assumed, pooled-variance *t* test
[2] equal variances not assumed, separate variance *t* test

4.7.2 Climate Change Information Needs

One question specifically asked respondents to indicate the level of addition information they require for seven climate change research topics: climate/atmospheric processes, errors/problems in computer modelling of climate, detection of climate change, climate impacts, mitigation, and adaptation. Respondents used a five-point scale from "no more information" (1) to "much more information" (5). This information can provide guidance on future research needs and target communication activities.

The energy industry respondents and ENGOs wanted more information on most topics although they attached different levels of importance to them (Table 4.17). ENGOs were least interested in the detail of problems and errors in modelling the climate system (2.7); their strong interests were in impacts (3.6, 3.7), adaptation (4.2) and mitigation (4.5) information. Adaptation (3.7) and detecting climate change (3.6) information was most of interest to the energy industry respondents.

4.8 Summary

ENGOs and energy industry respondents were significantly different in most themes of the analysis framework particularly their ecological worldviews and perception of risk.

The ENGOs, as expected, exhibited strong ecocentric worldviews. Many are preservationists. The energy industry supported a balanced approach to economic development and the environment. Energy industry respondents strongly believe that science and technology are beneficial; ENGOs are doubtful.

The groups are equally aware of the climate change issue. Both have similar lengths of exposure to the issue and frequency of contact with climate change information. They report the same level of informedness. But, their beliefs on the issue are dissimilar.

Table 4.17 Additional Climate Change Information

Information		no more info. (%)	more info (%)	Mean	SD	*t* test	p	N
Climate or atmospheric processes	Energy Industry	24.6	50.9	3.3	1.3	1.069[1]	0.287	57
	ENGO	36.5	41.3	3.1	1.3			63
Errors and problems in computer modelling of the climate system	Energy Industry	28.1	49.1	3.2	1.4	1.885[1]	0.062	57
	ENGO	43.5	30.6	2.7	1.4			62
Detecting climate change (e.g., temperature trends)	Energy Industry	14.0	54.4	3.6	1.1	0.176[1]	0.861	57
	ENGO	22.2	57.1	3.5	1.2			63
Consequences of changes in temperature, rainfall, etc.	Energy Industry	20.0	50.9	3.4	1.1	-2.609[1]	0.010	55
	ENGO	14.8	72.1	3.9	1.2			61
Social, industrial, and economic impacts	Energy Industry	18.5	55.6	3.5	1.2	-3.074[1]	0.003	54
	ENGO	7.9	82.5	4.2	1.0			63
Strategies for human response (adapting) to climate change	Energy Industry	14.8	63.0	3.7	1.2	-2.528[1]	0.013	54
	ENGO	9.7	80.6	4.2	1.1			62
Strategies for slowing (mitigating) climate change	Energy Industry	22.2	64.8	3.5	1.4	-4.348[2]	<0.001	54
	ENGO	6.3	85.9	4.5	0.9			64

[1] equal variances assumed, pooled-variance *t* test
[2] equal variances not assumed, separate variance *t* test

The key contested area is whether climate change is real and harmful. ENGOs believe climate change is certain to occur while the energy industry is skeptical. For some of the ENGOs climate change is occurring and some energy industry respondents questioned whether climate change was real. Many energy industry respondents minimized the impacts - there would be "no effects" on many economic sectors in Canada. ENGOs predictions of temperature increase in the next 50 years were similar to the international scientific consensus while the energy industry underestimated the increase.

The energy industry and ENGO have a different framing of the issue of climate change. Many energy industry respondents are sceptical and deny impacts whereas ENGOs believe the issue is real and hazardous.

CHAPTER 5

CONCLUSIONS AND DISCUSSION

This study has audited the beliefs and values of two social groups, ENGOs and the energy industry, actively engaged in agenda-setting for climate change rather than focusing on the common lay-expert disjunct in climate change knowledge. A survey instrument was used to collect primary data on environmental values, awareness of and knowledge on climate change, responsibility for action and information needs in order to understand their worldviews. This audit may help map contested beliefs and provide strategic information for negotiating risk and developing and implementing policy (Ungar, 1994, 298; West *et al.*, 1992).

5.1 Conclusions

This study has demonstrated empirically that there are differences in environmental values and beliefs on climate change between the groups. The ENGO and energy industry respondents are well educated with an equivalent length of exposure to and frequency of contact with climate change information. Both are highly aware of climate change. ENGOs and the energy industry have reasonably similar beliefs within their respective groups. Yet, the social construction of climate change between groups varies significantly; they have different worldviews. The results highlight some of the contested beliefs.

The strong cleavage along DSP-NEP was not evident but there were statistically significant differences in environmental values. ENGOs had a cohesive, strong ecological worldview. Energy industry had a mixture of beliefs ranging from DSP to strong NEP. In resource development and use, the energy industry supported equal consideration for the economy and environment while most ENGOs were environmental "preservationists". ENGOs and energy industry respondents held opposing beliefs on technology as a solution

to resource scarcity and as a benefit to quality of life. The energy industry exhibited key DSP-traits in strongly held beliefs in the capabilities of science and technology and human ingenuity to deal with ecological problems.

A key point of disagreement is the perceived threat of climate change. ENGOs have a greater belief in climate change occurring – some reported that it is already happening. All ENGOs agree that there is enough scientific information about global climate change to be concerned and to take steps to reduce greenhouse gases; economic costs of limiting greenhouse gases are not too high. The energy industry is ambivalent. Some respondents focussed on the "natural" processes of climate change and questioned whether human-caused climate change is real. This is the fundamental rhetoric of framing whether climate change is occurring.

The majority of respondents from the two groups held opposite perceptions of the level of consensus between experts on the direction and causes of climate change. The energy industry thought there was disagreement; this position may reflect their focus on the "uncertainties" and "controversies" of the science. ENGOs thought there was agreement. Unfortunately, the survey did not allow for further exploration of the nature of the supporting and conflicting information of the experts.

A higher proportion of ENGOs identified the causes of climate change correctly. But they were more likely to identify the incorrect causes of climate change as causes. Their higher perceived risk of climate change may lead to an expanded perception of what causes climate change.

Climate change is not perceived as personally dangerous. Both groups thought that the negative impacts of climate change (e.g., increased drought, floods, diseases, food shortages and reduction in living standards) were more likely to occur elsewhere and to

someone else (e.g., many places, many people) rather than to themselves. If climate change is not personalized, it becomes difficult to assume ownership and harder yet to act on necessary measures.

Sea level rise, drought and flooding emerged as most likely threats common to both groups. Thereafter the groups' positions differ markedly and reflect their contrasting beliefs in the risks of climate change and society's adaptability to increases in temperature. Starvation and food shortages particularly in Canada are not a threat. The energy industry response to economic impacts is generally 'no effect" although the insurance industry is recognized as the most vulnerable sector. Perhaps they are reflecting that industry's acknowledged climate change position. ENGOs believe there is a negative economic impact to many sectors of Canada. There is also concern for more environmental refugees and increased foreign aid.

ENGOs and energy industry respondents differed significantly in their assignment of responsibility for action. Individuals are most responsible from an energy industry perspective. Their worldview puts a priority on individual responsibility and initiative. However, it fails to recognize the societal barriers impeding action even if there is intention. Many environmental problems are imbedded in the production treadmill (Ungar, 1994). ENGOs think industry is primarily responsible for action - perhaps it is the polluter pay perspective. Federal and provincial governments have an equally high responsibility for action in both groups. ENGO support for government is not unusual but it is surprising that the energy industry recognizes a strong responsibility for action by federal and provincial governments. Their position frequently advocates less government intervention. The weakness with the question is that it only solicits responsibility for action but does follow up with a request for what type of action should be taken.

The self-reported informedness of ENGOs and the energy industry respondents is the same. ENGOs want more information than energy industry on impacts, mitigation and adaptation. Perhaps this is a reflection of a perception of a greater threat of climate change and wanting information to respond.

In summary, there are clearly contested beliefs between the energy industry and ENGOs. They include beliefs that:

- climate change is occurring versus it is not real;
- climate change is a dangerous risk versus there are minimal effects;
- scientific controversy exists versus there is consensus on the science of climate change;
- science and technology and well as human ingenuity can overcome ecological problems versus skepticism on adaptability; and
- individuals are responsible for action versus industry is responsible.

Revisiting the quotes from Chapter 1 confirms the competing and different constructions of the issue of climate change from ENGOs and energy industry representatives in this study. Again, ENGOs are certain of global warming; they highlight impacts of climate change and need for action to reduce greenhouse gases (mitigation). The energy industry focused on uncertainty surrounding the issue quoting actual cooling of the Earth and portrayed action as more harmful than climate change itself. Different worldviews are competing on defining the certainty of the scientific facts surrounding the issue and risks from climate change.

The benefit of the social constructionism perspective applied to climate change research is that social constructionism has developed the notion that environmental risks are socially constructed (Hannigan, 1995, 189). It acknowledges that different claims-makers or

social groups such as ENGOs, energy industry, governments and scientists make contributions to the climate change discourse based on their distinctive worldviews.

5.2 Contributions of the Research

Attitudes, beliefs and values related to climate change and its risks and the social feasibility of implementing mitigation and adaptation responses are important areas of research. This study has contributed to the understanding of Canadian beliefs on climate change. To date there are three published studies for the Canadian context in which university students, the general public and an informed public are surveyed. This is the first empirical study of climate change beliefs of ENGOs and the energy industry.

The framework for development and analysis of the climate change survey included factors to describe characteristics of the group (social demographic, environmental values, awareness of climate change) and components of outcomes (knowledge, action and information needs). This framework is a unique synthesis of factors that are relevant to understanding climate change beliefs.

Many climate change belief surveys have used a lay/expert dichotomy and the "information deficit model". Social constructionist theory and the concept of a claims-maker offer a new framing for research on climate change beliefs. The lay/expert focus of climate change research on beliefs fails to recognize the different social groups involved in negotiating the risk of climate change. In this framing information on climate change flows from the expert to the public and from science to policy but there are also numerous other groups involved in the communication process. Other claims-making groups have beliefs, worldviews, perceptions of risk and policies that need to be explored. This survey has tried to uncover the beliefs and worldviews of ENGOs and energy industry representatives that influence their positions in contesting the climate change issue.

While this thesis was informed by social constructionism, it did not embrace the methods typically used such as observation, face-to-face interviews, and focus groups in fields studies or reconstruction of the claims-making process (e.g.. through newspaper articles (Bullock, 1998) and documenting an environmental hearing process (Miller and Holstein, 1993)). This situation is a reflection of dialogue within constructionism. The strict constructionist wants to focus exclusively on the interpretations and practices of participants in social problems construction while the contextual constructionist is supportive of the use of empirical data in the evaluation of claims (Hannigan, 1995, 188). This limitation of the study clearly indicates where next research steps could take place. This study tried to understand the beliefs of claims-makers – ENGOs and energy industry - to identify potential contested areas. It was successful in measuring the differences between the groups but did not attempt to address the process of negotiation of this environmental issue.

5.3 Future Research Opportunities

Future directions in research could follow a quantitative route using survey results for modelling of behaviour intention or a qualitative route by using focus groups to explore belief differences in groups.

The modelling approach would build upon the work of O'Connor *et al.*, 1998a; 1999b and Jaeger *et al.*, 1993. Factors such as climate change knowledge or environmental values could be related to behavioural intentions or risk perception through regression analysis.

The use of a structured questionnaire rather than an interview or focus group misses the rich data source created when people are allowed to raise their own agendas and present in their own words their interpretation and understanding of issues (Bulkeley, 2000). Focus

groups with ENGOs and energy industry representatives would allow dialogue on key issues uncovered by the survey. Those topics might include:

- How has your view of climate been constructed?
- What scientific evidence supports or discredits climate change as an issue?
- What "weight of evidence" is necessary for determining risk?
- Why are climate change impacts less personal and more likely to happen to others?
- Who is responsible for action on climate change? Why do ENGOs chose industry and energy industry chose the individual as most responsible. What type of action(s) should they undertake?
- If the federal and provincial governments are also considered responsible for action, what is the form of the action that should take place.
- What are your behavioural intentions toward climate change and what are the societal and personal barriers to undertaking the action?
- If more information is needed on climate change detection, impacts, adaptation, and mitigation, what should it be?

Conflict and consensus are a natural part of the climate change issue. The contested positions of claims-makers could be mediated through participatory techniques or methods of group facilitation to "negotiate" solutions. These solutions could provide guidance on what might be done at a larger societal scale in negotiating whether the issue is dangerous and requires remedial action.

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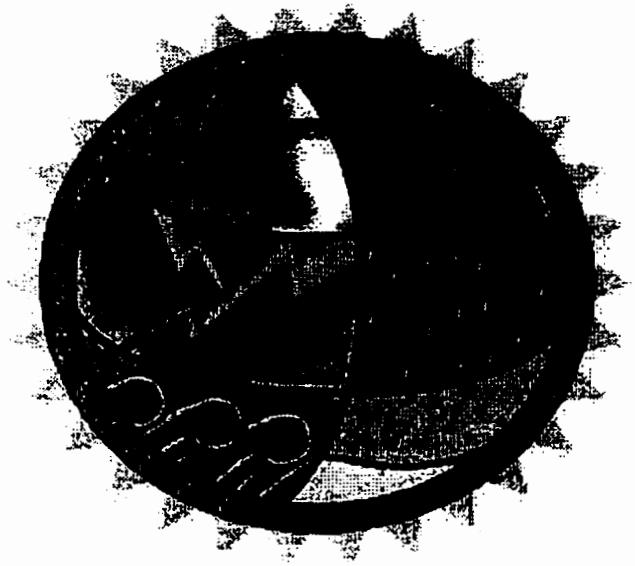
A Survey of Climate Change



Climate change is emerging as an important environmental issue. This survey explores the perspectives of people involved in the dialogue on climate change. Some of the following questions may be easy to answer, while you may feel uncertain about others. Please use your best judgement. This survey is anonymous and all responses will be pooled for analysis and reporting to ensure confidentiality.

Linda Mortsch, Department of Geography, University of Waterloo

Section A: You will be asked questions about climate change

Q1a Approximately how long ago do you think there has been a form of climate change? Put a ✓ next to the response that is closest to your answer.

- ☐ less than 1 year
- ☐ 1-2 years
- ☐ 3-5 years
- ☐ 6-10 years
- ☐ 11-20 years
- ☐ more than 20 years

Q1b Approximately how often do you see, hear, or read something about climate change?

- ☐ never seen, heard or read anything about climate change
- ☐ a few times a year
- ☐ once a month
- ☐ several times a month
- ☐ once a week
- ☐ several times a week
- ☐ daily

Q1c How certain, or uncertain, are you that climate change will occur? Please put a ✓ beside the statement that reflects your view.

- ☐ climate change is certain to occur
- ☐ climate change is likely to occur
- ☐ climate change may occur
- ☐ climate change is unlikely to occur
- ☐ climate change will not or cannot occur

Q1d How well informed about the following do you feel you are? Please circle the appropriate number.

	Not at all informed				Very well informed
a Atmospheric processes related to climate change	1	2	3	4	5
b Impacts or consequences of climate change	1	2	3	4	5
c Human responses to climate change impacts (adaptation)	1	2	3	4	5
d Strategies to reduce or slow climate change (mitigation)	1	2	3	4	5
e Detection of climate change	1	2	3	4	5

Q2a How likely do you think it is that the Earth's average annual temperature will increase by 1.5° Celsius within the next 50 years?

Very Unlikely				Very Likely
1	2	3	4	5

Q2b Please put a ✓ beside the temperature change that you think is most likely over the next 50 years.

☐	a decrease, provide a range: _____ degrees Celsius
☐	virtually no change
☐	an increase, provide a range: _____ degrees Celsius
☐	do not know

Q2c Suppose annual average temperature does increase by 1.5° Celsius over the next 50 years. If this were to happen, how likely do you think each of the following would be? Please circle the appropriate numbers.

	Very Unlikely				Very Likely
a People can adapt to small changes in temperature (e.g., 1.5°C)	1	2	3	4	5
b Many people's standard of living will decrease	1	2	3	4	5
c My standard of living will decrease	1	2	3	4	5
d Many places will experience more pleasant temperatures	1	2	3	4	5
e The region where I live will experience more pleasant winter temperatures	1	2	3	4	5
f The region where I live will experience more pleasant summer temperatures	1	2	3	4	5
g Starvation and food shortages will occur in much of the world	1	2	3	4	5
h Starvation and food shortages will occur in Canada	1	2	3	4	5
i Serious diseases will increase in Canada	1	2	3	4	5
j My chances of suffering from a serious disease will increase	1	2	3	4	5
k Many places will experience more frequent droughts	1	2	3	4	5
l The region where I live will experience more frequent droughts	1	2	3	4	5
m Many places will experience more frequent floods	1	2	3	4	5
n The region where I live will experience more frequent floods	1	2	3	4	5
o Serious plant diseases will increase among both crops and natural plants	1	2	3	4	5
p Richer countries will have to make large donations of financial aid to poorer countries	1	2	3	4	5
q Insect infestations will increase globally	1	2	3	4	5
r The number of global environmental refugees will increase	1	2	3	4	5
s Many coastal areas will experience a sea level rise	1	2	3	4	5

Q3 For Canada, how much of an economic effect, if any, do you think global climate change will have on each of the following?

		Very Negative Effect		No Effect		Very Positive Effect
a	Commercial fishing	1	2	3	4	5
b	Recreational fishing	1	2	3	4	5
c	Forestry	1	2	3	4	5
d	Human health	1	2	3	4	5
e	Insurance industry	1	2	3	4	5
f	Tourism and Recreation	1	2	3	4	5
g	Infrastructure (e.g., roads, bridges, reservoirs and dams)	1	2	3	4	5
h	Agriculture	1	2	3	4	5
i	Electric utilities	1	2	3	4	5
j	Transportation (shipping, trucking, air and rail)	1	2	3	4	5
k	Public water supplies	1	2	3	4	5
l	Manufacturing	1	2	3	4	5

Any comments?

_____

_____

_____

Q4 For each pair of statements below, please ✓ the one that best describes your beliefs:

a) ☐ There is not enough scientific information about global climate change to be concerned.
b) ☐ There is enough scientific information about global climate change to be concerned.

a) ☐ If global climate change occurs, it will be too far in the future for me to be concerned.
b) ☐ If global climate change occurs, we should be concerned about future generations.

a) ☐ We know enough to effectively deal with problems that will result from climate change.
b) ☐ We do not know enough to effectively deal with problems that will result from climate change.

a) ☐ There is not enough scientific information about global climate change to take steps to reduce greenhouse gas emissions.
b) ☐ There is enough scientific information about global climate change to take steps to reduce greenhouse gas emissions.

a) ☐ The economic costs to reduce greenhouse gas emissions are too high to justify action.
b) ☐ The economic costs to reduce greenhouse gas emissions are not too high to justify action.

a) ☐ Human ingenuity can offset most negative effects of global climate change.
b) ☐ Human ingenuity cannot offset most negative effects of global climate change.

a) ☐ There is not enough scientific information about global climate change to take steps to adapt to changes in climate.
b) ☐ There is enough scientific information about global climate change to take steps to adapt to changes in climate.

Q5 Please indicate whether you think that each of the following is a **major cause** of climate change, a **minor cause** of climate change, or **not a cause at all.** (Circle one number for each potential cause).

	Not a cause	Minor cause	Major cause
a Pollution / emissions from business and industry	1	2	3
b People driving their cars	1	2	3
c Use of chemicals to destroy insect pests	1	2	3
d Use of coal and oil by utilities	1	2	3
e Depletion of the ozone in the upper atmosphere	1	2	3
f People heating and cooling their homes	1	2	3
g Nuclear power generation	1	2	3
h Destruction of tropical forests	1	2	3

Q6 To what extent do you believe the following groups are responsible for doing something about climate change?

	Not responsible				Very responsible
industry / business	1	2	3	4	5
federal government	1	2	3	4	5
provincial governments	1	2	3	4	5
municipal governments	1	2	3	4	5
individuals	1	2	3	4	5
environmental groups	1	2	3	4	5
scientists/researchers	1	2	3	4	5

Q7 Overall, would you say that there is agreement or disagreement between the various experts on the direction and causes of climate change.

Total agreement				Serious disagreement
1	2	3	4	5

Q8 Research is being done on many climate change issues. Please rate the level of additional information you would like to receive on the following topics from 'no more' information to 'much more' information.

		No more info.				Much more info.
a	information on climate or atmospheric processes	1	2	3	4	5
b	errors and problems in computer modelling of the climate system	1	2	3	4	5
c	detecting climate change (e.g., temperature trends)	1	2	3	4	5
d	consequences of changes in temperature, rainfall, etc.	1	2	3	4	5
e	social, industrial, and economic impacts	1	2	3	4	5
f	strategies for human response (adapting) to climate change impacts	1	2	3	4	5
g	strategies for slowing (mitigating) climate change	1	2	3	4	5

Q9 How likely do you think it is that unusual extreme weather events in Canada are related to climate change?

Very unlikely				Very likely
1	2	3	4	5

Section B The following questions will ask you about general environmental issues

Q10 For each of the statements below, please rate the degree to which you agree or disagree.

		Strongly agree		Neutral		Strongly disagree
a	The balance of nature is very delicate and easily upset by human activities	1	2	3	4	5
b	The Earth is like a spaceship with only limited room and resources	1	2	3	4	5
c	Plants and animals do not exist primarily for human use	1	2	3	4	5
d	Modifying the environment for human use seldom causes serious problems	1	2	3	4	5
e	There are no limits to growth for nations like Canada	1	2	3	4	5
f	Humankind was created to rule over the rest of nature	1	2	3	4	5

Q11 Please indicate whether you agree or disagree with the following statements.

		Strongly agree		Neutral		Strongly disagree
a	Technology will solve problems from shortages of natural resources	1	2	3	4	5
b	People would be better off if they lived a simpler life without so much technology	1	2	3	4	5
c	Future scientific research is more likely to cause problems than to find solutions	1	2	3	4	5

Q12a This question asks your opinion on the importance of the following environmental goals for Canada. Read all the goals. Rate each from 1 to 7. You may have more than one with the same importance.

	Not very important for Canada						Very important for Canada
a Stopping development in flood plains to reduce flooding losses	1	2	3	4	5	6	7
b Reducing agricultural runoff	1	2	3	4	5	6	7
c Restoring aquatic animals and plants	1	2	3	4	5	6	7
d Reducing the loss of wetlands	1	2	3	4	5	6	7
e Building dams to control flooding	1	2	3	4	5	6	7
f Reducing pollution in lakes and rivers	1	2	3	4	5	6	7
g Making logging practices more sustainable	1	2	3	4	5	6	7
h Reducing carbon dioxide emissions that cause climate change	1	2	3	4	5	6	7
i Maintaining national parks	1	2	3	4	5	6	7
j Increasing water storage capabilities in case of drought	1	2	3	4	5	6	7
k Preventing urbanization of agricultural land	1	2	3	4	5	6	7
l Reducing soil erosion	1	2	3	4	5	6	7
m Ensuring safe drinking water	1	2	3	4	5	6	7
n Preserving wildlife habitat	1	2	3	4	5	6	7
o Improving air quality	1	2	3	4	5	6	7
p Reducing emissions that cause acid rain	1	2	3	4	5	6	7
q Reducing smog in urban areas	1	2	3	4	5	6	7
r Other: _____	1	2	3	4	5	6	7
s Other: _____	1	2	3	4	5	6	7

Q12b Thinking about the environmental goals for Canada listed above, which do you think is most important?_____

Q13 Which statement most closely reflects your opinion? Please put a ✓ in the **most** appropriate box.

The only consideration in deciding what to do with natural resources and the environment should be what will contribute most to the growth of the economy	☐
The growth of the economy should be the most important but not the only consideration in deciding what to do with natural resources and the environment	☐
Protection of the environment and the growth of the economy should be given equal consideration in deciding what to do with the environment and resources	☐
Protection of the environment is the most important but not the only consideration in deciding what to do with natural resources	☐
The only consideration in deciding what to do with natural resources should be the preservation of the environment	☐

Section C The questions in this section will ask you for some background information. Please circle or ✓ the appropriate answer for each question.

Q14 Are you:

1 Male
2 Female

Q15 What is your age?

1 under 25
2 25 to 35
3 36 to 45
4 46 to 55
5 56 to 65
6 66 or over

Q16 Highest level of education achieved is:

1 high school diploma
2 college or trade certificate
3 some college or university training
4 university undergraduate degree
5 graduate or professional degree
6 other

Q17 In what area do you work?

1 government
2 industry
3 educational institution
4 private, non-profit organization (not academic)
5 other _____(specify)

Q18 In what province or territory do you live?

☐ British Columbia ☐ Alberta ☐ Saskatchewan
☐ Manitoba ☐ Ontario ☐ Quebec
☐ New Brunswick ☐ Nova Scotia ☐ Prince Edward Island
☐ Newfoundland ☐ Yukon ☐ Northwest Territories
☐ Nunavut ☐ None of the above:_____(specify)

Thank you

for completing this climate change survey.

PLEASE RETURN AS SOON AS POSSIBLE

IN THE ENCLOSED, STAMPED ENVELOPE

Linda Mortsch, c/o Faculty of Environmental Studies, Dept. of Geography

University of Waterloo, Waterloo, ON N2L 3G1

If you would like a copy of the survey results, please request by:

1) ✉ Filling out the 'cut off' section below and sending it in

2) ☎ Phone: (519) 888-4567 ext. 5495

3) ✆ Fax: (519) 746-2031

4) 💻 Email: ldmortsc@fes.uwaterloo.ca

✂ ✂

A Survey of Climate Change

Linda Mortsch
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University of Waterloo
Waterloo, ON, N2L 3G1

Please send me the results of your survey:

Name: _____

Dept./Agency: _____

Address: _____

_____ **email:** _____