

**WORKING TOWARDS IMPROVED CLIMATE CHANGE
COMMUNICATION IN THE RIDING MOUNTAIN BIOSPHERE
RESERVE**

By

Randall C. Shymko

A Thesis Submitted to the Faculty of
Graduate Studies in Partial Fulfillment of the
Requirements for the Degree of

**MASTER OF NATURAL RESOURCES
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Randall C. Shymko

**A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University
of Manitoba in partial fulfillment of the requirements of the degree
of
Master of Natural Resources Management**

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Abstract

This thesis is a synthesis of a research project that explored the issue of climate change communication in the Riding Mountain Biosphere Reserve (RMBR). Climate change has become an increasingly important environmental issue that has gained wide public awareness over the past fifteen years. Yet, despite the overwhelming multi-disciplinary research, policy efforts, and public education and communications on the issue, there has not been appreciable improvement in public understanding of the potential impacts of climate change and actions that can be taken. There is also a shortage of evaluative research conducted to determine the attributes of effective communications with adult learners. This study identified perspectives on the climate change issue among selected adult learners; developed and evaluated a climate change information program; established the effectiveness of the program in communicating climate change information with adults; identified potential barriers to communication; and, suggested tools and methods for improved communication of climate change information with adult learners.

This research was carried out in a case study setting using a community climate change workshop. An extensive literature review conducted prior to the study helped set the context for the investigation. An adaptive multi-criteria process of evaluating the workshop program was implemented, primarily based on a comparative analysis of participants' perspectives on the climate change issue and workshop activities. A pre-survey, a post-survey, researcher observation, and semi-structured follow-up interviews were the instruments used to collect the qualitative and quantitative data.

The perspectives of participants show a high concern for local environmental and socio-economic issues. Regarding the climate change issue, there was a high level of awareness, moderate level of knowledge, and low level of understanding prior to the workshop. As a result of the workshop activities, there were varying levels of improved understanding on climate change. In general, this occurred most often as a result of workshop information that was locally and personally relevant in terms of the potential

biophysical, and socio-economic impacts of climate change and what could be done about them. The communication qualities that were associated with improved understanding, and therefore deemed to be more effective, were personal and interactive in nature, integrative of participant's views, engaging, and interesting. Specifically, expert verbal and interactive presentations, and the climate change short story were found to be the most effective workshop tools. Conversely, The Winds of Change poster and governmental materials were least effective for workshop participants.

In conducting future climate change communications, stakeholders' perspectives should be considered, and existing organizations identified to coordinate and deliver the climate change message through several tools and methods. As well, the barriers to future communications need to be further identified and addressed. More resources need to be allocated towards environmental education in the RMBR and in Canada as a whole that includes a strong climate change component and leads towards more environmentally responsible behavior amongst the general adult population.

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List of Acronyms

BP	Before present
CASA	Clean Air Strategic Alliance
CCBP	Canadian Climate Board Program
CCCma	Canadian Centre for Climate Modeling and Analysis
CCME	Canadian Council Ministers of the Environment
C-CIARN	Canadian Climate Impacts Adaptation and Research Network
CD	Conservation District
CO ₂	Carbon dioxide
EAS	Environmental Atmospheric Service
ENGO	Environmental non-governmental organization
GCCP	Global Climate Change Program
GHG	Greenhouse gas
GCM	Global Climate Model or Global/General Circulation Model
GISS	Goddard Institute of Space Studies
GFDL	Geophysical Fluid Dynamics Laboratory
IISD	International Institute of Sustainable Development
IPCC	Intergovernmental Panel on Climate Change
NCCP	National Climate Change Process
NCCIS	National Climate Change Implementation Strategy
NRCan	Natural Resources Canada
PARC	Prairie Adaptation Research Collaborative
PEO	Public education and outreach
RMBR	Riding Mountain Biosphere Reserve
RMNP	Riding Mountain National Park
RM	Rural Municipality
SIA	Science Impacts and Adaptation
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change

Chapter 1: Introduction

1.1 Background

Climate change is currently considered one of the most important environmental issues in Canada (PEO Issue Table, 1999; Environment Canada, 1999).¹ The potential impacts of climate change are anticipated to influence all aspects of Canadian society and regions (Options Paper SIA, 1999). Global or General Circulation Models (GCM's) have predicted temperature increases between four to ten degrees Celsius and slight precipitation changes for Canada in response to an equivalent doubling of atmospheric carbon dioxide (CO₂) by about 2050 (Bruce et al., 2000). Human activities, mainly through the production of greenhouse gases, agriculture and landscape modifications, are identified as a main contributor of recent climate change. In fact, the Inter-governmental Panel on Climate Change (IPCC) now reports that "The balance of evidence suggests a discernable human influence on global climate" (IPCC, 2001a: 10).

The impacts of these changes are anticipated to cause fundamental changes in Canada's ecosystems, agriculture, urban centers, and the way we live our lives (Herrington et al., 1997). Longer summers may also mean more heat waves and droughts, while shorter winters may result in more storms and less severe cold spells. Increased severe weather events including floods, tornadoes, ice storms, and thunderstorms, may be in store throughout the year for much of Canada (e.g. Herrington et al., 1997). Boreal forest ecosystems, including those in Riding Mountain National Park (RMNP), may migrate

¹ Please refer to Appendix A for a comprehensive list of definitions of the key concepts and terms associated with the issue of climate change relevant to this research project.

northward resulting in Aspen Parkland regions or grasslands (Scott and Suffling, 2000). Resource sectors, the economy, and the way we live are likely to change as a result of climate change.

International policy efforts to curb greenhouse gas emissions reached an important milestone with the *Kyoto Protocol* in 1997. Pursuant to the *Protocol*, Canada agreed to reduce emissions by six percent from 1990 levels (Options Paper Science Impacts and Adaptation (SIA), 1999). This commitment, while still not ratified, has led to a suite of ongoing initiatives to develop mitigation, adaptation, and technology-based strategies as part of the slowly emerging National Climate Change Implementation Strategy (NCCIS). This national strategy includes a climate change secretariat, a funding component, various research activities, and sixteen Issue Tables or Working Groups. These Tables include various sectors and resources that are anticipated to be influenced by climate change or required as a result of those changes.

Part of the NCCIS strategy addresses the need for public Education and outreach (PEO) on climate change to improve public understanding and initiate mitigation efforts. Therefore, one of the sixteen Tables is the PEO Issue Table, established to explore education and outreach programs, research barriers to PEO, identify lessons learned from previous initiatives, and develop a PEO plan as part of the NCCIS.

Recent PEO research consistently report that Canadians currently perceive climate change as less important and more impersonal than socio-economic issues. Rather,

concerns for the environment tend to be focussed upon water and air pollution, and ozone depletion (PEO Issue Table, 1998, 1999). Additional research shows that public knowledge on the issue of climate change is generally low in Canada (e.g. Andrey and Hachey, 1995; PEO Issue Table, 1998, 1999; Mortsch, et al., 2000), and in the United States (e.g. Rayner and Malone, 1998; Kearney, 1994).

Despite the growing base of knowledge and communication techniques related to climate change education and communication, human behavior has not changed in response (Andrey and Hachey, 1995). Effective communication of information on the science, potential impacts, and remedial actions to address the issue of climate change are clearly needed. However, climate change communications are not a discrete component of PEO efforts. Instead climate change communications should be considered an embedded component of a total public education and outreach program.

Accordingly, the need for climate change communication has been given attention in the literature. The World Conference on Science described communication as the flow of information or misinformation to the public via the media, and secondly, as the exchange between policy-makers, the public and scientists (Toomey and Roots, 1999). But given the cross-cutting and complex nature of the climate change issue, these activities must embrace a much broader and more interactive interpretation:

Communication involves imparting information with the intent of promoting understanding, ..[and] is thought to be effective when it improves the basis on which decisions are made. [Newer models suggest that] .. communication should be viewed as a more open and interactive process, where information,

opinions and evaluative principles are exchanged among individuals, groups, and institutions. (Andrey and Hachey 1995:6)

It has been argued that the message of climate change must be communicated to all sectors of Canadian society, on a local and regional basis, to promote increased public awareness (Herrington et al., 2000). Specifically, “The results of climate system science, monitoring, impacts studies and development of adaptation options need to be accurately and effectively communicated to Canadians” (Options Paper SIA, 1999: 7). As such, the Canadian Climate Board Program (CCBP) has recommended that “Canadian climate change scientists be engaged to participate in a major climate change **communications** initiative”[Options Paper SIA, 1999: vi (bold underlined text in original document)].

Effective communication on climate change is needed to increase public knowledge and understanding for informed individual action, and mainstream support of mitigative and adaptive measures. Since adult learners comprise a large segment of the general population in a position to make significant behavior and policy changes, this group should be targeted for climate change communications.

Yet, simply implementing a communication initiative, as part of a PEO program does not, in itself, ensure that the target audience receives the information and that improved understanding on the issue occurs. Evaluating public education and communication activities is also necessary to maximize the effectiveness of climate change programs (Andrey and Hackey, 1995). Successful educational outreach strategies contain an evaluation component, especially at the community level, to allow the transfer of

effective communication initiatives or programs to other communities (PEO Issue Table, 1998). Post-evaluation of communication endeavors also help ensure that limited resources are utilized effectively (Andrey and Hachey, 1995). Effective local and regional public education programs on climate change require information to be communicated accurately, effectively and directly to target audiences in a two-way and pro-active process.

1.2 Purpose and Objectives

The overlying purpose of this study was to develop an understanding of effective methods and tools for communicating climate change information with adult learners.

Specific objectives included:

1. To determine perspectives on the climate change issue among selected adult learners;
2. To develop and evaluate a climate change information program targeted at adult learners;
3. To establish how effective the program was in communicating climate change information with adults, while also identifying potential barriers to communication; and,
4. To suggest tools and methods for improved communication of climate change information with adult learners.

1.3 Scope of the Research

Geographical Context

The geographical focus of this research was the Riding Mountain Biosphere Reserve (RMBR) region of Manitoba. The RMBR is one of ten Reserves in Canada. They are all

part of a global network of United Nations Educational Scientific and Cultural Organization (UNESCO) Biosphere Reserves. These reserves are designed to promote research towards sustainable ecosystems, communities (Francis, 1990a), and economies that are locally controlled through municipal councils (Whitaker, 2001). This region of Manitoba is well suited to explore the perspectives of adult learners and determine effective communication tools and methods on the growing environmental issue of climate change as the mandate of the RMBR lies within the framework of research towards sustainable development. However, the region is also a suitable study region due to the varied ecosystems that exist within the region, especially within RMNP, and extensive human development occurring outside the Park.

Human Scope

This research was directed primarily towards people that live around RMNP but within the RMBR. Agriculture is the main livelihood and economic driving force in this region (RMBR, 2000). For this reason, the project focused extensively upon the agricultural producers living peripheral to RMNP. A secondary emphasis was placed on those who work for and are affiliated with RMNP, since they are the main group responsible for maintaining the Park in accordance to the mandate of *Parks Canada*. The perspectives and views of other less numerous RMBR stakeholders were also collected through their participation in data collection activities. This combination of citizens' perspectives facilitated a more representative assessment of how people perceive the climate change issue and their views on potential communication efforts in the future.

1.4 Research Methods

This research was conducted in the above case study setting. Designing and implementing a one-day *Community Climate Change Workshop* directed towards adult learners in the study region served as the foundation for the case study. At the workshop various information was provided using several different communication techniques or tools. As part of the research activities, two survey questionnaires were administered at the workshop. The pre-workshop questionnaire (or pre-survey) collected participants' perspectives on the climate change issue, including those pertaining to climate change information and communications. The post-workshop questionnaire (or post-survey) concentrated on participant's evaluative feedback on the workshop activities and on the climate change issue more generally. Semi-structured interviews with self-selected workshop participants were conducted in the weeks following the workshop to gather more in-depth insight on the climate change issue and on the quality of the workshop materials.

All data were pooled to assess the participants' perspectives on the climate change issue both preceding and following the workshop. The evaluation of workshop information and communications utilized an adaptive, multifaceted approach to determining improved understanding on climate change, and, as such, greater effectiveness. The evaluative process included post-workshop feedback provided by workshop participants, and insights, criteria, and suggestions from the literature and research investigator. Data analysis and subsequent conclusions culminated with a discussion of the results and development of a climate change communication strategy for the study region.

1.5 Organization

This thesis consists of six chapters. This chapter introduced the issue and importance of the research, establishes the purpose and objectives, then sets the spatial and human research context for the study. Chapter Two reviews the related literature, including information pertaining to public education and communication on climate change for adults and the general public. Chapter Three provides a detailed overview of the research methods. This includes a synthesis of the organizational and promotional activities leading up to and including the workshop. Chapter Four is broken into two main components. The first component provides a review of participants' perspectives on the climate change issue before attending the workshop. The second section systematically presents the results of the workshop information and communication evaluation. Chapter Five also presents project results in two main sections. The first section details participants' perceived barriers to climate change communications. The second section advances suggestions for future climate change communications. In Chapter Six the findings of the research are documented, including potential guidelines for future climate change communications in the Riding Mountain Biosphere Reserve.

Chapter 2: The Climate Change Issue, the Social Sciences, and Public Education and Communication

2.1 Introduction

The crosscutting issue of climate change as it relates to the social sciences, public education and outreach (PEO), and communication is not easily summarized within one chapter. However, developing a basic understanding of these issues is integral to appreciating the challenges and opportunities associated with this research. Therefore, this chapter begins with a brief overview of the science and history of climate change, as well as projected GCM predictions and resultant impacts for Canada and the Prairies. A broad discussion of the social sciences and climate change precedes an exploration of recent climate change PEO and communication activities, including federal PEO initiatives. A general discussion of the difficulties in communicating climate change information with the general public complements a selection of recent communication tools and methods in Canada and the RMBR. Lastly, a detailed review of communication program evaluations and suggestions completes the chapter.

2.2 Climates of the Past and Present

It appears that there is a mainstream misconception that the climate change issue, specifically, 'global warming,' is a new phenomenon of the late 1980's. In reality, the climate of Canada and the Earth as a whole has always varied substantially (e.g. Lamb, 1988). The issue of human induced climate change has also been speculated among scientists as early as the late 1800's (Options Report, SIA, 1999; Glantz, 1988). What has emerged in the past fifteen years is the renewed public and political interest in human induced climate change, and the growing body of scientific research on the issue.

2.2.1 (a) Climatic Change and Variability in the Past 10, 000 Years

The Earth is presently in an interglacial period or warm phase between two ice ages (Lamb, 1988). Ice core evidence has shown that for about the past 10, 000 years, the Earth has experienced a climate that has been abnormally benign and stable (White 1993; Dansgaard 1993; Broecker 1995; Calvin, 1998). This is despite the well-known potential for dramatic natural climatic variation on the Earth (Kellogg, 1985 as cited in: Glantz, 1988, Lamb, 1988; Calvin, 1998; Smit et al., 1997; Hamilton, 1999; Herrington et al., 1997). Natural climatic variability and change prevail on both temporal and spatial scales (Smithers and Smit, 1997; Smit et al., 1996). Temporal changes have been revealed in the ice core records which indicated rapid changes just prior to, or after ice age periods (White 1993; Dansgaard 1993; Broecker 1995; McDonough 1994), and during interglacial periods similar to contemporary times (White, 1993). In addition, other natural forces where the origins are geophysical (e.g. landforms, oceans), orbital, and solar, are also known to cause variations in global climate including the cyclical return of ice ages (Lamb, 1988). Changes in the composition of the atmosphere also cause climatic changes (Lamb, 1988; Herrington et al., 1997).

2.2.1 (b) Past Climate for the Canadian Prairies

Using mainly paleo-environmental records such as pollen and tree ring records, researchers have broadly established three post-glacial climates for the Prairie region (since about 18, 000 years ago), summarized by Herrington et al. (1997). The first period, prior to 9000 years before present (BP), was a time of rapid de-glaciation and rapid climatic change (based on limited data). The second climatic period occurred

approximately between 9000 and 6000 years BP. This period is known as the Hypsithermal, a time of increased temperatures and aridity in the Prairies.¹The third period occurred after about 6000 years BP in which other phases can be distinguished up to the present given more and better records. Overall, there was a trend towards probably cooler, and likely wetter conditions. The past millennium has experienced other climatic changes including the Medieval Warm Period that ended around the twelfth century and the Little Ice Age which followed.

2.2.2 (a) Recent Climate Changes in Canada and the Prairies

Instrumental records have indicated that average temperatures have warmed in Canada by about 1.0 to 1.5 degrees Celsius (greatest over the Northwest Territories) from the late 1880's to the 1990's. (Options Paper SIA, 1999). For the Prairie climatic region (including the RMBR) the average surface air temperatures have, on average, risen 0.9 degrees Celsius from 1895-1991 based on the 1951 to 1980 normal trend (Gullet and Skinner, 1992 in Herrington et al., 1997). For RMBR specifically, a discontinuous instrumental record (based on Wasagaming and Dauphin weather stations) has shown temperature fluctuations both above and below the 1961 to 1990 normal baseline; however, the curve has trended towards above normal temperatures since the 1980's (Hamilton, 1999).

¹ This period is believed to be a good historical analog for a doubled CO₂ climate scenario.

2.2.2 (b) Present Ecosystem and Climatic Character of RMBR

The RMBR region is comprised of two Ecozones. Firstly, the Boreal Plains Ecozone exists within RMNP as a small isolated island from the larger area to the north and west. It consists of both conifer and broadleaf forest stands. Within the Boreal Plains, RMNP is situated at the convergence of aspen-oak, aspen-spruce, and grassland communities (Francis, 1990b). Secondly, the Prairie Ecozone surrounds RMNP and consists of short and mixed grasslands and aspen parkland on a landscape of mostly plains with some rolling hills (Herrington et al., 1997). The RMBR region is currently classified as a Prairie or cold temperate climate that is characterized by cold winters and warm summers. Annual precipitation in this region is between 300 to 500 millimeters (Herrington et al., 1997).

2.3 Future Climate Change Predictions for Canada and the Prairies

Since most climate predictions are first created at the global scale, it is befitting to start with these predictions. Combined results from thirty-eight GCM scenario ensembles puts the current IPCC mean annual global surface temperature rise between 1.4 to 5.8 degrees Celsius by the year 2100 (IPCC, 2001a). On average, it is projected that surface air temperatures will rise by 1.6 degrees Celsius and precipitation increase by one percent by 2050 given a 'business as usual' scenario for greenhouse gas emissions (Bruce et al., 2000). Notwithstanding the many uncertainties associated with GCM predictions (IPCC, 1995a; IPCC, 2001a), the average rate of warming is anticipated to be greater than is currently known in the past 10, 000 years (IPCC, 1995a; IPCC, 2001a).

For Canada, the Canadian Centre for Climatic Modeling and Analysis (CCCma) has projected a 4 degree and 6 to 10 degree Celsius warming in summer and winter respectively, with varied precipitation changes for Canada (Bruce et al., 2000). Overall, a “solid body of scientific information suggests that future climate change will be real, significant, and potentially dangerous” (Hengeveld, 2000: 15).

The Prairies, including southern Manitoba and the RMBR, are expected to experience some of the more dramatic climate changes after about the year 2050. Table 2.1 provides a range of seasonal temperature and precipitation projections using three GCM scenarios. Instead of showing a mean value for each GCM and season, Table 2.1 provides the full range of temperature and precipitation changes that could result.

Winter and spring are modeled to bear the greatest increase in both temperature (up to 9 degrees Celsius) and precipitation (50% increase). Less marked rises in temperature are depicted for summer and fall, with both moderate decreases and increases in precipitation.

Table 2.1 Predicted seasonal precipitation (percent change) and temperature change (degree's Celsius) for the Prairie Climatic Region in a doubled CO₂ atmosphere using three GCM scenarios (generally expected to occur by the later half of the 21st century).

Season	Model	Temperature Range		Precipitation Range	
		Lower end	Higher end	Lower end	Higher end
Winter (DJF)	CCCma*	5.5	8.0	-10	35
	GFDL**	2.5	3.5	5	20
	GISS***	2.0	2.5	10	25
Spring (MAM)	CCC	5.0	9.0	20	50
	GFDL	2.5	3.0	5	15
	GISS	1.5	2.0	5	15
Summer (JJA)	CCC	3.5	5.5	-15	0
	GFDL	2.5	3.0	-15	10
	GISS	0.5	1.0	-10	15
Fall (SON)	CCC	2.5	3.5	0	30
	GFDL	3.5	4.0	-5	10
	GISS	1.5	2.5	-15	10

Source: Herrington et al. (1997:17)

Legend: *CCCma is the Canadian Centre for Climate Modeling and Analysis

**GFDL is Princeton University's Geophysical Fluid Dynamics Laboratory

*** GISS is NASA's Goddard Institute of Space Studies

2.3.1 Potential Climate Change Impacts to Prairie Agriculture

Agriculture is an important industry in the Canadian Prairies that is highly dependent upon weather and climate. Agriculture is therefore vulnerable to climate change and variability (Dolan et al., 2001), especially drought (e.g. Tyrchniewicz and Chiotti, 1997; Herrington et al., 1997; IPCC 2001b). Many of the most commonly anticipated biological and physical impacts of climate change to Prairie agriculture are listed in Table 2.2. This overview, based on GCM scenarios and other research, tend to show consensus in depicting increases in pests and plant diseases, temperature, evapotranspiration, growing

season, heating units, and precipitation, (slight increases for the most part especially in eastern regions).

Table 2.2 Potential biophysical impacts of climate change to Prairie agriculture

Potential Impacts of Climate Change	Supporting Authors
Increased evapotranspiration	Tyrchniewicz and Chiotti, 1997; Luciuk and O'Brien, 2000
Increased risk of soil erosion by wind/water	Tyrchniewicz and Chiotti, 1997; Wheaton, 1999
Increased growing season and heat units	Tyrchniewicz and Chiotti, 1997; Wheaton, 1999; IPCC, 2001b; Herrington et al., 1997; Mooney and Arthur, 1990
Increased drought frequency and severity	IPCC, 2001b ¹ ; Williams et al., 1988
Increased frequency and severity of floods	IPCC, 2001b-with El Nino events
Decreased soil moisture	Herrington et al., 1997; Tyrchniewicz and Chiotti, 1997
Increased insect pest and plant diseases	Wheaton, 1999; Herrington et al., 1997; Rosenberg, 1992
CO₂ fertilization to C3 crops (i.e. grass crops such as wheat and barley)	Tyrchniewicz and Chiotti, 1997; Mooney and Arthur, 1990; Luciuk and O'Brien, 2000; Helms et al., 1996; Rosenberg, 1992
Reduced crop yields	Wheaton, 1999; Tyrchniewicz and Chiotti, 1997
Reduced water quality And quantity	Tyrchniewicz and Chiotti, 1997; Wheaton, 1999; Wheaton, 1999; IPCC, 2001b; SIA Options Report, 1999
Decreased herbicide performance	Herrington et al., 1997

¹ The IPCC predictions are global based. However many of the impacts to agriculture are expected, with a higher level of certainty, to have larger effects on the middle and high latitude continental interior regions of North America, including the Canadian Prairies.

Overall decreases in soil moisture, water quality and quantity and herbicide performance are other possible impacts anticipated at this time. These potential impacts are pertinent to this research since grain and cattle production is the key economic engine and main lifestyle for citizens in the RMBR.

2.3.2 Climate Change Impacts to the Riding Mountain National Park Region

Since Riding Mountain National Park is situated within the Prairie climatic zone, the region will bear impacts from climate change similar to those predicted for other regions of the Prairies. The location of RMNP as an island of Boreal forest surrounded by Prairie and private agricultural lands makes the regions ecosystems and species particularly vulnerable to climate change due to the limited ability for migration outside the Park (Hui et al., 2000). A study on climate change impacts on all of Canada’s National Parks made use of finer scale GCM modeling to depict regional changes in climate. For the RMNP region, higher temperatures and lower precipitation are predicted for a doubled CO₂ scenario expected to occur near or after 2050 (see Table 2.3). Possible impacts of these climate changes include increases in the fire severity index and soil and water erosion (Scott and Suffling, 2000).

Table 2.3 Climate predictions from four GCM’s for RMNP with a doubled CO₂ scenario

Temperature Change (Celsius)		Precipitation Change (% change)	
Spring	+2.0 to +8.0	Spring	+4.0 to +26.0
Summer	+1.0 to +6.0	Summer	-29.0 to +18.0
Fall	+2.0 to +4.0	Fall	-7.0 to +24.0
Winter	+2.0 to +8.0	Winter	-9.0 to +14.0

(Source: Scott and Suffling, 2000: 73)

2.4 The Social Sciences, Climate Change and Need for PEO and Communication

Until recently, research on climate change has tended to focus upon the natural sciences dimension, analyzing the issue strictly as an environmental problem, often ignoring the more prevalent human dimensions (Cohen et al., 1998; Jaeger et al., 1993). Now the importance of social sciences, as it relates to climate variability and change, is growing among climate change researchers (Rayner and Malone, 1998a, b; Cohen et al., 1998).

As part of the research into the human dimensions of climate change, there is a growing awareness that the efforts to achieve sustainable development are inextricably linked with the climate change issue. Developing mitigation and adaptation strategies are thought to be key to taking effective action on the impacts of anthropogenic climate change, while concurrently make progress towards the larger goal of sustainable development (Cohen et al., 1998; Bach, 1994). In fact, future work on sustainable development has been recommended to be part of initiatives to solve the climate change issue (Mayer and Avis, 1998; Bach, 1994). However, research and discourses on climate change and sustainable development have taken separate paths up to this time (Cohen, et al., 1998). This has occurred despite the inability to separate the two issues as summarized by Nilsson (1993: 96):

The climate change issue in its long-term and global scope cannot be solved as an isolated problem: it is intimately linked to ozone depletion, acid rain, economic development, lifestyles, north-south conflicts, population, and resource management.

In addition to the expansion of climate change research into the social sciences there is a strong need at this time to enhance the quality and quantity of public education and communication programs. The need for public education and outreach on climate change has been given modest levels of attention through articles in international policy agreements such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (PEO Issue Table, 1998, 1999). At the Canadian level there is the PEO Issue Table (described below). There are also the scholarly research and implemented education and communication efforts by a variety of governmental and non-governmental organizations. Despite all these efforts, public understanding of the climate change issue has not improved adequately enough to enable responsible mitigative and adaptive behavior change or support for such changes.

Public education and outreach is required to improve awareness, knowledge and understanding on climate change, and to support and take appropriate mitigative and adaptive action (Herrington et al., 1997; PEO Issue Table, 1998, 1999). A key component of any PEO activity on climate change is effective communication (Popescul and O'Brien, 1999; Option Paper SIA, 1999; Andrey and Hachey, 1995). But has there been effective communication on climate change towards the adult general public? Or is this one of many deficits of PEO and communication work thus far? After reviewing the literature, it would appear that the lack of understanding among the lay public on the climate change issue and paucity of comprehensive and effective PEO and communication programs necessitate additional applied research. Without effective communications embedded as part of a PEO strategy, the general public will likely not

regard climate change as an important environmental issue, and subsequently will not become fully engaged, informed on the issue, and empowered to take appropriate action.

2.5 The Need to Communicate the Issue of Natural Climatic Change

While the emphasis of this research is climate change communications, rather than the study of natural climatic variability, there is nonetheless a linkage between the two issues. Understanding natural climate change and variability facilitates a broader comprehension of the entire climate change issue as it relates to human activities and behavior. Morehouse (2000) argues that communicating the geophysical or natural aspects of climate change is important for creating a foundation for improved regional and local scale information on long-term climate change. There is also the need to communicate the comparison of historical changes in climate, rapid fluxes and thresholds to projected human caused changes (Gilmore, 2000). As seen below, these issues have a great deal of relevance for those in the study region.

2.5.1 The Need for Climate Change Communications in the Agricultural Industry

The producers and those affiliated with the agricultural industry are key stakeholders within the RMBR. This is an important target group to educate on climate change since producers continuously cope with and are impacted by changing environmental conditions. In fact, agriculture is already known to be vulnerable or impacted by natural climate variability and change (Rosenberg, 1992; Smit et al., 1996; Luciuk and O'Brien, 2000; Tyrchniewicz and Chiotti, 1997). For example, the droughts of the 1930's and 1980's demonstrate the sensitivity of the Prairies to severe moisture deficits

(Tyrchniewicz and Chiotti, 1997). It has been roughly estimated that agricultural adaptation to current natural climatic conditions and inherent variability costs Canada over \$1.3 billion, a value that is anticipated to increase with future climate change (Herbert and Burton, 1995).

Communicating the issue of climate change to farmers as part of a public education program is additionally important since the agricultural industry is anticipated to bear large impacts from human induced climate change in the Canadian Prairies (see Table 2.2). Given the current economic costs of climate change and variability, and potential impacts in the future, it would seem prudent to understand both natural and human induced climate change. Such an understanding could enable concurrent modifications that limit agricultural vulnerability to the impacts of all climate and associated environmental change.

Despite the extensive quantity of research on the physical impacts of climate change on agriculture, there is a lack of findings regarding the perspectives and understanding farmers maintain about anthropogenic climate change. Little is known about how producers make changes to their operations in response to current environmental change (Smit et al., 1996). Much of the research related to climate change and agriculture has concentrated on the physical impacts to crop yields and other similar aspects (e.g. Smit et al., 2000; Wheaton, 1999; Mooney and Arthur, 1990), adapting to climate change in agriculture (e.g. Smit et al., 1996; Chiotti, 1995; Dolan et al., 2001; Wheaton and Maciver, 1999), and mitigating greenhouse gases (Agriculture Issue Table, 2000). This

reveals a large research void understanding producers' perspectives on the climate change issue, and, more over, in delivering and evaluating climate change communications at the local level. Farmers and others associated with the agricultural industry in the Prairies, including the RMBR, will need to know what the potential impacts of climate change will be, and how to undertake mitigative and adaptive responses.

2.6 Barriers to Effective Climate Change Communications

Determining barriers to public education, outreach and communication on the climate change issue is important for improving the effectiveness of a program, and in stimulating local grassroots and community action (PEO Issue Table, 1998). Therefore, the barriers to communicating the issue of climate change with the general public are first reviewed. Then the limited literature on the barriers related to farmers and the agricultural industry is reviewed.

First, on a national scale, public opinion surveys and other studies compiled by the PEO Issue Table (1999) explored the barriers to effective climate change communication.

Characteristics of less effective communication methods are summarized as follows:

- Science and future scenarios information that is “too woolly,” “too equivocal,” or “too uncertain” don’t promote much public concern.
- Referring to the Kyoto target and related details is ineffective as people are unaware of these events and the language is not strong or clear enough.
- Promoting a strong reliance upon renewable energy sources given that people think that the technology is not developed sufficiently to replace existing sources.
- Focussing on the “long-term legacy aspects” of climate change, since families are people’s general frame of reference.

Andrey and Hachey (1995) explored the nature and quality of climate change communications in the Great Lakes Basin, with an emphasis on Ontario. Included in their findings were eight key challenges regarding global climate change communication with the general public. These challenges are summarized below in Table 2.4.

Table 2.4 Communication challenges to global climate change

Communication Challenge	Description
1) General public is not well informed	Despite surveys that indicate increased awareness, a general lack of understanding remains as the link between climate change and human activities is elusive to most of the public
2) Problematic language of climate change	Climate change is communicated as probabilities/potential impacts and responses as real uncertainties. People don't understand these notions, especially probabilities, and the media and public construe them as facts.
3) Credibility problem	There are three main challenges: 1) Like weather, climate is perceived as non-static; 2) Scientific debate of climate change & environmental risk is overstated mainly by media; and, 3) People in mid-latitudes are optimistic about a warmer climate.
4) Lack of urgency	Climate change lacks risk salience; the impacts are spread out, indirectly, and to no one individual. Public perceptions illustrate this as environmental issues rank low on the list of public concerns.
5) Sense of helplessness of scale and complexity	Global scale of the problem engenders a sense of helplessness for an individual-how can he/she possibly make a difference? Therefore, people seek national governments to address the issue.
6) More important issues of the day	Socio-economic and political issues are the main public concern. Other environmental concerns, e.g. water pollution and ozone depletion take precedence over climate change. There are also concerns over the economic repercussions of mitigation efforts related to climate change.
7) Individual action won't make a difference	A tragedy of the commons dilemma. Individual actions cannot make a difference to the cumulative global impacts to climate change. Individual change is also perceived to be a costly and insurmountable barrier.
8) Mitigation and adaptation efforts require cooperation among all involved	Nations, stakeholders, sectors will need to cooperate in an unprecedented fashion to enable effective action in response to climate change.

Source: Andrey and Hachey (1995: 10-12)

Given the diverse range of challenges, the remaining review groups these barriers within the categories identified by Andrey and Hachey (1995).

1. The General Public is Not Well Informed

An uninformed public¹ represents a formidable challenge to climate change education and communication efforts. This lack of public knowledge and understanding on climate change has been revealed by many other researchers (e.g. Bostrum et al., 1994; Read et al., 1994; Wittrock, 1999; PEO Issue Table 1998, 1999; Popescul and O'Brien, 1999; Kearney, 1994; Mortsch et al., 2000; Chalecki, 2000; Jasanoff and Wynne, 1998a; Thompson and Rayner, 1998a). Among the studies, the most common manifestation of an uninformed general public is the strong confusion and misconceptions between stratospheric ozone depletion, the greenhouse effect, and climate change, and between weather and climate. Ironically, this lack of understanding and misconception about climate change exist at a time when opinion polls in Canada (Greenpeace, 2001; Pollara, 1998) and the United States (Krosnick and Visser, 1997; Thompson and Rayner, 1998a) have consistently shown public concern and support for action on the environment and climate change. The public confusion and resultant lack of understanding on climate change has also been attributed to ineffective communication skills among scientists and misinformation presented by contrarians (McBean, 2000).

Gilmore (2000) attributes the low public understanding of climate change to seven sensory-based illusions that act as barriers to oral and written climate change communications. Peoples' physical senses and learned understanding of the environment

¹ The terms 'public' and 'general public' should be interpreted to refer to the same audience, namely, the general public at large, also known as the 'lay.'

result in the creation of seven erroneous concepts. These concepts are: a vast atmosphere; projected climate changes will appear “innocuous” compared to current natural weather variability; temperature changes will be gradual; warming is not bad; past environmental blunders have been solved; technology will fix the problem; and, a tragedy of the commons dilemma.

The fact that the public has to a large extent been excluded from the process of developing both the federal (NCCIS) and Manitoba response to climate change likely contributes to their lack of knowledge and understanding. Diduck et al. (2000) explored the barriers to public participation by comparing an environmental assessment case in Brandon, Manitoba to the issue of climate change using a local ENGO initiative. The authors found that public lack of understanding on climate change is one of many potential constraints to public involvement. In developing a provincial strategy, the Manitoba Task Force on Climate change has provided some opportunities for public input. However, there was very limited notice given, and, moreover, inadequate time and available venues for personal submissions, especially from rural residents like those in the RMBR. This low level of public involvement in assessing the information needs of various audiences and informing the public on the issue of climate change may tend to perpetuate lack of understanding on the issue. This results in a cycle of positive reinforcement, where the lack of public involvement promotes low understanding of the climate change issue, and lack of understanding is a formidable barrier to participation. More research is needed on the issue of public involvement and climate change PEO and communication.

2. Problematic Language of Climate Change

Problematic language in terms of communicating climate change information has been discussed by other authors, particularly when experts discuss the uncertain nature of climate data and predictions (Dotto, 2000; Andrey and Mortsch, 2000¹; Socci, 2000; Fischhoff, 1995). The technical vocabulary of specific scientific research also results in “incomprehensible” or overly technical research papers for the public (Chalecki, 2000).

The abstract, large-scale, and indirectly experienced nature of the climate change issue contribute to the ineffectiveness of textual communications aimed at mitigation (Kearney, 1994). In addition, when communicating for improved awareness and subsequent behavior change, these constraints are compounded by internal cognitive difficulties, namely, the inability of the human brain to process and store information, such as written documents and newspapers. This is due to the selectivity of stored information, and the decision-making changes caused by personal experiences, perceptions, and overall knowledge of climate change.

There are other cognitive and perception issues that create a language barrier. Nilsson (1993) notes that the cognitive constraints and basic beliefs about nature influence individual perception of climate change. Halford and Sheehan (1991) suggest that since there is no experiential base for learning about climate change, and, given the abstract

¹ This article is first of many printed in an International Climate Change Communication Conference Proceedings which can be ordered by phone at: 1-800-668-6767, by e-mail at: enviroinfo@ec.gc.ca or downloaded as a PFF file from: www1.tor.ec.gc.ca/airg

nature of the issue, we are forced to receive information from artificial sources, mainly from the media, where other constraints arise (see below).

3. Credibility Problem

The first of the three credibility problems addressed by Andrey and Hackey (1995) maintains that belief systems are inter-linked with personal life experiences and that current climate is perceived to be non-static. However, Lamb (1988) does not share the latter view. Rather, he views the attitudes and awareness of western society to climate as notoriously fickle but notes the public's general tendency to believe that climate is inherently benign and that any anomalies that occur will stabilize back to the climatic norm. Kempton (1997) adds that public misconceptions about climate change arise from the pre-existing cultural models or worldviews people hold (e.g. pollution, ozone depletion) with respect to environmental issues.

Regarding the second challenge in Table 2.4, the authors suggest that the role of the media in creating or perpetuating the credibility problem by overstating the debate on the climate change issue is a constraint to effective public education and communication.

While Popescul and O'Brien (1995) have previously reported that the media lack knowledge on the climate change issue, Meisner's (2000) analysis of 1999-2000 American print media concluded that the mainstream media now accept the reality of human-induced global warming. Yet, Meisner argues that they construct the problem as an economic, technical, and anthropocentric issue, while neglecting the eco-centric aspects.

Given the prominence of the mass media as the primary instrument in which the public receives environmental information, they are justifiably the focus of considerable criticism from researchers. Despite our reliance upon the media for climate change information, the message conveyed is clearly confusing to the public from a risk communication perspective (Good, 2000; Halford and Sheehan, 1991). This confusion has been attributed to vested interests in media coverage, and their emphasis upon drama, conflict and human interest in their stories (Halford and Sheehan, 1991). The media have also been purported to exploit environmental issues such as climate change by being dramatic and creating sensationalism for the benefit of ratings, sales, and institutional competitiveness (McComas and Shanahan, 1999). Andrey and Mortsch (2000) indicate that this credibility barrier is deepened when the media give equal coverage in their stories on the uncertain aspects of climate change despite the discernable evidence of human influences upon the climate system, the seriousness of the impacts, and benefits of responses. This issue also creates a language barrier as described above. The ‘balanced’ media coverage makes it appear that scientists disagree on the issue of climate change, which then permeates it as a minimal or non-existent problem to the public (Dotto, 2000). From a scientists’ perspective, the media gives balance to a story, while science uses uncertainty, creating a parting of the two principle communicators (Socci, 2000).

Good (2000) provides another view to the media-public communication challenge, emphasizing a “social interaction” or social network perspective in how the public processes climate change information. The key is therefore “how people understand what they are experiencing.” (p. B2-28). As such, “defining the risk of climate change is a less

tangible exercise” for the media than other environmental issues such as air pollution caused by a visible plume of smoke from a factory stack (p. B2-28-29). Perhaps an overlying issue over all media derived constraints to communications is how the media construct the climate change issue with regard to the issue-attention cycle and socio-cultural factors described by McComas and Shanahan (1999).

Regarding the third credibility challenge listed in Table 2.4, Andrey and Hackey (1995) also argue that people in the mid-latitudes are actually optimistic about a warmer climate and that all environmental risks are overstated. This first phenomenon is readily observed in Winnipeg during the winter and spring when both the general public and the mass media appear to relish exceedingly balmy temperatures when cold weather is the norm.

4. Lack of Urgency

The lack of urgency described by Andrey and Hachey (1995) underscores the paucity of impending risk perceived by the public on the climate change issue, and the endless list of other issues that are discerned to have more importance. To this end, Ungar (2000) argues that there are no “ready made popular cultural metaphors” that provide easy mechanisms for understanding climate change in a way that the stratospheric ozone hole and skin cancer risk issue were made topical through popular culture outlets such as the print media.

5. Sense of Helplessness of the Scale and Complexity of the Issue

Andrey and Hachey (1995) note that the complexity of the issue causes individuals to believe there is nothing that can be done. According to Popescul and O'Brien (1999), public indifference on the issue of climate change is one of many impediments to communications.

6. More Important Issues of the Day

Pertaining to the ongoing reality of more important issues facing the public, Ungar (2000) has argued that the 'information society', namely, the explosion of scientific and technical knowledge has created a "knowledge-ignorance paradox" where more available information has caused a rapid, but natural increase in public ignorance in issues such as climate change.

7. Individual Action Won't Make a Difference

This challenge appears to expand upon the sense of helplessness issue. The authors argue that because of the tragedy of the commons dilemma climate change creates, it would be unwise or irrational and costly on an individual basis to attempt mitigative actions.

8. Mitigation and Adaptation Efforts Require Cooperation Among All Involved

Bray (2000) argues that a "bottle neck" currently exists in the effort to communicate the geophysical aspects of climate change to the social sciences. Bray also notes the need for cooperation and integration when transforming the science information into the social and policy contexts. To this end, Chalecki (2000) has discussed the complexity of the

climate change effects framework and feedback loops, and the lack of scientific research into fourth order or social consequences of climate change as a partial cause of the scientist-public information gap.

2.6.1 Barriers to Communicating Climate Change Information with Farmers

The barriers to communications described above are not specific to any audience or stakeholder group, but pertain to the public at large, including those in the agricultural sector and others living in the RMBR. Since the agricultural industry, and specifically farmers, are profoundly affected by current environmental factors such as weather and climate, and are expected to be impacted by anthropogenic climate change, it would seem beneficial to develop a deeper appreciation of the constraints to disseminating climate change information to these stakeholders. However, a deficiency of such knowledge exists with these stakeholders on the climate change issue.

Preliminary research by Smit et al. (2000) argues that communication of climate change information to the agricultural industry tends to contain three characteristics that diminish the immediacy and importance of the issue:

- 1) Information is presented as average temperatures;
- 2) There a communication focus upon the physical impacts of climate change; and,
- 3) There is an underlying assumption that farmers will be able to adapt.

2.7 Climate Change Communications in Canada

Following the increased public awareness of climate change in the late 1980's and particularly following Canada's signing of the Kyoto Protocol in 1998, the

communication of climate change information has increased among governmental, environmental non-governmental organizations (ENGO's), and sectoral groups in Canada. Most general public programs have focussed upon science-based PEO programs using the internet, educational institutions, brochures, radio and limited TV usage (PEO Issue Table, 1998). Popescul and O'Brien (1999:6) provide an extensive list of climate change communication tools:

Meetings, workshops; conferences; newsletters; advertising; direct mail; websites; toll-free lines; news releases; media briefings; climate change awareness kits; teacher support programs; videos; resource kits; radio announcements; public service announcements; posters; displays; radio talk shows; newspaper articles; community forums; classroom presentations.

2.7.1 Public Education and Outreach (PEO) Issue Table

The PEO Foundation Paper

The Foundation Paper (1998) assessed over thirty Canadian and other international outreach initiatives and case studies from a wide range of governmental, business, environmental, and community members. Key findings of the Foundation Paper conclude that there is a high awareness and concern among Canadians towards climate change.

However, there is a large gap in understanding the issue and what mitigative and adaptive actions will be required. The Paper underscored the need for public outreach to promote Canadian understanding, support, and action on climate change, and importance of promoting behavior changes by identifying and surmounting barriers. The Paper outlined key program guidelines and recommendations including an emphasized need to evaluate community based programs and pass successful strategy components to other areas.

The PEO Outreach Strategy

From the findings of the Foundation Paper the PEO Issue Table issued the PEO Strategy Report in 1999. The goal of the strategy is to facilitate the progression of both Canadian society and key sectors from “key audiences” to “key players” with the objective of reducing green house gas production. There are three fundamental objectives of the PEO strategy:

1. Build Canadian’s awareness and understanding on the potential impacts of climate change, and the related environmental, economic, and social issues;
2. Develop support from Canadians to promote policy changes and actions regarding the NCCIS; and,
3. Motivate Canadians to take personal actions to reduce greenhouse gases.

Lessons learned and recommended approaches regarding successful or effective PEO campaigns on climate change and other environmental issues were presented in the Options Paper. As a result, many PEO efforts, such as media campaigns, posters, workshops, websites, brochures using a variety of approaches have been implemented through the PEO Issue Table (Government of Canada, 2001). One recommendation of the Options Report that is being implemented in Manitoba, and across Canada, is regional and local pilot PEO Hubs or Centers where provincial or territorial based activities and programs are to be coordinated and implemented (Government of Canada, 2001).

2.8 Recent Climate Change Communications in Canada and the RMBR

Aside from mass media outlets and the 1991 Russell workshop outlined below, climate change communications in the RMBR has been limited to informal discussion in some

RMNP interpretation programs (Kingdon, 2001 *pers comm*). Below are samples of main communication methods used in Canada and specifically in the RMBR.

1. Workshops

Workshops have been a common way to conduct PEO and communication activities on climate change in Canada with various adult audiences, including the general public.

However, since climate change is still a relatively new environmental issue, many workshops have, up to this time, been directed towards the policy, research and academic communities, presumably to enable these stakeholders to become informed on the issue, initiate collaboration, and discuss future options. Figure 2.1 summarizes a sampling of workshops that have occurred in Canada, most of which were co-supported by the federal government's Climate Change Action Fund. While these workshops targeted the adult population, targeted audiences were often organized community, sectoral, or business groups rather than the general population.

For the RMBR, A one-day climate change workshop took place in Russell, just west of RMNP in 1991. The workshop included information about climate change science, and human caused global warming, as well as an iconoclastic presentation on the issue including the natural causes of climate change. (Whitaker, 2000 *pers comm*).

2. The Mass Media (Newspapers, Television and radio news, etc.)

The mass media are the main avenue in which the general public receives climate change information in North America (Meisner, 2000; Halford and Sheehan, 1991; McComas and Shanahan, 1999).

Workshop Organizer	Targeted Audience	Description of Activities
Clean Nova Scotia	Community Groups and individuals	“Climate Change 2000” intended to increase knowledge and understanding of the issue and how to deliver local programs
The Saskatchewan Regional Council	Resource sectors, local, provincial governments of Prairies	Pilot workshop to improve understanding on the issue of climate change and its socioeconomic, environmental, and human health impacts
B.C. Energy Aware Committee	Municipalities in British Columbia	Workshops to assisted communities realize opportunities for combining energy planning with community development
Energy Council of Canada	Public in the workplace	“Action By Canadians on Climate Change” is a national public education and mitigative action program
Call Canada 99	Local representatives and leaders from rural regions in Canada	A nation wide “Train the Trainer” program to deliver information sessions on climate change to transfer information on the risks, threats and opportunities to their own communities
Vivre en ville	General Public	Colloquium aimed at raising awareness of the linkages among climate change and sustainable development; exploring barrier to behavior change and their solutions
Clean Air Strategic Alliance (CASA)- Alberta ENGO*	Communities and general public in central Alberta	Six two-hour workshops on topics including climate science, human influences, mitigation techniques and consumer behavior
International Institute for Sustainable Development (IISD)**	Farmers, farm groups in the south and west regions of Agro-Manitoba	Several workshops on the impacts of climate change on agriculture and potential mitigation strategies

Source: modified from Government of Canada (2000b)

*Source: Gendre (2000)

**Source: Tyrchniewicz (2001 *pers comm*)

Figure 2.1 Sample of Public Oriented Climate Change Workshops in Canada

This is later found to be the case for the RMBR region as well. Mainstream media coverage on climate change began in the late 1980’s during the period of drought and heat waves in many parts of North America.

Since then, mass media coverage on the issue of climate change has been given considerable investigation (e.g. Shanahan, 2000; Brossard et al., 2000; Meisner, 2000; McComas and Shanahan, 1999). Often times the media are not favorably critiqued (see Halford and Sheehan, 1991; Blair, 2001; Meisner, 2000).

Some actual or potential climate change communication outlets within the RMBR are reviewed below:

Newspapers

Local newspapers are widely read and are published in many communities within the RMBR, many of which are published on a bi-weekly or monthly basis. The Brandon Sun and The Dauphin Herald are the two daily papers available south and north of the park respectively. The Dauphin Herald is a large daily newspaper serving the region north of the park with a circulation of about ten thousand. Other less frequently published newspapers in the region include: *The Shopper* (put out by the Dauphin Herald), *The Rossburn Review*, *The Shoal Lake Star*, *The Russell Banner*, *The Crossroads*, The Minnedosa Tribune, Nepawa Banner, and *The Manitoba Co-operator* (a paper for the agricultural industry available in all of Agro-Manitoba).

While there has certainly been at least some local newspaper coverage on the issue of climate change in the past several years, the extent or quality of the coverage in the RMBR is not known. For Manitoba, perhaps the most prominent coverage occurred in the Winnipeg Free Press on January 11, 2001 following a Clean Environment

Commission workshop (Winnipeg Free Press, 2001). The front-page article entitled “*In the year 2030*” depicted future potential impacts of climate change using a regional analogy scenario. Due to promotional efforts associated with this project, an article on climate change and the *Community Climate Change Workshop* was printed in the *Brandon Sun* on February 13 (Beam, 2001).¹ Another article was printed in the *Crossroads* newspaper on February 10, 2001 (Crossroads, 2001). This syndicated editorial was also seen in the Winnipeg Free Press on January 27. This editorial gave a cynical view of human induced climate change arguing that little warming has occurred in the past century.

Radio and Television

Television is a powerful medium for communicating information on such a complex issue such as climate change (Halford and Sheehan, 1991). In the RMBR, a Brandon Television station serves the southern area. In addition, most, if not nearly all people have access to basic television stations such as the Canadian Broadcasting Corporation. As for local radio, there are stations in Brandon and in Dauphin that reach the RMBR region. While the quantity or quality of coverage is unknown, there have no doubt been at least some climate change information given out through local radio and TV media and programming.

¹ See Appendix B for a copy of the Brandon Sun article.

3. Internet Websites on Climate Change

As more Canadians are gaining access to the Internet, websites are growing as a primary vehicle for communicating climate change information to the general public. The federal government has many sites containing an extensive amount of information on all issues of climate change, with links to many other sites. The Global Climate Change Program (GCCP) (www.climatechange.gc.ca) is the principle federal site. Others sites include the National Climate Change process (www.nccp.ca), Environment Canada (www.eg.ca), and Natural Resources Canada (www.NRCan.ca). The Canadian Institute of Climate Studies provide information on Global Circulation Model scenarios (see www.uvictoria.cics.ca).

Websites often contain lengthy, and sometimes technical reports and documents (Andrey and Hackey, 1995), but also some easy to read fact-sheets and publications targeted for general reading. The public can also download many larger publications and reports including those from the Canada Country Study and the sixteen Issue Tables. The International Institute for Sustainable Development (IISD) (located at: www.iisd.ca) is one site that maintains comprehensive but sometimes technical and lengthy documents, reports and other relevant information on the national and international policy aspects of climate change. There are also numerous ENGO websites such as Greenpeace, Friends of the Earth, The Pembina Institute. These sites tend to contain comprehensive but more action oriented communications (Andrey and Hackey, 1995).

Those who have Internet access in the RMBR are able to access the climate change

information contained in all the websites listed above, as well as hundreds of other sites containing climate change information. There is also access to mass media information in print form on the Internet. However, Internet access in the RMBR region is not believed to be high, nor is it speculated that people who do have Internet access in this area are readily accessing climate change information (Toombs, 1999). Even those who do have it in some portions of Agro-Manitoba, have been found to use it infrequently. This is true even for highly pertinent weather information (Toombs, 1999).

4. Posters

A poster entitled “*Winds of Change: Climate Change in the Prairie Provinces*” (see Figure 2.2) is one of a series of six regional posters compiled by the government of Canada to communicate the issue of climate change to the general public and other audiences (EAS, 2000).¹ The 90 x 150 cm poster consists of several sections including climate cycles, variability, the impacts of the greenhouse effect and global warming on key sectors and resources.

5. Government Documents and Mass Mail-outs

Governments, ENGO’s and other groups have created countless pamphlets, brochures, information sheets and kits, publications, and other printed documents on climate change.

¹ This and all regional posters can also be viewed more clearly on the Internet and ordered at the following site: <http://pages.InfiniT.net/permadtd/prairies3.htm>. Or call Toll Free: 1-888-252-4301 or order the poster(s) online from: gsc_bookstore@gsc.nrcan.gc.ca

Many of the federal government materials can be ordered free of charge by telephone or e-mail order.¹ There is also the federal Global Climate Change information package that contains an Office of Energy Efficiency order form.²

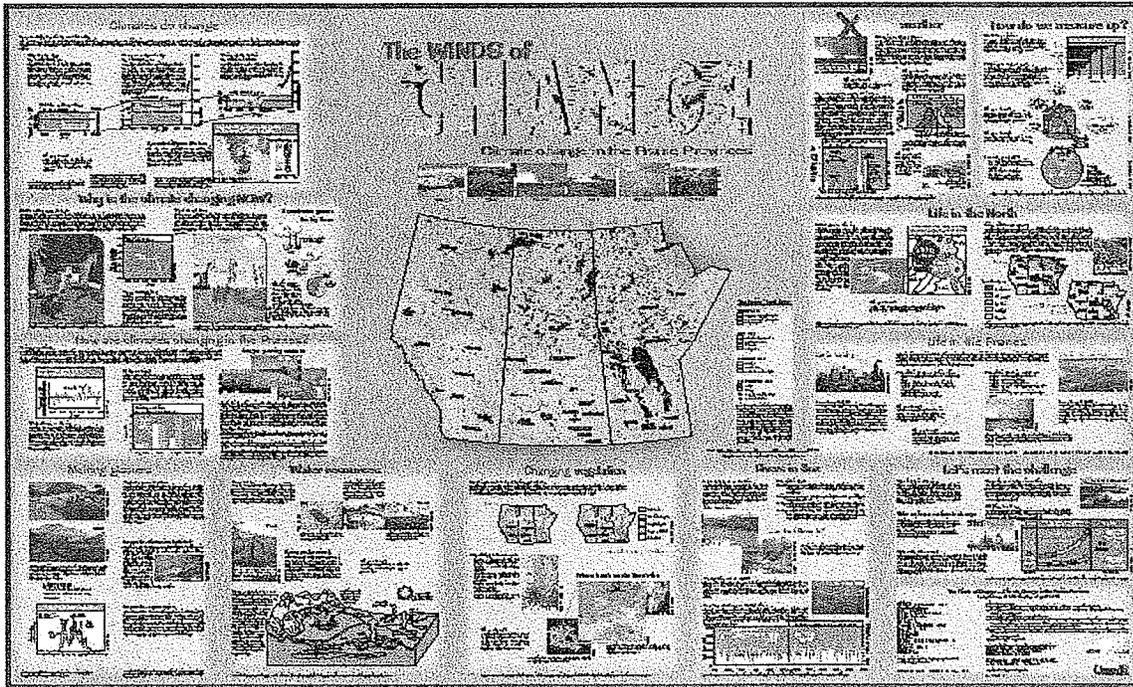


Figure 2.2 Winds of Change Poster (Source: EAS, 2000)

The largest available publication set in the multi-volume Canada Country Study that includes abundant scientific textual information on climate change science, impacts and adaptation for the Prairies (see Herrington et al., 1997).

¹ Go to: www.climatechange.ca or call 1-800-387-2000 for more information

² Call Toll Free: 1-800-387-2000 to receive the package

As part of the federal effort of climate change PEO, a four page supplement entitled “*Our Climate is Changing: Its Time to Act!*” was prepared by the Global Climate Change Program (1999)¹. Seven million copies were sent out through daily and community newspapers in the fall of 1999. The poster-like supplement consists of a broad-based, easy to read primer on the issue of global warming, giving examples of ongoing governmental led actions and initiatives to mitigate greenhouse gases and including examples of how the average citizen can take action (Government of Canada, 2001).

6. Novels, Stories, Books and Narratives

Textual information on climate change has, to a limited extent, been communicated to many audiences, including the general public, using a story-like or narrative format. This form of communication has been used in public oriented informational books (e.g. Wheaton, 1998; Schneider, 1990), novels (Wright, 1997), occasionally in newspaper articles (e.g. Winnipeg Free Press, 2001), and rarely in journal articles (see Meisner, 2000). In all mediums in which the story or narrative form is used, the information is usually presented in a more comprehensible, interesting and engaging format compared to many journal articles, reports and publications which often contain technical, intensive and disengaging text.

Steven Schneider (1990) wrote a lay-oriented book on global warming taking a more American and global perspective. Canadian author Ronald Wright wrote of a time traveler who finds himself in a tropical jungle while searching for a cure to his terminal

¹ To order this information supplement or for more information call 1-800-622-6232

illness in the year 2500 England in his best selling book *A Scientific Romance* (Wright, 1997). In her 1998 book *But It's A Dry Cold!* Elaine Wheaton provides a Prairie perspective to weather and climate. She includes a narrative, story-like setting when she depicts what Saskatchewan could be like in the year 2040 in a global warming scenario.

2.9 Climate Change Communication Evaluations

Many researchers and practitioners advocate evaluating PEO and communication efforts on climate change (see Andrey and Hackey, 1995; PEO Issue Table, 1998, 1999; Good, 2000; Popescul and O'Brien, 1999; Wilson, 2000; Iribarne et al., 2000). Despite this documented requirement to evaluate climate change programs, formal evaluations appear to be an uncommon practice (PEO Issue Table, 1998, 1999; Andrey and Hackey, 1995; Andrey, 2000, *pers comm*). In Canada most results monitoring of public education and outreach programs on climate change have at most employed public opinion polling (PEO Issue Table, 1998). However, as part of future PEO, an "Evaluation Framework" has been suggested by the PEO Issue Table (1999) for determining the effectiveness of regional and local PEO hubs across Canada.

The Clean Air Strategic Alliance (CASA) climate change workshops in Alberta (described earlier) included a post-evaluative survey following each of the six two hour sessions. The surveys queried participants about the workshop, their interest in the subject, and the effectiveness of the workshop information, presenters and activities (Gendre, 2000). Results from the workshops in Vegreville indicate that the participants attended mainly to learn more about the issue given their concern over the environment,

and to save money. The participants also thought that the information, activities and the presenters were generally effective or very effective. The participants also enjoyed the presentations provided by speakers and the hands on activities.

A far more in-depth communication evaluation was undertaken by Andrey and Hackey (1995). The authors first identified five dominant characteristics of global climate change that challenge communications. They are:

- Global climate change is a relatively new environmental issue;
- Global climate change is fraught with uncertainties
- The complexities of the issue are enormous;
- Effects will occur in the future and over long time scales; and,
- There are no easy solutions.

Evaluations of select climate change communication programs were undertaken using nineteen guidelines identified specifically for this study (see Figure 2.3, p. 44). Telephone surveys with over 100 agencies, including case studies of three agencies significantly engaged in climate change communications (Greenpeace, Friends of the Earth, and the United Church of Canada) were selected for evaluation. Key results from the evaluations are as follows:

- The GCCP and other federal communications are generally information intensive aimed towards a wide array of publics including adult learners.
- Provincial governmental agencies played a minor role in communications.
- Communication efforts from ENGO's are mainly action-oriented.
- The scope and quality of communications have improved recently.

- Government and scientific communications target for improved awareness and understanding of global climate change. This information is often long and technical.
- ENGO material use short brochures that outline the climate change problem and give examples of the benefits of individual action; i.e. aim for behavior changes.

2.10 Suggestions for Communicating Climate Change with the General Public

The Public Education and Outreach Issue Table (1998: 53) has summarized that

“Communication campaigns will need to provide simple balanced messages consistently and over the long term.” Other findings of the table based on case studies of previous environmental education programs (1998: 39) reveal that effective communications invoking action at the community level consist of the following themes:

- Personal communications one on one or directly with a local group work best
- Reiteration of the same information
- Effective networking among the environmental/NGO movement
- Positive and personal strategies and actions need to be included
- Creativity and consistency are key to effectiveness

According to the PEO Issue Table (1999: 9), to advocate increased awareness and knowledge of the climate change issue; support for policy change, and mitigative action among the general public, a broad public-targeted approach using “national branded, mass media advertising and promotion” will promote engagement in climate change opportunities, setting a “social climate” that encourages action and establishes a new “attitudinal and behavioral norm.”

The nineteen broad, public-oriented communication guidelines for global climate change developed by Andrey and Hackey (1995) provide the most inclusive list found to date (see Figure 2.3 below). Given the comprehensive nature of these guidelines, they serve as a benchmark or organizational framework for communication suggestions given by other researchers on the climate change issue. Therefore, as done earlier with the barriers to climate change communications, a description of each guideline will be briefly elaborated upon first by the above report authors. Then meaningful input by other researchers and disciplines will be given including risk communication, cognitive psychology, sociology and environmental education. However, to limit the quantity of the literature review, only the guidelines that are considered highly relevant to this research will be given further elaboration in this chapter. A description of the remaining guidelines can be found in Appendix C.

1. Devote More Resources to Communications

First and foremost, there needs to be a shift in emphasis from science research to action. To enable action, more and better communications are required (see also Socci, 2000). While PEO activities have been carried out to some extent through public opinion polls, the PEO Issue table research, and various local initiatives (e.g. Resource Conservation Manitoba's mitigation education efforts), there has not been enough done to reach the mainstream public, including those in the RMBR.

Communication guideline	Concurring Authors
1) Devote more resources to communication	Fishhoff (1995); Lofstedt, (1995); Soggi (2000); IPCC (1995b)
2) Carefully define communication goals	Popescul and O'Brien (1999); Wittrock (1999); Fishhoff (1995); Rowan (1994); CCME (2000); PEO Issue Table (1998)
3) Identify and characterize the targeted audiences. Identify existing biases, perceptions, values, belief systems and knowledge base.	PEO Issue Table (1998); Popescul and O'Brien (1999); Kearney (1994); Lofstedt (1995); Iribarne et al (2000); Halford and Sheehan (1991); PEO Issue Table (1998); Kempton (1997); Wilson (2000)
4) Have informed and committed front lines workers	PEO Issue Table (1999)
5) Work on improving the credibility of communicators	Wittrock (1999); Fishhoff (1995); Bostrum et al. (1994); PEO Issue Table (1998)
6) Develop communications partnerships and work with them	Wittrock (1999); Fishhoff (1995) PEO Issue Table (1998, 1999)
7) Ensure that communication is not just one-way	Bray-Palmer (2000); see West et al. (1988); PEO Issue Table (1999)
8) Do not trivialize the communication challenge	Kearney (1994); PEO Issue Table (1998)
9) Take lessons from other fields and evaluate risk communication efforts	PEO Issue Table (1998, 1999); Strong (2000); Good (2000); Andrey and Mortesch (2000); Popescul and O'Brien (1999); Wilson (2000); Fishhoff (1995)
10) Capitalize on opportunities to piggyback the climate change issue on other environmental and social issues	Popescul and O'Brien (1999); Strong (2000); Wilson (2000)
11) Be careful about the choice of language	Soggi (2000); Andrey and Mortsch (2000); Kearney (1994); Kempton (1997); PEO Issue Table (1998)
12) Break down the complex message onto components and build the knowledge base one step at a time	Read et al. (1994); McBean (2000); Kempton (1997); CCME (2000)
13) Be proactive and open about the uncertainties	Fishhoff (1995)
14) Use analogs, parables, comparisons, examples and indexes in an appropriate way that increases understanding	Read et al. (1994); PEO Issue Table (1998, 1999); Kearney (1994); Wheaton (1998); Schneider (1990); Halford and Sheehan (1991); Glantz (1991)
15) Capitalize on situational opportunities.	
16) Focus on actions. Concentrate on what can be done for different groups.	Wittrock (1999); Wilson (2000); Strong (2000); PEO Issue Table (1998, 1999); Kempton (1997)
17) Focus on three different types of action: investment, management, and reduction	PEO Issue Table, (1998 and 1999)
18) Consider proposed actions from the perspective of activities of various stakeholder groups. Do not expect communication alone to solve/resolve problems/conflicts	Fisher et al. (2000); Welling et al. (2000)
19) Do not be weary of ethical /justice issues.	PEO Issue Table (1998)

Source modified from Andrey and Hackey (1995)

Figure 2.3 Communication guidelines for global climate change

3. Identify targeted audiences beliefs, biases, perceptions, values, etc

There is the need to understand the socio-demographic qualities of the communications recipients; the need to target communications; and, the opportunity to deliver information using the formal education system. Many others also support the need to understand the knowledge, perceptions, and values of communication recipients (see Figure 2.3).

Lofstedt (1995) notes the importance of public perception studies to pinpoint public concern over environmental issues including climate change. Lofstedt calls on governments to research the barriers to public understanding of global warming, and conduct education campaigns that re-direct public concern to the causes of climate change.

Kempton (1997) urges that to correct public misconception about climate change and global warming, communication strategies need to invoke pre-existing cultural models or conceptual models explaining how the majority of people in the culture fundamentally believe the world works. As such, the pre-existing cultural models that need to be addressed are ozone depletion, photosynthesis, weather, and air pollution.

For broad environmental risk communication, Fischhoff (1995) suggest that empirical and analytical efforts in summarizing the relevant science, and assessing the target audience beliefs, biases and values are needed. In addition, Fischhoff recommends that communicators focus on the “numbers that really matter”(p.140), and tell people the things they need to know. To enable this, the use of “Mental Models” is suggested. This

begins by identifying the influences of risk and their factors as viewed by science experts (Expert Model). Next, individual lay beliefs (Mental Models) are assessed using open and closed-ended survey instruments. Then the “Expert” and “Mental” models are characterized to enable risk communication that reinforce correct beliefs, correct misconceptions, and fill gaps (Fischhoff, 1995). Since climate change is often identified as a risk issue, this model could easily be applied when addressing the potential risks of climate change impacts, and individual inaction to mitigate or adapt to those risks.

As part of an effort to overcome the lack of understanding and “fragmentary knowledge” among lay people, Read et al. (1994) suggests emphasizing the industrial source of carbon dioxide as the primary and most important cause of global warming. As well, the misunderstanding and confusion over ozone depletion and the association with climate change should be addressed.

6. Develop Communication Partnerships and Work with Them

Partnerships among the scientific community and educators/communicators are needed. This includes stakeholders within the agricultural community (Hucq et al. 2000). The scientific community should develop communications with the mass media; and, notwithstanding some caveats, the mass media have a large opportunity to communicate climate change to the general population. In fact, the media are considered a “key audience” by the PEO Issue Table (1999), given their ability to create legitimacy on climate change and improve public awareness.

A communication strategy using the media as the key outlet is suggested by Good (2000). This three-pronged approach begins with the dissemination of improved and accurate climate change information to the media. This enables better communications to the public that is void of the “balance phenomenon” seen in journalist’s reports. The second prong targets urban communities by providing more information on climate change and alternative energy options using the media and other means such as billboards or posters. The third prong targets local politicians to promote alternative energies.

Meisner (2000) notes the importance of the media in the communication of climate change information to the public using narratives (see also guideline fourteen) for three reasons. In the first place, the media are “pervasive” in society. Secondly, the media have become the dominant “socializing and storytelling institutions” (p. B2-37) having displaced the education system and religion. Lastly, the media influence both the information received but also individual beliefs and values.

7. Ensure That Communications Are Not Exclusively One-Way

Opportunities for feedback and citizen involvement in the decision-making process by all stakeholder groups, including the general public, needs to be accounted for.

Communications need to be improved upon between scientists and the general public to enable adaptation to climate change as part of planning processes (Bray-Palmer, 2000).

An interactive approach to communication is key to an effective program (PEO Issue Table, 1999).

8. Learn from Other Fields and Evaluative Studies of Risk Communication Efforts

Communication guidelines from other disciplines, such as risk management, energy conservation, and education could be incorporated into climate change communications (see also Andrey and Mortesch, 2000). Education standards could also be included, such as active learning, the requirement for repetition and reinforcement, as well as the use of visual aids (maps, graphs, and computer simulations). As well, evaluating climate change communication programs is needed. Indeed, there is the need to evaluate communication efforts in both the tools used, and the methods employed as indicated earlier (see section 2.9). For evaluation criteria, Good (2000) suggests the use of content analysis and audience surveys to discern the improvement of qualitative climate change information targeted towards urban communities.

9. Capitalize on Opportunities to Piggyback Climate Change on Other Issues

Action on climate change should include other environmental issues (e.g. pollution), since many are caused by the global population explosion. We also have an opportunity to address other environmental issues in conjunction with climate change. As an example, The Partners for Climate Protection, a partnership between the Federation of Canadian Municipalities and the International Council for Local Environmental Initiatives has been created to focus on community sustainability achieved by the integration of climate change mitigation with human health and sustainability (Jeena, 2000).

10. Be Careful About the Choice of Language

Narrative presentations are better suited for the public than technical ones (see guideline fourteen for more on narratives). Since the public is reported to be largely risk illiterate, such terminology should either be avoided or well explained. Communicators should use the term ‘climate change’ rather than ‘global warming’ to better capture the biophysical consequences of change, not just the often relished balmy temperatures (Kempton, 1997). The language should be personal, dramatic and gripping in illustrating the potential effects of climate change and what mitigative action individuals can undertake (PEO Issue Table, 1999).

11. Break Down Complex Messages and Build the Knowledge Base One Step at a Time

Despite the poor cognitive ability of people to understand complex issues, such as climate change, the intricacy of the dilemma cannot be repressed. By understanding why some concepts are difficult for people to understand through evaluative feedback on communications, improvements in communications can be achieved (see guideline # 9).

Rowan (1994) has proposed a problem solving method to effective risk communication that goes beyond adherence to rules and guidelines. Effective risk communication requires “knowledge, fair processes, and communication skills” (p.308). The conceptual tools to improving communication skills are identifying the goals and obstacles, and using well-supported methods of surmounting those barriers. Rowan presents five stepwise goals for effective risk communication:

1. Build trust —————> Credibility
2. Create awareness —————> Awareness

3. Deepen understanding —————▶ Understanding
4. Gain agreement on solutions —▶ Solutions
5. Motivate action —————▶ Enactment

A two-day workshop organized by the Canadian Council Ministers of the Environment (CCME) developed a set of nine climate ‘drivers’ (for example Air Quality) and twenty-seven indicators for climate change impacts. These components of climate change help to break down the complexity of the issue forming a foundation in which a communication plan directed towards Canadians will be developed (CCME, 2000).

14. Make Use of Analogs, Parables, and Comparisons to Improve Understanding

Communications should include comparisons, like those implemented in the education field, as a facilitative tool in improving audience understanding on the range of options and tradeoffs regarding individual actions on climate change. Gilmore (2000) offers a direct, unambiguous and empowering approach to surmounting sensory and policy-based illusions and barriers to behavior change. This includes the use of clear messages with graphical examples depicting the potential impacts and scenarios of global warming at the regional and global level. The PEO Issue Table (1999: 11) has noted that effective PEO campaigns contain key messages that are “personal, real, and vivid.” Glantz (1991) offers up the use of expository (i.e. the greenhouse effect), historical, and regional analogs to communicate the issue of climate change impacts, societal responses, and improved understanding of the issue.

Since a climate change short story was an integral component of the research activities (described in chapter three), it is befitting to describe the influence of stories in society and their communicative potential for environmental issues such as climate change.

Robert Fulford (1999:9) has succinctly summarized the power of stories in society:

“Stories are how we entertain, teach, and explain, and do all three at once; its where facts and feelings meet.” Meisner (2000: B2-37) emphasizes the influence of narratives as one of the “most important ways that we socially construct our understanding of reality.”

Unfortunately, stories have often now become replaced by the mass media, and sound or video bytes (Sandlos, 1998).

The benefits of using stories or narratives for effectively communicating environmental issues (Bardwell, 1991), and climate change information has been asserted by several authors (Hughes and Andrey, 2000; Kadonga, 2000; Gilmore, 2000; Kearney 1994).

Kearney (1994) provides a cognitive perspective to textual communications on global change, specifically the climate change issue. Kearney reasons that effective text directed towards the public “..depends on activating pre-existing prototypes and integrating the information contained in the text into existing cognitive maps so that it becomes part of the readers real world knowledge” (p. 436). To facilitate this, Kearney stresses that text content must draw the readers involuntary interest, be concrete, have vivid detail and coherence, contain an element of mystery, and relate to the readers’ prior knowledge. Narratives often contain these effective characteristics and should be further explored when communicating climate change. Narratives do seem to be gaining in usage for

climate change communications as they are reportedly being used in the third IPCC assessment publications (Hughes and Andrey, 2000).

16. Focus on Actions and What Can be Done for Different Groups

Specific actions need to be drawn out for people rather than just improving understanding. This helps make the “think globally act locally” slogan more tangible for people. In Ontario, climate change communications by the Green Communities Association (GCA) has successfully focused on action-oriented efforts or “client-driven marketing.” Effective public communications have been those that provide incentives to action on climate change rather than an increase in awareness (Wilson, 2000). As such, Wilson suggests the following steps for incentive-based climate change communications:

1. Identify the client and the climate action measures(s);
2. Identify the Client Incentive(s) (i.e. economic gain) and barriers to action;
3. Establish a communication objective (important in assessing program effectiveness and conducting an evaluation to enable improved messages);
4. Tailor the communications to the identified incentives and barriers to action; avoid a holistic approach; and,
5. Deliver and support the communication in a professional manner.

At the municipal level effective communications in Ottawa have been key to promoting public action and mitigation on climate change (Strong, 2000). There, public education efforts revealed that the most effective climate change communications focussed on the economic and home comfort benefits of energy efficiency, with climate change mitigation benefits given minor emphasis (Strong, 2000). Other municipal public outreach suggestions for GHG mitigation by Strong are as follows:

- Keep the message simple, visual, and personally relevant
- Provide balanced perspectives on the problems and solutions
- Use multiple approaches, media, and local agents
- Evaluate program effectiveness
- Avoid scare tactics or pleas for sacrifice
- Promote feedback, reminders and prompts; elicit a public commitment

17. Focus on Investment, Management and Reduction Actions

Actions or behavior changes relating to investment (i.e. home retrofitting such as insulation), management (energy conservation), and to a lesser extent, reduction of comforts need to be communicated. These are consistent with the third objective of the PEO Issue Table (1998, 1999), namely, to motivate Canadians to personally reduce their greenhouse gas production. Communicating actions has also been the effective message for the Ottawa mitigation program (Wilson, 2000; Strong, 2000).

18. Consider Proposed Actions from Stakeholders

In addition to communication efforts, other barriers to action such as social norms, institutions, governments, markets and the socio-economic situation of individuals need to be identified and addressed. There is a move to an inclusive and collaborative response to addressing the climate change issue that involves stakeholders, communities and individuals (Government of Canada, 2001). Using workshops, the Upper Midwest Aerospace Consortium has engaged various stakeholders in the assessment of environmental issues, including climate change and variability (Welling et al., 2000).

2.10.1 Communication Suggestions Pertaining to Agricultural Producers

There is a paucity of literature on suggestions for communicating the issue of climate change with producers or those in the agricultural industry. However, in response to the three earlier described characteristics of climate change that act as barriers to communications with farmers, Smit et al. (2000) have provided three suggestive statements:

1. Farmers are interested in extremes weather events not average increases;
2. The socioeconomic implications of climate change are what concern farmers; and,
3. There should not be an assumption that farmers can adapt to climate change, since that creates a sense of false security.

2.11 Summary

Climates have changed in the past as a result of natural forces, but scientific data increasingly support a warming of the global climate in the past century due to human influences. Models consistently predict a continual increase of global surface temperatures in the next fifty years. These changes are likely to result in changes to the environment, economy, and socioeconomic conditions, certain to affect the Canadian Prairies, including the agricultural industry. Predictions have lead to increased scientific concern on the issue of climate change, prompting varying levels of policy action at the international and national level. As part of Canada's NCCIS, a Public Education and Outreach Issue Table has been struck. Findings from this and other research show that the Canadian public is concerned about climate change, but lack the understanding, knowledge, and overall capacity to take action.

There are numerous and wide reaching barriers to communicating the issue of climate change to the public and as such, adults in the study region. Some PEO and communication efforts have been initiated in Canada and to a lesser extent, in the RMBR. Many broad multi-disciplinary suggestions for communicating the issue of climate change to the general public have also been devised including the need to understand the targeted audience, possess good communication skills, use analogies, implement 'no regret' actions, and evaluate for success. Communicating for improved understanding on the climate change issue must take an abstract, complex, and largely invisible problem, and make it real, immediate and important to adult learners.

Chapter 3 Methods

3.1 Introduction

Designing the process in which to conduct this research project was not an intuitive undertaking. Rather, there was some uncertainty in how to most effectively go about discerning how people feel about the issue of climate change, and moreover, how to undertake a program evaluation. However, given the complex, multidisciplinary and interdisciplinary nature of climate change, PEO, and communications, it was decided to carry out this study using a qualitative or interpretive social science approach. For clarification, Creswell (1994:2) identifies the qualitative approach to be:

..an inquiry process of understanding a social or human problem, based on building a complex, holistic picture.. reporting detailed views of informants, and conducted in a natural setting.

Through the application of an interpretive social science approach, this research was carried out in a case study setting. Data were collected using several survey instruments, pooled, analyzed, documented, and then an evaluation was conducted based on a multi-criteria framework, including a set of scholarly based guidelines.

3.2 Literature Review

A comprehensive literature review was conducted to establish the research context, defined the major gaps or barriers to climate change communications, and help define the criteria for assessing effective communication.

The literature review considered:

- (1) Natural climate change, climate science, recent and climate change predictions and potential impacts for the Prairies, and the social dimensions of climate change;

- (2) Recent PEO and communication strategies and tools implemented on climate change in Canada and in the study region;
- (3) Barriers to effective climate change communications with the general population of Canada and with farmers; and,
- (4) Evaluations and suggestions in communicating climate change information with the general public and the agricultural sector.

3.3 Temporal and Spatial Limitations of the Study

While conducting the study, a fifty-year time frame of climate change was employed where possible, most notably in the survey instruments. In a spatial dimension, the issue of climate change can be addressed on a global, national, regional, or local scale.

However, for this research the spatial scope of the study was limited to the regional (Prairie region of the Canada) and sub-regional (RMBR area) context whenever possible.

Limiting the temporal and spatial dimensions of the research was done in the attempt to improve the data collection process on two levels. Firstly, imposing these limitations provided a focussed research situation allowing the request of precise information to improve question-answer response accuracy, credibility and comparability as discussed by Foddy (1993). Secondly, limitations elicited responses that were more relevant to the respondent's local or regional worldview rather than the global and often nebulous concepts associated with the climate change issue.

3.3.1 The Study Area

Geographical Scope

Where possible, such as with the survey instruments, the study was restricted to the Riding Mountain Biosphere Reserve (RMBR). The RMBR was established in 1986 as part of the Man and the Biosphere Program developed by UNESCO in 1971 to enable a global network of regions with the objectives of conservation, demonstration of biodiversity, sustainable development, and support for research towards these goals (Francis, 1990a; Whitaker, 2001). RMBR consists of a core and buffer areas within RMNP boundaries and a “zone of cooperation” outside the park comprising 18 rural municipalities in a total area of 975, 000 hectares (Francis, 1990b).

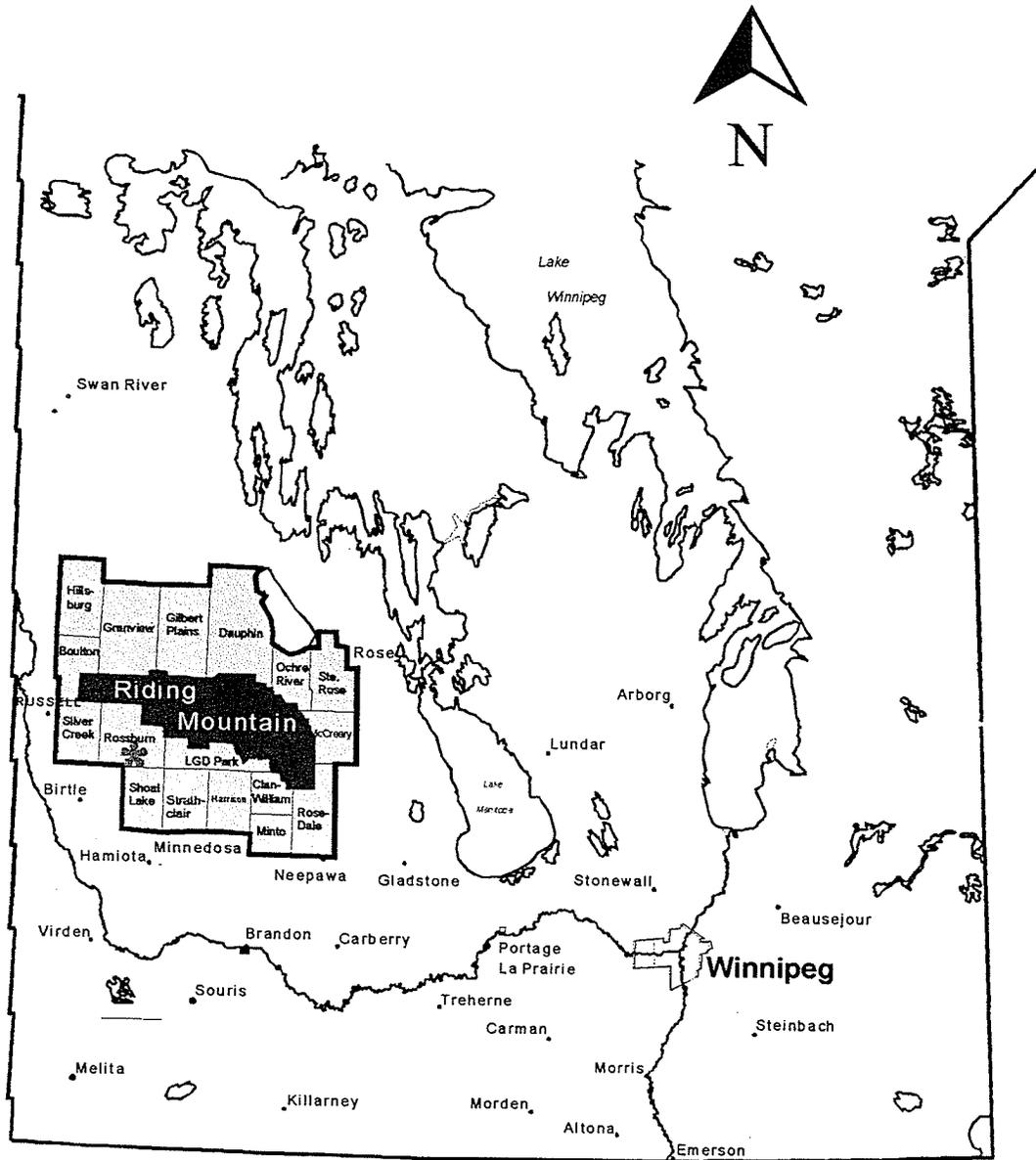
Established in 1930, Riding Mountain National Park is often referred to as ‘an island of wilderness in a sea of agriculture’ consisting of a mix of deciduous and coniferous trees and grasslands within the park, and mainly agriculture land use peripheral to the park boundary (Parks Canada, 2000). The park is 297, 800 hectares in size situated approximately 300 kilometers northwest of Winnipeg, Manitoba (Francis, 1990b). The satellite image of the region depicted in Figure 3.1 clearly illustrates the contrasting vegetation and land use boundaries between the park forests (dark shaded) and the peripheral agricultural lands (light shaded or white). Figure 3.2 depicts the study region, both RMNP and the larger area delineated as the RMBR.



Source: RMBR (2001)

Figure 3.1 Satellite image of the RMBR area strongly outlining the boundary for Riding Mountain National Park (darker pistol shaped area) from the peripheral agricultural lands

Southern Manitoba



Map source: Soil Survey and Mapping, Manitoba Agriculture

- * Town of Rosburn (workshop location)
- Area comprising Riding Mountain National Park

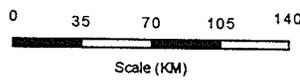


Figure 3.2 Map of the study area: RMNP is the green area in the center. The Riding Mountain Biosphere Reserve consists of the Park and the surrounding rural municipalities colored in yellow.

3.3.2 Target Stakeholders

Farmers, RMNP employees, and other area stakeholders within the “*zone of cooperation*” were targeted for participation in this research. As a result of the representative participation in research activities, specifically the workshop, survey instruments, and the self-selection process in which interviewees were chosen, the analysis invariably focused more upon two key stakeholders groups in the region: farmers and RMNP employees. As a result, a large portion of the research results and findings were derived from farmers residing outside the park and RMNP staff or affiliated people¹. Indeed, it was these two stakeholder groups that comprised the largest proportion of workshop participants (15 of 23 pre-survey respondents). In addition, while stakeholders within the entire RMBR were intended for data collection, the results are more indicative of the region south and west of RMNP (19 of 23 pre –survey respondents were from these regions), as other regions were not well represented throughout the study. Given the low number of workshop participants, interviewees, and the dominance of participants from the southern and western RMBR, the results and conclusions are not likely to represent the views of all groups within the entire RMBR region, including those of farmers and RMNP employees.

¹ During the initial data collection period, pre and post survey responses were received mainly from farmers and RMNP staff (pre =15 of 23, post =12 of 20), but also from other area stakeholders and citizens. It was the self-selection interview process that lead to in depth responses from farmers (50%) and RMNP staff (50%). Having this detailed data on these two stakeholder groups tended to restrict the focus of the data analysis.

3.4 The Case Study Approach

This research was conducted in a case study setting. Implementing a case study facilitated a more effective climate change communication program evaluation by limiting the scope of the study in terms of target audience and the geographical area. This enabled a more in-depth analysis of the people and perceptions they hold on the issue of climate change and assessment of their perceived barriers and recommendations for communicating this issue. The case study centered on a *Community Climate Change workshop* organized and delivered for interested stakeholders in the RMBR region.

3.4.1 Process Implemented for Case Study

The one-day climate change workshop was carried out as a setting in which to determine the level of concern, understanding and general perceptions towards the issue of climate change among adult learners. The workshop also served as a closed setting from which to conduct a climate change information and communication evaluation.

For the realization of the project objectives, five key initiatives were implemented:

- 1) Development and promotion of the *Community Climate Change Workshop*;
- 2) Delivery of a *Community Climate Change Workshop*;
- 3) Development of the pre-survey and post-survey questionnaires, and interview protocol;
- 4) Data analysis to assess participants' general perspectives of climate change before and after the workshop; evaluate the effectiveness of the workshop information and communications; present participants communication suggestions; and,
- 5) Develop a climate change communication strategy for the RMBR region.

1) Workshop Development and Promotion

The organization of the workshop required attention to several logistical and procedural matters. These matters included what information and communication activities to conduct at the workshop, location, day of the week, duration, and promotional activities required. To make RMBR citizens aware of the workshop and to encourage participation in the event, a total of five promotional activities were applied prior to the workshop and are summarized below in Table 3.1 (see Appendix D for more information).

Table 3.1 Promotional activities utilized for the *Community Climate Change Workshop*

Promotion Tool	Description	Promotion Audience	# of People reached ¹
Mail packages	Cover letter, 8.5 x 11 inch poster, registration forms (total of 27 packages)	Councilors, Chief and Council members, and general public in 23 town and 4 First Nation offices in 18 RM's in RMBR	>200, up to 2000 (estimated number)
Newspaper advertisements	Advertisement (similar to poster) in 6 local papers	Newspaper readers i.e. general population	Approx. 15-25, 000
Posters	One to three 8.5 x11 to 11 x 14 inch posters on 14 community notice boards	Members of the general public	100-400
Delegations	Presentations made to four Town/RM councils and RMBR Liaison committee	Town and RM councilors, Reeves, Mayors, RMNP and provincial stakeholders, farmers and the public	50-70
Electronic mail notices	E-mail and poster	Sent to various stakeholders: RMNP, CD's, government	20-30

¹ For the mail packages, posters, delegations and the newspaper advertisements, the audience receivership numbers are estimated based on educated estimates and total newspaper circulation figures.

2) Overview of Community Climate Change Workshop

The *Community Climate Change Workshop* took place in Rosburn, Manitoba on February 17, 2001 between 10:00 am and 4:30 p.m. (see Figure 3.2 for the location of Rosburn). Thirty- seven individuals pre-registered for the workshop by mail, fax, e-mail, or telephone. At the workshop, pre-registrants accounted for eighteen of the twenty-seven participants; the nine additional participants represented same day ‘walk ups.’ The other nineteen pre-registrants did not attend. Workshop participants resided mainly throughout the southern and western region of the RMBR and represented many walks of life including farmers, RMNP employees, students and other citizens. Table 3.2 reviews the age and occupational information of the workshop participants. Table 3.3 identifies the communities where the participants reside.

Table 3.2 Age and occupation distribution of workshop participants

Age category	Under 25	25 to 35	36-45	46-55	56-65	66 & over	No Response
N=27	4	6	4	4	1	3	5
Occupation	Grain/ cattle Farmer	Conservation District	RMNP affiliation	Government /Manitoba Agriculture	Student, Other citizen	No Response	
N =27	10	1	5	1	4	6	

Table 3.3 Area of residence for workshop participants

Rural Municipality/Town	Inhabitants	Rural Municipality/Town	Inhabitants
RM of Rosburn	3	Dauphin	1
RM of Shoal Lake	2	Clanwilliam	1
RM Silver Creek	1	Rosburn	3
RM of Straithclair	2	Wasagaming	1
Grandview	2	No Response ¹	4
Russell	1	Total	27

Workshop Information and Communications

Four key workshop communication tools and associated information content were chosen for the workshop activities: two expert verbal presenters, a climate change short story, a poster, and government information kits, leaflet and other materials. Appendix E outlines the specific format and proceedings of the workshop. These workshop tools and activities were chosen for their diverse range of communicative potential. The workshop tools were evaluated for their relative effectiveness in improving understanding on climate change. A Meteorologist and a PFRA speaker presented verbal and graphical information on climate science, impacts and predictions, and agricultural adaptation to climate change. Verbal presentations are important tools to evaluate since they are commonly utilized at workshops and other public information functions. Evaluating two expert verbal presentations allowed cross-comparisons between the different styles and information presented.

¹ For Tables 3.2 and 3.3, the 'No Response' category represent those who did not complete a pre-survey (23 of 27 workshop participant's filled most or all of the survey).

The *Winds of Change: Climate Change on the Prairies* poster, previously described and depicted (see Figure 2.2, p. 39) was brought in as an alternative tool in which to evaluate effectiveness. Some government materials were made available for participants to study during breaks or after the workshop. These materials were provided to discern the relative effectiveness of more information intensive communication sources often associated with government agencies. The four page leaflet entitled '*Our Climate is Changing: Its Time to Act*' described earlier in Chapter Two, and the Global Climate Change information kit were among the main governmental documents provided for workshop participants.

While all other workshop information and communications were either brought in for viewing or developed by the expert presenters, a narrative (or short story) entitled '*Climate Change in Manitoba: Challenge and Opportunity*' was researched and written specifically for the workshop. Therefore, some explanation of the story and the communication objectives are needed. The purpose of the narrative was to provide an alternative way of communicating climate change information with workshop participants by creating a vivid picture of future climate in the Prairie region of Canada and Riding Mountain area in the year 2050. In doing so, an attempt was made to depict the state of agriculture, ranching, and socio-economic conditions that may ensue as a result of a doubling of atmospheric carbon dioxide and natural climate change from the perspective of an area farmer in 2050. See Appendix F for the full text of the story.

The narrative format was considerably enhanced with advice from Kearney (1994), including her four key criteria for developing effective text. Suggestions from other

scholars (Hughes and Andrey, 2000; Meisner, 2000; Gilmore, 2000) were also taken into account when developing the story; this included guidance from Canadian author Ronald Wright on content and style (2000, pers comm).

The narrative content included information on scientific predictions of human induced climate change derived from several sources. Most extensively utilized were the *Canada Country Study: Responding to Global Climate Change In The Prairies* (Herrington et al., 1997), and *Climate Change and Canada's National Park Systems: A Screening Level Assessment* (Scott and Suffling, 2000). Other materials were also used in the attempt to make the story plausible and within the range of scientific predictions (Wheaton, 1998; Luciuk and O'Brien, 2000; Smit et al., 1996; Chiotti and Johnson, 1995; Mooney and Arthur, 1990; and, Wittrock, 1999).

3) Survey Instruments

a) Pre-survey questionnaire

To gain an appreciation of people's level of awareness, understanding and general perspectives on climate change, a pre-questionnaire survey was developed¹. Specific objectives of the questionnaire were to:

1. Assess the perspectives (concern, familiarity, knowledge, understanding) of the workshop participants on the issue of climate change;
2. Assess workshop participants' information and communication needs relating to the issue of climate change; and,

¹ For the full text of the pre-survey questionnaire and all other survey instruments and accompanying cover letters see Appendix G.

3. Establish a baseline for evaluating the tools and methods tested for effective communication of climate change information.

The pre-questionnaire consisted of both open and closed-ended questions. It included the three elements of awareness, understanding, and action to climate change (Mortsch et al., 2000). The questionnaire also addressed the four concepts of weather and climate, namely, facts about weather and climate; causes of climate change; effects of the greenhouse effect and global warming; and, questions regarding policy options (Read et al., 1994).

The pre-questionnaire was disseminated to, and completed by, workshop participants at the onset of the workshop prior to any formal workshop activities. This method of dissemination proved beneficial in two ways. First, in-workshop survey dissemination ensured a very high participant response rate (23 of 27 or 95%). Secondly, the pre-workshop perceptions and understanding on the climate change issue among workshop participants were captured before participant learning occurred as a result of the workshop activities. The results of the pre-survey were determined to be a preliminary and guiding indicator of the stakeholders' perceptions and understanding on climate change.

b) Post-survey questionnaire

The principle purpose of the post-questionnaire was to assess the effectiveness of the climate change workshop. Specifically, three main objectives were to:

1. Assess if an improvement in concern, awareness, and understanding occurred among participants as a result of the workshop information and communications;
2. Assess participants' evaluative feedback on the information presented or made available during the workshop; and,
3. Assess participants' evaluative feedback on the tools used to communicate climate change information during the workshop.

Many of the post-questionnaire questions resembled those in the pre-questionnaire. This facilitated a comparative analysis of participants' perspectives prior to and following the workshop. A main component of the post-survey, however, was to solicit participants candid feedback on the information presented and the tools used to communicate that information. To facilitate such evaluative feedback, a greater emphasis upon open-ended responses was encouraged.

c) Follow-up interviews

Semi-structured interviews with workshop participants were conducted between seven to thirteen weeks following the workshop. Interviewees were self-selected, through an indication of willingness to participate in a follow-up interview. The data obtained from the interviews augmented the responses from the pre and post-survey questionnaires. The interviews were conducted to facilitate the workshop evaluation, ascertain a set of participant-based barriers to climate change communications, and obtain follow-up information and communication needs on climate change and suggestions for future communications. Sixty to ninety minute personal or telephone interviews were conducted with four farmers and four RMNP employees.

4) Data Analysis and Workshop Evaluation

a) Participants' perspectives on the climate change issue

Quantitative and qualitative data from all survey instruments were combined in order to assess workshop participant's initial level of concern, familiarity, awareness, knowledge, and understanding on the issue of climate change.

b) Process used for Information and Communication Evaluation

Information Evaluation

To enable an effective evaluation of the information contained within the workshop communications, it was necessary to disconnect the informational content of the workshop materials from the communication process. This analysis relied heavily upon the evaluative feedback provided by survey and interview respondents on the information provided during the workshop. At length, an analysis was conducted to:

1. Assess what information participants received in the past and need in the future;
2. Summarize the information presented or available during the workshop;
3. Compare the workshop information to the participant's needs and their evaluative responses to the information presented; and,
4. Based on the above three steps, evaluate the effectiveness of the informational components of each workshop presentation or information piece.

The information evaluation was not the principle emphasis of the study. Rather, the way the information was communicated (e.g. presentation, poster, story format, brochure) with participants was believed to impart greater significance to the study. Therefore,

more attention was directed towards the vehicle or sender of information dissemination rather than content delivered.¹

Communication Evaluation

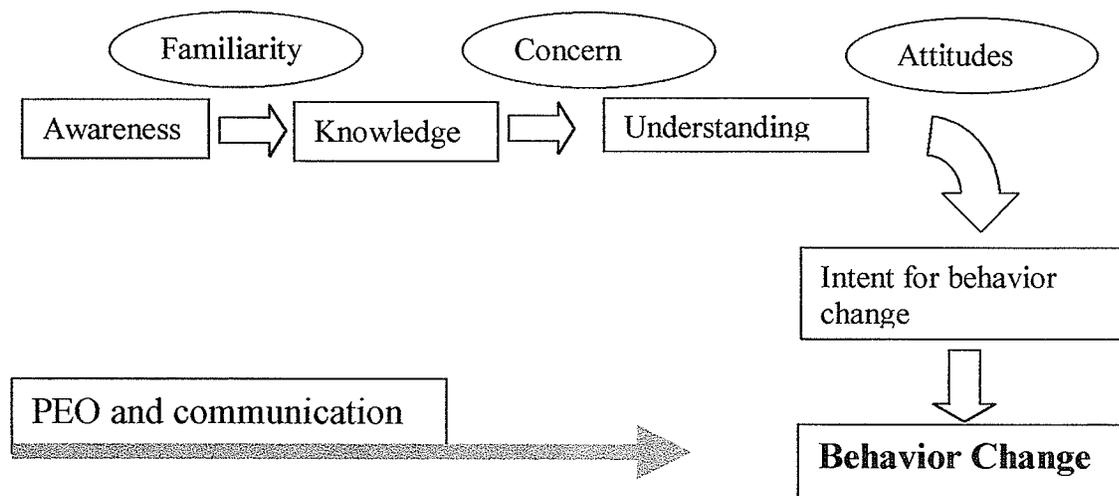
The climate change communication evaluation was conducted in a step-wise, multi-criteria process. The process endeavored to assess all relevant research data (pre and post surveys, interview transcripts). The evaluation contained three central components listed below in the chronological sequence in which they occurred:

1. Identification and development of relevant communication criteria or guidelines; evaluation of workshop communications based on those criteria;
2. Assessment of post-survey and interview responses on the effectiveness of workshop presenters and tools in improving understanding of the climate change issue; and,
3. Identification and comparison of participants' perspectives on climate change before and after the climate change workshop. Identified and discussed any changes/improved post workshop perceptions (awareness, concern, knowledge, understanding) or intent to change behavior among participants.

While the information and communication evaluation often discuss improvements in awareness, knowledge and understanding as separate phenomena, these should really be interpreted as increasing levels of learning brought about through public education and communication efforts as depicted in Figure 3.3. 'Awareness' of the climate change issue is the initial stage and gaining a full 'understanding' is the highest level of learning at

¹ The information content was separated from the communication process primarily to facilitate data collection and evaluation. See Section 4.4.2 for more explanation.

which an individual can be considered fully informed. In between ‘awareness’ and ‘understanding’ stages is ‘knowledge’ on the issue. Understanding the issue of climate change is a principle precursor of behavioral change, the end goal of PEO efforts on climate change and other environmental issues. Additional factors in this process are familiarity, concern and attitudes (or perspectives) pertaining to the climate change issue.



Source: modified from Hungerford and Volk (1990); and Finger, (1994)

Figure 3.3 Learning process leading to responsible behavior on climate change

The process depicted in Figure 3.3 should be broadly interpreted, not as a linear progression of learning, but rather as a flexible framework with inter-connected and dynamic variables upon which the workshop evaluation takes place. The PEO and communication component of the figure (i.e. the workshop event) has the ultimate objective of promoting mitigative behavior change. The workshop information and communication evaluation was based on participants improved awareness, knowledge, understanding, overall perspectives on the issue of climate change, and intent to make

changes. Participants' perceptions collected on the issue include their familiarity, concern, and overall attitude on climate change. While Figure 3.3 is depicted as a linear process, there are synergies within all levels of learning that do not conform to such a pattern of learning. For example, achieving understanding is not the only precursor of intent to change behavior or behavior change. A change in attitude or awareness may prompt behavior modification; however, gaining a full understanding does not ensure such actions (e.g. PEO Issue Table, 1998; Finger, 1994).

c) *Design of the survey questionnaires and interview schedule*

For the design and development of the survey questionnaires and interview protocol, the methods outlined by Foddy (1993) were followed. Foddy embraces the symbolic interactionist view of question-answer behavior. This theory emphasizes a shared definition of a situation between an interviewer and a respondent in the question-response cycle in which both actors decode and encode questions and responses. Under Foddy's symbolic interactionist umbrella, several issues were addressed in designing questions for the pre-survey and post-survey questionnaires and the semi-structured interviews. These issues include topic definition, the challenges of developing intelligible questions, contextual influences, the need for response frameworks, the use of filters, reducing question threat, measuring attitudes, and the use of checks for questionnaire and interview question design. Sound advice on developing the survey instruments, including survey format, and content, was provided by Dr. Jean Andrey from the University of Waterloo, Academic Advisor Dr. John Sinclair from the Natural Resources Institute and the other committee members.

Chapter 4: Perspectives on Climate Change and Evaluation of Workshop Activities

4.1 Introduction

This is the first of two chapters presenting results of this case study research. This chapter is divided into two discrete sections. To begin, there is a description of participants' pre-workshop perspectives on the issue of climate change. This includes their views on the environment, information needs, as well as knowledge and familiarity of climate change and its potential impacts. The ensuing section presents the results of the workshop information and communication evaluation. This analysis implemented several criteria and the combined responses of the workshop participants to provide a better understanding of what information is currently needed and how it would be best received in the RMBR. These results also help in understanding the barriers to climate change communications and in coming to conclusions on developing a strategy for future communications.

4.2 Environmental and Socioeconomic Perceptions among Participants

The pre-survey identified participant's views on environmental and socioeconomic issues. Most participants held strong views towards socio-economic, agriculture and environmental concerns (see Table 4.1), many of which are inter-connected with the issue of climate change. Noteworthy results reveal that sixty-five percent or fifteen pre-survey respondents rated sustainable agricultural practices and environmental conservation as very important. Forty-eight percent thought cooperation among RMBR stakeholders was

very important. One farmer succinctly summarized these corresponding views among workshop participants several weeks following the workshop:

..we are all interested in how we are going to survive in this country and how the future is going to survive. We're very very interested in the municipality in making sure that everything is done in a manner that will help our community.

Table 4.1 Importance of socioeconomic and environmental issues (N=23)*

Issue	Neutral or uncertain	Important	Very Important
Rural Economic Development	9% (2)	56% (13)	35% (8)
Cooperation among stakeholders in RMBR	13% (3)	39% (9)	48% (11)
Sustainable Agriculture	13% (3)	22% (5)	65% (15)
Environmental Conservation	13% (3)	22% (5)	65% (15)

* Results are shown in percent values and number of respondents for each category. Percent totals may not add up to 100% due to rounding off of values. All quantitative data presented in this chapter are presented in the same manner as this Table 4.1.

These results are indicative of area farmers, RMNP employees, and other workshop participants that are aware and show concern for the environmental and socioeconomic issues that impact their locality and daily lives.

4.3 Perspectives on Climate Change

Gaining an understanding of stakeholders or citizens perspectives on climate change was found to be useful for two reasons. First, doing so helped assess participant's level of awareness, concern and understanding on the climate change issue. This served as a very general indication of the perspectives held by the RMBR population, and a guideline upon which future PEO and communication efforts could proceed more effectively.

Secondly, gathering participant's perspectives formed an evaluative benchmark in which

to compare their post-workshop perspectives on climate change information and communication workshop activities. Understanding the perspectives of a target audience is important for conducting a program evaluation, and to provide accurate, efficient, and needed communications in the future.

4.3.1 Familiarity and Awareness of Climate Change

Results from the pre- survey indicate that sixty-one percent of workshop participants have known about the issue of climate change for six years or longer; thirty-five percent have known about the issue for between eleven and twenty years (see Table 4.2). As well, Table 4.3 show that forty-eight percent of respondents come in contact with climate change information at least once a week or even on a daily basis; however, forty-three percent indicate they come in contact no more than once a month. Overall, workshop participants have been familiar with or aware of the climate change issue for several years and have come in contact with such information on a monthly to weekly basis.

Table 4.2 Duration participants have known of the climate change issue (N=23)

Less than 1 year	1-2 years	3 to 5 years	6 to 10 years	11 to 20 years	More than 20 years	Other	No response
0	9% (2)	22% (5)	26% (6)	35% (8)	0	4% (1)	4% (1)

Table 4.3 Frequency participants received climate change information (N=23)

Once or twice a year	About once a month	Once or twice a week	Daily	Never seen, heard or read anything	Other	No response
17% (4)	26% (6)	39% (9)	9% (2)	0	4% (1)	4% (1)

However, when discerning participants' pre- workshop familiarity with the issue of climate change following the workshop, a clear dichotomy emerged among farmers and RMNP employees. Overall, those working for RMNP believed they were quite familiar with climate change prior to the workshop, and they considered other park employees to be increasingly aware and concerned, specifically about the potential physical impacts to the Boreal ecosystem. Some were even thought to be taking steps to address the issue or act as leaders.

In contrast, interviewed farmers noted that while they were quite aware of the climate change issue prior to the workshop (i.e. aware of the issue in general), they were generally not familiar with specific concerns. As one farmer stated, "I guess maybe I was really unfamiliar, never really thought about it to begin with until the workshop." When all interviewed farmers were asked about the views of other RMBR farmers on climate change, three common themes emerged:

1. There is not much familiarity and concern with the issue of climate change;
2. Climate change is not often heard about and therefore not discussed; and,
3. There is a lack of understanding of the impacts of climate change and measures to take action to prevent it and make adaptations.

As one farmer stated "...I would say a large majority of them [farmers] haven't even thought about it." Farmers seem to be aware of climate change but don't appear to have a familiarity with the issue. Moreover, they don't understand the potential impacts, including those to agriculture and what the *Kyoto Protocol* is all about. This lack of familiarity, knowledge and, particularly, understanding among farmers has been revealed to some extent in two other studies (Toombs, 1999; Smit et al., 2000).

4.3.2 Knowledge of Participants

The first question ascertaining the knowledge of workshop participants addressed their views on the causes of climate change (see Table 4.4). Participants provided a wide spectrum of responses to this open-ended question that were categorized into two primary themes: human related causes and natural causes. Three secondary categories emerged from the human related causes: factual/correct, erroneous and abstract/ambiguous.

Table 4.4 Participants' views on the causes of climate change

Primary	Secondary	Description
Human Related	Factual/Correct	Industry, greenhouse gas emissions
	Abstract/Ambiguous	Environment, human manipulation, pollution
	Erroneous	Hardware in orbit; economics
Natural Causes		Volcanoes

Under human related causes, many responses represented 'factual' or scientifically accurate known causes of climate change. The production of anthropogenically caused greenhouse gas emissions as a result of fossil fuel consumption was the most common 'factual' response given. The second sub-category produced 'abstract' or 'ambiguous' responses that nearly equaled the number of 'factual' responses. These responses were not incorrect per se, but were rather vague or overly general in nature. Examples include "chemical" and "pollution" as causes of climate change. 'Erroneous' responses were much fewer in number and were characterized by incorrect causes to any human or natural climate change; for example, "too much hardware in orbit" or "..education" and

“mad scientist manipulation.” ‘Natural causes’ emerged as the second main, albeit uncommon response category where volcanoes were commonly mentioned.

Results from basic questions on climate, the greenhouse effect, global warming, and climate change in general indicated a fairly good knowledge on the issue. Pre-survey respondents were accurate an average of eighty percent of the time¹. However, in one instance there was a noticeably lower correct response rate (fifty-seven percent) pertaining to the global warming concept. Some respondents likely encountered difficulty with this question because the incorrect response contained an erroneous reference to the ozone layer as a cause of global-warming. This concept has often created confusion with other lay audiences (Read et al., 1994; Bostrum, et al., 1994).

Asking participants how informed they felt on climate change helped to crystallize how limited their knowledge and understanding was on the issue. Table 4.5 indicates that most felt only somewhat knowledgeable or informed prior to the workshop and less than one third were ‘well’ or ‘very well’ informed on the six main climate change themes.

¹ The respondent had a choice of two responses to the question; one answer was correct, the other was incorrect. Consequently, there was a 50% chance of choosing the correct response when the respondent was guessing.

Table 4.5 How well informed participants felt about climate change prior to workshop activities. (N= 23)

Climate Change Theme	Not at all informed	Only slightly informed*	Somewhat informed	Well informed*	Very well informed	No response
Climate science	9% (2)	35% (8)	39% (9)	13% (3)	4% (1)	0
Natural climate variability & change	22% (5)	17.5% (4)	35% (8)	17% (4)	4% (1)	4% (1)
Physical impacts of climate change	5% (1)	30% (7)	30% (7)	30% (7)	5% (1)	0
Social and economic impacts of climate change	0	52% (12)	22% (5)	17% (4)	9% (2)	0
Strategies for mitigation	9% (2)	22% (5)	52% (12)	17% (4)	0	0
Strategies for adapting to climate change **	9% (2)	30% (7)	43% (10)	13% (3)	9% (2)	0

* These response categories were not explicit in the survey. They were interpolated from the adjacent response categories on each side based on a 5-point response scale (see Appendix G for the surveys). For example, the category “Well informed” was interpolated as being in between “Somewhat informed” and “very well informed.” Categories were inferred in this way for other tables where indicated by the asterisk.

** The total number of respondents was 23 for all themes. In this theme one respondent indicated that they were in between the ‘Somewhat informed’ and ‘Well informed.’ Therefore, the value of respondents for this theme was 24 rather than 23.

4.3.3 Perspectives and Concern for Possible Future Climate

Regarding future temperature trends, just over sixty-five percent of respondents believed that the average annual temperature is likely or very likely to rise in the southwest region of Manitoba by 2050¹, while nineteen percent thought that no change is likely (see Table 4.6). These results are lower than those from a recent Greenpeace Canada survey (2001)

¹ In the pre-survey questionnaire the southwest region of Manitoba included not only the RMBR region, but also the area extending south and west to the Saskatchewan/North Dakota border and northwest to the southern Duck Mountain region (see Appendix G-II).

which showed that both eighty-nine percent of Canadians (N=2011) and those specifically from Manitoba/Saskatchewan believe that global warming or climate change is occurring.

Table 4.6 Participants' views on how likely the annual average temperature will increase in the Southwest region of Manitoba by the year 2050 (N=23)

Very unlikely	Unlikely*	No change	Likely*	Very likely	Uncertain	No response
9%	4%	4%	17%	48%	13%	4%
(2)	(1)	(1)	(4)	(11)	(3)	(1)

This common view among workshop participants on future temperature trends did not hold true with regard to precipitation. Overall, there were no trends as to whether precipitation would increase or decrease. In fact, many were uncertain on the issue. Twenty-six percent of respondents believed that annual average precipitation will increase in southwest Manitoba by the year 2050; thirty-four percent were uncertain or did not know (see Table 4.7).

Table 4.7 Participants' perspectives on changes in precipitation in the Southwest region of Manitoba by 2050 (N=22)

Decrease	No change/ small decrease	No change	Small increase*	Increase	Don't know/ uncertain	No response
9%	18%	9%	18%	9%	36%	4%
(2)	(4)	(2)	(4)	(2)	(8)	(1)

This high level of uncertain responses and lack of predominant outlook on future precipitation is congruent with the lack of data and high uncertainty on future precipitation regimes in North America (e.g. IPCCa, 1995). In contrast, there is more information and much greater certainty for future temperatures on a North American and

global scale. This information has been disseminated to the public mainly through the mass media, while precipitation scenarios have not, perhaps due to the very high level of uncertainty associated with the data.

The next pre-survey question rated participant's perceived importance of common potential biophysical impacts of climate change, given a 3-5 degree Celsius temperature increase by the year 2050. Overall, most respondents thought that these impacts were either 'important' or 'very important' to them and their community (see Table 4.8).

Table 4.8 Importance of predicted climate change impacts among respondents (N= 23)

Predicted Impact of climate change ¹	Not important	Neutral/uncertain	Important*	Very important	No response
More extreme weather events	0	9% (2)	26% (6)	65% (15)	0
Increase in drought severity and frequency	0	13% (3)	30% (7)	57% (13)	0
Longer hotter summers	0	30% (7)	17% (4)	48% (11)	4% (1)
More insects, weed pests and crop diseases	0	22% (5)	30% (7)	39% (9)	9% (2)
Longer growing season	4% (1)	22% (5)	35% (8)	39% (9)	0
Increased evapotranspiration	0	13% (3)	26% (6)	57% (13)	4% (1)

¹ These are a sample of the most commonly cited potential impacts of climate change to the Prairie region of Canada, with an emphasis upon agriculture, as seen in the relevant literature.

More extreme weather events appeared to be the most important issue. However, increased drought and evapotranspiration, and longer, hotter summers were three other important implications of global warming.

These views hold considerable similarity with respect to the survey by Greenpeace of 2011 Canadians (2001). Results from this poll indicate that thirty-two and fifty-four percent of those surveyed in Manitoba and Saskatchewan are ‘very’ and ‘somewhat’ concerned about the effect of climate change on future generations.

4.4 Evaluation of Workshop Activities: Information and Communications

4.4.1 Introduction

The preceding section identified participants’ pre-workshop perspectives on the issue of climate change with the adult public. However, doing so does not go far enough to enable effective PEO and communication. While it is important to know the perceptions of the target audience, it is also critical to evaluate what information is needed and, moreover, to discern what tools and techniques are most effective at engaging recipients and improving their understanding on an issue. This evaluation needs to be done, not only as a literature review case study, but as a “hands on” or grounded assessment with the recipients of the communications. This was a principle objective this study endeavored to accomplish. Therefore, the first section detailed below evaluates the informational component of the workshop. Then, the second evaluation component will assess the effectiveness of the workshop communications.

4.4.2 Evaluation of Workshop Information

Before detailing the evaluation results, the reader should first understand the rationale for separating the information and communication components while conducting the evaluation process. At a broad scale, information is a component of the process of environmental education (Finger, 1994). Information is also an integral component of the communication process (Robbins, 1993). Therefore, information content and communication are inextricably linked. However, for the purpose of this research, a more systematic workshop evaluation was employed, requiring the disjoining of the informational workshop content materials from the communication process. The information evaluation considered only information contained within the workshop based intensively on feedback from the participants. As such, separating information from the communication process was also done in the attempt to clarify the request for evaluative workshop feedback from the participants.

To achieve the results of objective two, namely, *to evaluate a climate change information program targeted at adult learners*, the following analyses were undertaken:

1. Assessed what information workshop participants' received prior to, and needed at the onset of the workshop;
2. Summarized information presented or available during the workshop;
3. Assessed what information participant's needed following the workshop; and,
4. Summarized participants' evaluative feedback to the workshop information.

1. Participants Pre- Workshop Climate Change Information Needs

As indicated earlier, RMBR stakeholders were largely aware of the climate change issue through information they received prior to the workshop. Yet they did not feel well

informed on the issue. This discovery is strongly reinforced in Table 4.9 where ‘More’ to ‘Much More’ information was needed in all areas of climate change, though notably less so on climate science and natural climatic variability.

Table 4.9 Climate change information needs among pre-survey respondents (N=23)

Climate Theme	No more info	Slightly more info*	Somewhat more info	More info*	Much more info	No response
Climate Science	0	0	43% (10)	39% (9)	9% (2)	9% (2)
Natural climate variability & change	0	13% (3)	22% (5)	43% (10)	17% (4)	4% (1)
Physical impacts of climate change	0	0	17% (4)	30% (7)	48% (11)	4% (1)
Social and economic impacts of climate change	0	4% (1)	9% (2)	39% (9)	43% (10)	4% (1)
Strategies for reducing greenhouse gases	4% (1)	9% (2)	17% (4)	26% (6)	43% (10)	0
Strategies for adapting to climate change	0	0	17.5% (4)	26% (6)	48% (11)	9% (2)

In fact, forty-eight to eighty-three percent of respondents needed between more to much more information on the issue of climate change. The greatest need was for information on the social and economic impacts, and the lowest need was for climate science information.

2. *Review of the Workshop Information*

An abundant amount of climate change information was given out or provided during the *Community Climate Change Workshop*. Therefore, informational quantity ratings were approximated for each workshop presenter/communication media and each of the six

climate change themes in Table 4.10 below. It should be noted that these ratings were assessed on the relative amount of information provided by each of the four communication tools/presenters, not on cross-comparisons between communication tools.

Table 4.10 Information quantity disseminated during the climate change workshop

Communication Tool	Meteorologist	PFRA speaker	Winds of Change poster	Climate change story	Overall rating
Climate science	High	Medium	Medium	Low	Medium
Natural climate variability & change	High	Medium	Medium	Medium	Medium-High
Physical impacts of climate change	High	High	High	High	High
Social and economic impacts of climate change	Low	Low	Low	High	Low-Medium
Strategies for reducing GHG's	Low	Low	Medium	Medium	Low/Medium
Strategies for adapting to climate change	Low	High	Low	Medium	Medium-Low

The highest quantities of information made available focussed on the biophysical impacts of climate where all tools received a 'high' rating. This was not unexpected since this is an area where the majority of scientific research has been conducted, for example the Canada Country Study (see Herrington et al., 1997), and other studies (e.g. Wittrock, 1999; Mooney and Arthur, 1990). Medium to high amounts of information on climate science and natural climate variability and change was made available through all workshop tools.

The verbal presenters, especially the Meteorologist, gave moderate attention to science-based and natural variability information. The story was the one exception, providing

only low amounts of science information. With two exceptions, low to medium quantities of information were disseminated or made available to workshop participants on all remaining themes. A relatively high amount of socio-economic information was contained in the story. As well, the PFRA speaker presented high quantities of information on agricultural adaptation.

3. Post-Workshop Climate Change Information Needs

Following the workshop interview respondents elicited a need for moderate to high quantities of information on nearly all climate change themes (see Table 4.11). This was especially true for farmers who wanted more information on potential changes in temperatures, precipitation and soil moisture. These results are similar to participants' information needs before the workshop as indicated in the pre-survey. Also comparable to pre-survey findings was the need for information on the potential biophysical impacts of climate change in the future. RMNP employees mostly needed information on potential Boreal forest ecosystem changes and local agricultural and temperature forecasts.

This group also indicated a considerable need for all types of information, with the exception of science based information which was not particularly needed by both groups. This is an interesting finding since it is science-based background information, which is frequently thought to be needed, and is therefore often communicated to the general public. There was a moderate level of need for information on natural climatic variability by farmers; RMNP employees need high amounts of this information, representing a slight increase in need from the onset of the workshop.

Table 4.11 Future climate change information needs among farmers and RMNP employees

Climate Theme	Group	Info needs	Description
Background Science	Park staff	Low	Generally not essential or relevant information; feedback mechanisms, CO ₂ cycle
	Farmers	Low	Not essential or relevant information
Natural climate variability & change	Park staff	High	Examples of what is natural and what is human induced climate change; natural balances of system; impacts of natural changes on socio-economics
	Farmers	Medium	General information; there was some confusion on what the question was asking
Physical impacts of climate change	Park staff	High	Locally relevant (on the ground) information e.g. impacts to Boreal forest, farmlands, temperatures; climate projections
	Farmers	High	Temperature, precipitation, soil moisture changes; local impacts and explanation of predicted changes. Daily, weekly and seasonal weather reports are also needed
Social and economic impacts of climate change	Park staff	Medium-High	Impacts to farming community, recreation, rural aspects. What support available to stay economically viable? Link economic to social impacts and physical changes to economics
	Farmers	Medium	More general information
Strategies for reducing greenhouse gases	Park staff	High	Role/science of carbon sinks; industry policy on issue/ actions; practical personal actions; information for farmers and agriculture
	Farmers	Medium-High	General information; Kyoto Protocol (local actions needed, impacts; more details); linkages to socio-economic issues
Strategies for adapting to climate change	Park staff	High	More detailed information; adaptation strategies and techniques for farmers
	Farmers	Medium	More general information; what need to be done and how to make adaptations

4a. *Participants' Post-Workshop Perspectives on the Workshop Information*

The post-survey results yielded a limited amount of participant feedback on the quality of the workshop information. Two possible explanations are given for this. The first is derived from evidence indicating that many participants appeared to have misconstrued the term 'information' for 'communication' in the post-survey questions pertaining to the quality of the workshop information. This occurred despite the reminders given in the survey (written) and during the workshop. This resulted in responses that were relevant to the communications aspect of the workshop rather than the information content. The second constraint to the information evaluation was the disproportionate amount of information given out during the workshop on the six climate change themes seen in Table 4.10. This caused an unequal level of responses on the climate themes making cross-comparisons difficult. These two constraints appeared to limit the extent on which feedback on the workshop information was given; however they were anticipated prior to the data collection and so did not greatly affect the overall results or conclusions.

Despite these limitations, participants provided some useful feedback regarding the information quality of the workshop. This feedback on the least and most useful workshop information is summarized in Table 4.12. The least useful information included the uncertainty of data related to precipitation and soil moisture forecasts, non-specific and non-rural based information. Conversely, locally relevant (agriculture, rural-based) information on the biophysical and economic impacts of climate change, natural cycles, adaptation and mitigation examples was deemed the most useful information given out at the workshop.

Table 4.12 Post workshop perspectives of workshop information¹

Climate Theme	Least useful information	Most useful information
Natural climate variability & change	Uncertain data	Weather/climate cycles, examples of natural changes
Physical impacts of climate change	Uncertain/questionable precipitation/soil moisture data;	Temperature, ecozone, growing zones/season, soil moisture changes in future
Social and economic impacts of climate change	Governmental information; beneficial effects to farmers; uncertainty of the issue	Economic implications from climate change and impacts to agriculture & rural areas
Strategies for reducing GHG's	Non-rural based information;	Specific rural examples of mitigation; CO ₂ monitoring
Strategies for adapting to climate change	Lack of specific information regarding rural region or agricultural sector	Specific examples of adaptation

4b. *Participants' In-depth Perspectives on Presented Workshop information*

In the preceding sections, the quantity of climate change information given out during the workshop (see Table 4.10) and participants' post-survey perspectives on the quality of the information (see Table 4.12) were reviewed. Here, a closer investigation of the quality and effectiveness of the information is explored. This evaluation component is based extensively on detailed interview responses. The aim of this assessment is to address the information content given out by each communication tool/presenter. However, it must be understood that, given the intimate linkages of information within the process of communication indicated above, this component of the information evaluation does have some applicability to communications.

¹ The climate science theme was not included in the post-survey but was considered part of the natural climate variability and change theme. This was done to reduce the length and redundancies in the questionnaire.

I The Expert Verbal Presenters

a. Environment Canada Climate Trends Meteorologist

The Meteorologist was found to provide an abundant amount of excellent and very useful information on climate science, natural climatic variability and the physical impacts of climate change. Stakeholders in this region who participated in the workshop are interested in how conditions such as temperatures, ecozones, and soil moisture are potentially going to change in the future. Having this science-based impacts information appeared to advance the development of knowledge and understanding among many workshop participants. This can be illustrated with an interview comment:

I guess the one thing that really stuck in my mind the most was the scientist. His information on scientists using computers to track what has happened, what is happening on a daily, if not hourly basis in the world...I gained a lot of knowledge from him.

An insignificant portion of workshop participants appeared to be somewhat critical of the precipitation and soil moisture information, again due to the existing level of uncertainty or lack of data available evident in Table 4.12. However, it was his lack of commentary during his presentation regarding the policy aspects of climate change that lead to the most critical commentary. While the policy issues relating to climate change were not his expertise nor part of his presentation, the participants felt that the Meteorologist could have further enhanced the quality of the information he presented had he addressed the issue when asked.

b. The Prairie Farm Rehabilitation Administration (PFRA) Speaker

For the most part, the PFRA speaker was found to provide adequate information on adaptation to climate change in agriculture. However, the information he provided was somewhat general in nature. He did present some general impacts of climate change to agriculture in the Rosburn region and possible adaptation measures. This was appreciated by a number of workshop participants. Participants found, however, that there was a lack of information related to policy issues and what specific actions can be done at the farm and personal level. This left many unsure as to what they can or should do to take adaptive action on climate change. As one respondent indicated, “.he talked about agriculture but there wasn’t maybe enough on the ground.” When asked about workshop material that related to agricultural adaptation another respondent indicated that “ more and more detail would have been nice” and that “he declined to make many comments on policy..” This is information that workshop participants needed but were not given for the most part. Yet, specific and local information is most likely not currently available given the lack and infancy of research in this area.

Specific climate change adaptation information was given on innovative satellite and weather station technology. While interesting for participants, this information was not found to be relevant to most of the area farmers at the workshop. Many farmers are struggling financially with the ongoing economic farm crisis and can not afford such technological innovations.

Another information deficit noted by participants was the virtual absence of information pertaining to reducing greenhouse emissions in the agricultural sector. Mitigation measures comprise ten of the eleven recommendations listed by the Agricultural and Agri-food Climate Change Issue Table options report entitled *Reducing Greenhouse Gas Emissions From Canadian Agriculture* (Agriculture Issue Table, 2000). The PFRA speaker's information on climate change and adaptation is potentially useful at a regional level, as part of a comprehensive action plan. However, this research suggests that many workshop participants do not understand or are even unaware of greenhouse gas reduction measures or the basic principles of the *Kyoto Protocol*. The work of PFRA has focussed upon adaptation to climate change not mitigation. Therefore, it is understandable that the presentation was on agricultural adaptation to climate change. But at the very least it would have been informative to present some information on the Kyoto Protocol and mitigation of greenhouse gases.

II *The Climate Change Short Story*

Information contained within the story was not considered very effective under the climate science and the physical impacts of climate change themes. However, the information in the story was very effective in creating an image or potential scenarios of the social and economic impacts of climate change at the local level. The story was relevant to the workshop participants because it contained information on a human dimension at the local level. Even though the story was less than 1700 words and was read by participants in twenty minutes or less, relatively substantial commentary was given on it both during the workshop discussion session and follow-up interviews. The

story contained information relating to the economic farm crisis and the apparent continual lack of concern by the federal government on the issue. This appeared to help engage the farmers at the workshop by acknowledging the main issue at hand before giving information on climate change.

Though the story was believed to be of short length, some thought it was too long. A few interview respondents thought that there should be less information in the story and the content clarified or made plainer for area residents, particularly farmers. One respondent commented that the story was somewhat presumptuous to assume the same social and cultural structure in 2050 to what currently exists. Despite these observations, the information contained within the story appeared to make a connection with most workshop participants, improving knowledge and understanding on the issue.

III *The Winds of Change Poster*

The poster was observed to contain good and useful information by some workshop participants. The poster contains information on climate science, possible future climates, and the subsequent impacts to the Prairies including forestry, agriculture, and water resources. The extensive quantity of information contained in the poster, however, appeared to be its most critical weakness. The amount of information on the poster was a strong disincentive for some workshop participants to read it fully. During the workshop there was sufficient time during breaks and following lunch (about fifty minutes) devoted exclusively for the participants to investigate the poster. However, observations made during the workshop reveal that few participants appeared to fully read the poster. The

poster simply did not engage many respondents. As such, it was not effective in improving participants understanding on the issue of climate change.

4.4.3 Summary of the Usefulness and Effectiveness of the Workshop Information

It is a difficult task to ascertain the effectiveness of the information in improving participants understanding of climate change since much of it was new information and therefore deemed useful and informative on a general basis. As well, this research revealed that the level of effectiveness is more discernable with the communication medium or tool rather than the information contained within that process.

While information content is a component of the communication process and not the primary component of the evaluation, four principle insights on the more useful and engaging information provided at the workshop have emerged from the data. Firstly, nearly all information presented during the workshop appeared to provoke thought and discussion among participants. This elicited the desire for much more information on the issue in nearly all themes. Secondly, the greater the participant's previous knowledge and understanding on the issue of climate change, the more detail they were able to provide when evaluating the workshop information and discerning future information needs. Thirdly, information that connected with participants at a personal or local level, including the potential biophysical and socio-economic impacts of climate change, and specific responsive actions were found to be more useful to participants. It was this information that invoked the most heightened awareness, concern and knowledge on climate change. Information that was broad based, non-specific, and highly uncertain was

found to be much less useful to participants. Indeed, results from other studies and polls summarized in the PEO Issue Table (1998) show that the Canadian public and communities need more “certain” information that is clear, specific, and relates directly and personally to an individual.

Lastly, the source of the information appears to influence how, or if it was received, and how it was perceived and determined to be less or more effective by participants. For instance, the information received verbally by the expert presenters and through the story format connected most effectively with the participants, and was therefore most frequently recalled and favorably critiqued. The information contained in the Winds of Change poster and governmental materials was scarcely recalled or given critical commentary. This appeared to be in part because most did not read the materials. Overall, these findings illustrate the connectivity of information and communication and the challenges associated with conducting the evaluation.

4.5 Communication Evaluation of Workshop Materials

4.5.1 Introduction

The workshop communication evaluation was carried out mainly by summarizing and then categorizing post-survey and interview reflections on the four main workshop tools: two verbal presenters, poster, story, and government materials. These reflections were also examined for their relevance to a set of pre-developed communication guidelines, and whether they were indicative of modified perceptions and understanding on the climate change issue compared to the pre-survey results. Again, it should be restated that since this section evaluates the broad workshop ‘communications,’ there are

references to information, as communication is a process that inherently contains information as an integral component. The evaluation below is documented in two main sub-sections, beginning with a synthesis of participants' qualitative feedback on the workshop communications and assessment against a set of communication guidelines.

4.5.2 Participants' Perspectives and Communication Criteria

This first stage of the communication evaluation combined two sets of criteria in determining the effectiveness of the workshop tools/methods in improving participants' understanding on the climate change issue. The first criterion utilized participants' post-workshop feedback from the post-survey on the usefulness of the workshop communications. The second criteria set was based on adherence of the communications to a set of eleven guidelines or criteria listed below in Box 4.1. Adherence to the guidelines was determined primarily through in-depth interview responses on the most and least useful qualities of the communications. These views were complemented using non-participant observations and assessment of the communications during the workshop. Rather than detailing the level of adherence of each communicator to all eleven guidelines, the communicative qualities are identified and briefly described with respect to the guidelines. It should be noted that the two expert presenters and designer of the poster were aware that the evaluation was to occur but did not know the specific nature of how their presentation or poster was going to be rated.

Box 4.1 Criteria implemented to facilitate the communication evaluation

- 1) Use interactive expert-participant communications
- 2) Be careful about the choice of language
- 3) Be proactive about uncertainties
- 4) Use analogs, parables, comparisons, examples, indexes to increase understanding
- 5) Focus on actions of what can be done for different groups
- 6) Emphasize points where scientific consensus exists
- 7) Break down the message into components and build knowledge base one step at time
- 8) Capitalize on opportunities to piggyback climate change issue on other environmental /social issues
- 9) Invoke the precautionary principle in the absence of unequivocal scientific certainty
- 10) Emphasize the current need for adaptation to current climatic variability and change
- 11) Emphasize the importance of past, present and future natural climatic variability as an incentive to reduce greenhouse gas emissions and adapt to anthropogenic climate change

Source: modified from Andrey and Hachey (1995)

I The Verbal Expert Presenters

From the results of the post-survey questionnaire, the Meteorologist was rated as the overall best communicator by fifty-seven percent (8 of 14¹) of workshop participants who completed the survey. His communications were found to be useful because he used numerous diagrams, provided background information, and explained the information in an interesting fashion. He was also “succinct” and a good speaker.

Overall, the PFRA speaker was considered the most useful communicator by seven percent (1 of 14) of respondents. Sixty-two percent (9 of 14) of respondents rated the

¹ While there were twenty workshop participant’s who partially or mostly completed the post-survey, often less than fifteen responded to any individual question.

PFRA speaker as the most useful communicator on the issue of climate change adaptation. The PFRA speaker was also rated among the most useful communicator of the impacts of climate change to agriculture by thirty-nine percent of respondents and on adapting to climate change in agriculture by thirty-three percent of respondents.

Presenters' Communicative Adherence to the Guidelines

There were several qualities of the two presenters that, with respect to the eleven communication guidelines in Box 4.1, were found to be, in general, either effectively adhered to and/or well received by the workshop participants. When the communications were interactive in nature (guideline 1) there was a greater connection and understanding discerned with many of the participants. Interactive communications were aided when prizes were given to participants who asked or responded to a question throughout one presentation. Being informal and speaking in a down to earth manner also appeared to facilitate the communicative potential of the presenters. In fact, this was observed during the workshop and noted later by some participant's.

It was found that when the presenters were cognizant about the language (guideline 2) while speaking with participants, communications were more effective. Avoiding the use of difficult or technical terms and being an experienced speaker appeared to be a key prerequisite for effective communications with the adult participants of the Rosburn workshop. Participant's repeatedly indicated their appreciation of clear, concise and well-explained presentations.

Being pro-active about the inherent uncertainties and lack of data on the issue of climate change (guideline 3), and acknowledging a limited understanding of the issue may have helped to break down potential expert-lay communication barriers and improve presenters' credibility amongst the participants. In addition, using a multimedia PowerPoint presentation filled with colorful graphs and diagrams (guideline 4), and also providing full explanations, comparisons, and examples assisted understanding.

There was some attention given to general adaptive response actions that can be implemented in the Prairies, and the need to incorporate actions of other various stakeholder groups (guideline 5). This was appreciated by some respondents, though they did note the lack of rural and locally specific actions that could be initiated. During one of the presentations there was a point made regarding the scientific consensus that exists on the issue of climate change, (guideline 6) where the presenter strongly stated that global warming is occurring. This is believed to be important, as people need to be informed that the climate is currently changing, that it is real, and some form of action should and can be taken. However, both presenters were found to not effectively communicate mitigative and adaptive actions that the workshop participants could undertake.

Being able to break down the message into comprehensible pieces (guideline 7) proved valuable for greater understanding of the issue. Despite the enormous quantity of information involved with the issue of climate change, there were instances where the message was communicated in a understandable and step-wise manner. Presenting

lengthy details and explanations were associated with losing the attention of participants and less effective communications.

In one instance, presentation material did include the need to piggyback adaptive responses with other environmental issues (guideline 8). There was also a clear statement indicating the need to adapt to present climate variability and change as part of the response to global warming (guideline 10). Lastly, there was a good review on past climatic change and natural factors that influence past and present climate (guideline 11). However, while this is believed to be an important part of effective communications, workshop participants did not indicate that they are in great need of such communications.

II The Climate Change Short Story

In the post-survey, the climate change story was rated among the most useful communication styles in the potential social and economic impacts theme by sixty-seven percent (8 of 12) of respondents (fifty percent of respondents indicated that the story itself was the most useful). Many of these respondents indicated that the story depicted a reality in terms of future impacts that, for one respondent, made an “emotional impact.” In the adaptation theme, the story was the most useful style for twenty-one percent of respondents. However, in the general science theme, the story was found to be least useful for twenty-seven percent of respondents. Here one indicated that the story lacked explanation. Another said that the story was “..fiction, induces fear,” and provides “..no clues for [the] basics of solving a problem.” Under the adaptation theme, one participant

thought the story was least useful because it is was only coping with the change and offering no solution. For communicating agricultural information, the story was considered the most useful method among twenty-three percent and twenty-two percent of respondents on mitigating and adapting to climate change respectively. In overall usefulness, the story was rated the most useful style by twenty-one percent of respondents; no one thought that the story was the least useful tool.

Communication Strengths

Given the nature of the story as a textual form of communication, evaluative comments in this section tend to gravitate towards informational qualities. This made the separation of the story's information content and how it was communicated (words) even more troublesome. As well, unlike any other workshop tools, an attempt was made to implement the guidelines in Box 4.1 and those given by other authors (i.e. Kearney, 1994), when developing the story to maximize its communicative effectiveness. Despite these evaluative constraints, some communicative qualities of the story emerged from the data and are described below.

Responses from workshop participants indicate that some communication guidelines were successfully implemented when developing the short story. The story was found to be interactive (guideline 1) for many participants. For example, the recurring theme that the story "hit home," by making people aware of the impacts of climate change on "the ground" is indicative of its interactive nature. The story was well understood and was not considered technical in nature. The language (guideline 2) was given attention during the story development and appears to have been quite effective in contributing to improved

understanding. Participants appreciated that the story gave some indication of what actions can be made on climate change, both mitigation and adaptation (guideline 5). Much of the other main workshop materials did not provide much detail on this important aspect of climate change. The story was also found to be quite effective in improving understanding on the issue of what climate change may mean both socially and economically to the RMBR region and what actions can be taken as a response.

One significant factor that should be noted when evaluating the effectiveness of the story relative to other workshop materials was the comparative amount of time allocated for each activity. About twenty minutes were allocated for workshop participants to read over the short story. Given this short duration of time, considerable commentary on its content and quality was voiced during the discussion session, in the post-survey and interviews. In contrast, the Meteorologist and PFRA speaker's presentation and discussion were approximately seventy-five minutes and fifty minutes in duration respectively. This fact further underscores the communicative capacity the story held with many workshop participants during the workshop and even many weeks subsequent.

Communication Weaknesses

The story was less effective in communicating the science of climate and what the physical impacts of climate change may be for the Prairies. The story was also found to be lacking in required detail when giving background science information on climate change and explaining the various potential impacts. The story also assumed that socio-

economic conditions in 2050 would be more or less similar to what they are now. This shortcoming was thought to be a small weakness by one respondent.

III *Winds of Change Poster*

In the post-survey, twenty percent (2 of 10) of post-survey respondents rated the poster as most useful in communicating information on the reduction of greenhouse gases. Good diagrams, text, and the useful bits of information were found to be beneficial for a few workshop participants. Overall, however, the poster failed to attract the attention of many participants. One participant indicated that there was too much information given the size of the poster, causing him/her to lose interest. This comment was echoed under the social and economic theme (as elaborated upon in the information evaluation). Overall, the poster was found to be least useful by twenty-seven percent and most useful by fourteen percent of post-survey respondents.

More substantive comments revealed that the poster was not very useful, due mainly to its high information content described above. The poster was also thought to be impersonal in nature. While most participants recalled some portion of the Meteorologist presentation, some respondents could not remember any of the poster content or graphics. No post-survey respondents indicated that the poster was the most useful communication method. In the categories of natural climate change, physical impacts, and socio-economic impacts, only eight percent of respondents rated the poster as the most useful communication method. On communicating agricultural information only six percent of post-survey respondents indicated that the poster was most useful. These results lead to

the conclusion that the *Winds of Change* poster was not a useful and effective communication medium.

Communication Strengths

When assessing the poster against the guidelines in Box 4.1, only a limited degree of adherence can be established. The poster did use visual examples, such as diagrams and graphics, as a means to improve understanding (guideline 4). There was some general information on mitigative and adaptive actions that readers could engage in (guideline 5).

Communication Weaknesses

The poster did not communicate the opportunity to use natural climatic variability and change as an incentive to make changes (guideline 11). For most other guidelines the poster as a communication medium did not contain any overly weak qualities. It also appears that few participants viewed the poster well enough to provide substantial feedback. Most importantly, the poster also failed to generate the interest and positive comments that were anticipated prior to the workshop. This was an unexpected result.

When the same poster was displayed at a climate change workshop for policy-makers and researchers in Winnipeg in March of 2000, it was difficult to view the poster due to the constant congregation of people around it. Perhaps the poster is not the best tool for those who are less informed on the issue. The poster was also some what of a hard sell at the workshop with all the other activities and expert presentations.

IV Governmental Brochures and Other Materials

It is not known how many people read one or more governmental materials located at the back of the hall during and following the workshop. Given the paced nature of the workshop activities, it is presumed that many were unable to, or choose not to view the government materials before completing the post-survey. For those who did view these materials, they were rated as the least useful style under the climate science, physical impacts, and social and economic themes by twenty-five to thirty-eight percent of respondents. For many, these materials were found to be “vague,” and to “side track the issue,” only to be read quickly and then thrown away. Only in the reduction of greenhouse gas theme did a significant portion of the respondents (33%) think the governmental handouts were most useful. For one participant one useful document outlined step by step actions individuals can take to reduce emissions. However, the governmental materials were considered the least useful communication style overall by fifty-five percent of respondents. No respondents rated these materials as the most useful method overall.

V The Workshop

The workshop itself as a communication foundation for implementing other tools and methods for disseminating climate change information must also be evaluated for its effectiveness, even though there was no specific intent to do so in the initial research proposal. However, it became clear through participant feedback that the workshop was an excellent venue in which to provide climate change information to RMBR stakeholders. Workshops were listed as among the best ways to get the message of climate change out, both in the pre-survey and post-survey. One post-survey respondent

emphasized his or her enjoyment of the workshop. Another specified that it was an “Excellent educational workshop.” It was also suggested that “..more events like these could be useful for informing people and empowering them to make changes”. One interviewee later accentuated that the workshop itself was very effective in initiating the process of thinking and learning more about the climate change issue:

..I think that having the workshop itself was a good outlet, just a good education process in itself...So I found the workshop as a whole just a great kind of starting point...I don't think anything else would have been quite a catalyst for me, to be quite honest.

The one-day workshop was an effective means in which to bring in expert speakers on the issue and conduct other communication activities with the goal of improving knowledge and understanding on climate change.

Despite the positive effect the workshop had on the participants, there were some notable challenges to conducting such an event for the adult public in the RMBR. As revealed in chapter three, in order to attain enough participants' for an effective workshop, substantially more promotion efforts were required (see Table 3.1). This in turn required more time and financial resources that strained the project budget and left less time to plan the workshop and develop the survey instruments and evaluation criteria. Then, only half (18 of 36) of the pre-registrants came to the workshop, with a total of twenty-seven participants. Is all the effort and time that goes into a workshop program effective if less than thirty people attend? Or is it more effective to send out a newspaper insert on climate change to hundreds of Manitoba residents where only a fraction will read it over? Some of the discussion in the following chapter will re-visit these questions. The results

of the communication evaluation demonstrate that the workshop was a highly effective manner in which to conduct a PEO and communication program in the region.

4.5.2 Post Workshop Perspectives as an Indicator of Effective Communications

For this second stage of the communication evaluation, improvements in participants understanding of climate change were assessed through the post-survey questionnaire and the interviews. Participants were also queried on their intent to make mitigative and/or adaptive behavior changes as a result of the workshop communications. The aim of this evaluation component was not to evaluate individual tools or presenters. Rather, this component takes a broader look at the effectiveness of the entire workshop program in improving participant's understanding as part of the learning process.

I Improvement in Knowledge, Concern, and Understanding of Climate Change

The *knowledge* of many workshop participants was found to improve slightly from the onset of the workshop. On the causes of climate change, post-survey respondents gave more responses relevant to human sources, compared to the pre-survey. Seventy-five percent of post-survey respondents also indicated that global warming would occur or was very likely by the year 2050, up seven percent from the pre-survey. Improvements in knowledge, however, did not appear to be significant overall, particularly when compared to increases in concern over climate change (see below). Despite this, results indicate that participants received and stored workshop information, and then were able to recall some of that information at the end of the day.

One post-survey question queried participants on the main message that they gained from the workshop. Three broad and significant themes reflecting increased *concern* over climate change emerged from the large majority of responses:

1. A concern over climate change;
2. The seriousness/importance of the issue; and,
3. The need to do something about it.

The apparent high level of *concern* and perceived *seriousness/importance* with respect to the issue of climate change appeared to peak at the conclusion of the workshop among most respondents. However, while RMNP employees continued to exhibit a fairly high level of concern for climate change eight to thirteen weeks following the workshop, this concern appears to have waned somewhat with farmers. Farmers' attention became re-directed towards more pressing socio-economic issues at hand. They also indicated the long term and less immediate impacts of climate change. One even believed that climate change would not have much impact when it does potentially occur. These results show that while the workshop communications were effective in eliciting a heightened level of concern among the participants immediately after the workshop, they were less effective in sustaining this concern among farmers. The return to daily activities and other concerns likely gave the farmers a more pragmatic perspective on climate change than what they held at the conclusion of the workshop.

The *need to do something* about climate change was the third theme linked to heightened concern and awareness to climate change. While this perspective tended to endure several weeks following the workshop, there were few examples of personal actions that

would be taken. Rather, many implicated government or people in general for taking action on the issue. This appears to indicate that while workshop participants became more concerned and aware of the climate change issue, they did not receive the specific information and subsequent tools to become empowered or informed on what to do, and, how to go about taking environmentally responsible action. Nevertheless, there was a strong consistency that some form of action(s) needs to be implemented on the issue of climate change.

While very difficult to assess improved *understanding* of the issue of climate change, there were some inferred indicators of this occurring amongst workshop participants. Firstly, an initial indication of improved understanding was participants' post-workshop perspective on the seriousness and importance of climate change and the need to do something about it. These perspectives tend to suggest more than a heightened concern and increased knowledge on the issue, but at least a partial understanding that climate change is real, will impact their lives in some way, and that some action should and can be taken.

However, a more convincing indicator of improved understanding among the participants was their intent to take mitigative and/or adaptive action to climate change at the conclusion of the workshop. This intention suggests that a rather compelling connection had been made with the individual in understanding the potential implications of climatic change and their positive attitude to want to make a difference. Intent to change has been found to be a strong precursor of environmental behavior change (Finger, 1994). Forty-four percent (8 of 18) of post-survey respondents indicated that they will try to make

mitigative changes such as driving less, use a more efficient car, and setting up wind breaks. Twenty-eight percent (5 of 18) of the respondents did not intend to make any reductions in greenhouse gas production. Notably, seventeen percent of respondents were previously aware of mitigation and had already made modifications in their driving, energy use or farming practices. Regarding adaptive measures, forty-seven percent (7 of 15) of respondents intended to make such changes; twenty percent (3 of 15) did not. Overall, the intent to do something about climate change among those who had not previously taken action was powerful and often written or voiced in highly informed and persuasive language. This was somewhat of a surprise especially given the overall lack of specific responsive measures provided by the two main expert speakers and most other communications given out or provided at the workshops.

Regrettably, ascertaining interviewees intent to change their behavior several weeks following the workshop to infer improved understanding on climate change was not explored intently until the latter portion of data collection. Learning occurred throughout the process of conducting this research, often provoking better evaluative criteria, such as intent for behavior change, that were previously not emphasized, particularly at the onset of the study. Nevertheless, the few interviewees who indicated that they did not maintain a high degree of knowledge and understanding on the issue prior to the workshop indicated their intent to investigate and implement mitigation and adaptation measures. One seemed profoundly impacted by the workshop, indicating nearly three months following the event that, "I take second thought how in maybe some of the ways we do

things...definitely I [will] try and change anyway.” Another made specific intentions to be more cognizant of mitigation opportunities at home and in the work place.

Unfortunately, there is no tangible comparison that participant’s intent for behavior change can be assessed from any pre-survey results. It is also very difficult to accurately measure if understanding did indeed improve in such a short period, and what specific information or communication media caused it. It was instrumental that the process to determine improvements in understanding as an indicator of effective information and communications was not hinged upon any one factor, but rather several criteria.

4.5.3 Final Thoughts on the Communication Evaluation

Assessing the effectiveness of various communication tools in improving participant’s understanding of climate change within the context of a one-day workshop proved to be a formidable task. Despite the constraints to the communication evaluation mentioned here and in preceding sections, the step-wise, multi-criterion evaluation provided a good assessment of the more effective workshop tools. The evaluation results tend to conform to a key post-survey question asking participants to list the most and least communication tool (Table 4.13). These results places the Meteorologist as the most useful tool overall, with the short story far below, albeit quite surprisingly, in second and the PFRA speaker and poster in third and fourth respectively. While both expert verbal presenters were equally believed to have the most communicative potential with workshop participant’s, only the Meteorologist was found to effectively improve participants’ understanding of

the climate change issue to an expected level. As well, the story was a highly effective communication tool. The government materials were considered least useful overall.

Table 4.13 Communicative quality ratings for the key workshop tools and methods*

Communication Tool	Most useful overall (N=14)	Least useful overall (N=11)	Expected ranking	Actual ranking
Meteorologist	64% (8)	0%	1	1
PFRA speaker	14% (1)	27% (3)	1	3
Poster	14.5% (2)	36% (4)	3	4
Story	21.5% (3)	0%	4	2
Government materials	0%	55% (6)	5	5

*Many respondents made more than one response for the least and most useful communicator. Therefore, totals exceed 100% for both columns

4.6 Summary of Participants Perspectives and Workshop Evaluation

At the onset of the workshop, most participants sustained a moderate to high degree of awareness on the issue of climate change. This is similar to most of the general adult population in Canada. A dichotomy exists, however, in that those associated with RMNP generally maintain a high level of familiarity and concern, and moderate to high levels of knowledge on the issue, while most producers are only somewhat familiar and demonstrate low to moderate concern on climate change. With a few exceptions most stakeholders maintain a low understanding on the issue. As well, for most workshop participants, it was very likely the first time they had received such a large quantity of climate change information in one event. As such, there was not much information that was found to be altogether “ineffective” or “not useful.” The information that connected

with the participant's worldview and was relevant to their lives and region were most often recalled and found to be most useful. General, overly technical, and uncertain information was found to be least useful.

The participants were found to provide more critical observations with respect to workshop communications. Verbal expert presentations were the best forms of communications when they were personal, informal, and interactive. Overall, an enhanced interactive communication format that was informal in nature, contained non-technical explanations, and good presentation skills were most conducive to effective communications. Less effective communications were not interactive, contained more technical explanations and unpolished presentation skills. As such, the information contained in the story and the connection it made with the participants at a personal, local level, made it a more effective communication tool over the PFRA speaker. Despite its favorable visual qualities the *Winds of Change* poster was surprisingly not well read, or favorably critiqued by the majority of participants due to its information intensive nature. The governmental brochures and information kits were not considered an effective communication tool for many participants but were found to contain good information for the small number of people who did read them.

Combined results from the workshop event show the preponderance of increased concern and understanding on the issue. More targeted examination was successful in isolating effective information and communications for RMBR stakeholders. The evaluation reveals that participants gained a nominal increase in knowledge on climate change as a

result of the workshop activities. More convincing, however, was their increased awareness and concern over the issue, the seriousness and importance involved, and the need to take some form of action against it. As such, an improvement in understanding on the issue is discerned from the data.

Based on this case study evaluation, the fact that there appeared to be a greater level of improved understanding on the issue of climate change, compared to increased knowledge, is suggestive evidence that one does not need to first become highly knowledgeable before understanding ensues. This would therefore tend to suggest that the pattern of improved awareness, knowledge, and understanding leading towards responsible behavior change does not necessarily represent itself as a linear pattern as depicted in Figure 3.3. Rather, the data suggests that understanding on the climate change issue and intent to make mitigative and adaptive behavior changes can come about from greater concern and changed perceptions. But these are only possible outcomes as discerning the difference between improved knowledge and understanding is a tedious task, and not a key component of this study. To be sure, more research needs to be done to verify these statements.

Chapter 5 Barriers to Climate Change Communications and Suggestions for the Future

5.1 Introduction

The preceding chapter assessed the perceptions participants held at the onset of the workshop, and their feedback on the workshop information and communications. But in order to develop effective future climate change communications for stakeholders in the Riding Mountain Biosphere Reserve region additional inquiry is needed. In this chapter, two main streams of results are presented that aim to assist future PEO efforts in the study region. First, workshop participants' perceived barriers or challenges to future climate change communications are categorized and explained. In the later portion of the chapter, participants' suggestions for future communications are discussed.

5.2 Perceived Barriers to Climate Change Communications within the RMBR

Barriers to communicating climate change information with stakeholders in the RMBR region were determined almost exclusively through interviews with farmers and RMNP employees. Initially, there was the attempt made during the interviews to distinguish between barriers that were perceived at the individual level and those more prevalent for the entire RMBR region (i.e. external). In the end it was found that many barriers influence at both levels. Therefore, unless otherwise stated, the barriers presented below should be understood to pertain to both the individual, and externally or at the regional level. In total, five primary barrier categories to communicating the issue of climate change were identified from interview responses. From these ten secondary and four tertiary categories emerged from the data. In order to develop a better appreciation and

understanding of the meaning of each barrier, they will be described separately followed by some consideration from other authors. Then a discussion on the inter-linkages among and between the barriers in relation to PEO and communication efforts in the study region will ensue, followed by some personal reflections while conducting the research.

5.2.1 Uninformed Public

An ‘uninformed public’ emerged as a significant barrier, or more accurately, challenge to climate change PEO and communication efforts with stakeholders and citizens residing in the RMBR. This theme broadly comprises three increasingly progressive components:

1. The moderate to high awareness of the climate change issue,¹
2. The limited knowledge and low understanding of potential future climates;
and,
3. Limited to very limited knowledge and understanding of what implications those impacts may have on farmers, the region’s ecosystems, individuals and communities, and what can or should be done about it.

One farmer describes the essence of this theme both at a personal level and for people in the geographical area more broadly:

Well, I think the difficulty is in just trying to understand what it means for me type of thing.... But I don’t think anybody understands enough about it to really be able to put two and two together and get the information out type of thing, you know.

¹ Being highly aware of the issue of climate change does not equate to being fully informed on the potential impacts and responsive actions, as indicated in the second and third components.

For this farmer “put two and two together” refers to informing producers on what climate change means on the “ground,” or what are the impacts potentially going to be, how they may influence farming, and what steps will be required next. This, as well as other data suggests that this challenge is more relevant to farmers, given their higher level of unfamiliarity, and lack of knowledge and understanding of the issue, in comparison to most RMNP employees. Nevertheless, the gap in understanding the anticipated future climate scenarios and the impacts prevails among both farmers and RMNP employees.

For farmers, there is a large void in understanding the issue of climate change (i.e. global warming), and what it means to people on “the ground” or to their lives, and to agriculture at the farm level. RMNP employees emphasized that their lack of understanding includes the potential impacts to the ecosystems, flora and fauna in the area. These two stakeholder groups lack the information and subsequent understanding that are relevant to their lives and local concerns. As such, this barrier does not concern climate change communications specifically. Rather, this barrier underscores the challenge of improving understanding on this issue in the RMBR region sufficiently enough to change attitudes, perceptions and eventually promote action on the issue. This barrier, therefore, provides persuasive support for an intensive and extensive public education effort in the RMBR, and more research into doing so more effectively.

The ‘uninformed public’ barrier theme was derived from participants’ post-workshop responses, even after participating in a full day of climate change communications at the workshop. This seemed to provide the participants with a better perspective in which to

appreciate the complexity of the issue, and realize that most people in the RMBR, including themselves, are far from a full understanding of climate change.

Yet, the RMBR stakeholders who participated in the workshop are not isolated in their lack of understanding of climate change. In fact, one of the strongest correlation between participants' perceived barrier to climate change communications and other PEO research is the reality of an uninformed public (see Andrey and Hackey, 1995). Many other authors have reported a low public understanding of the issue (e.g. PEO Issue Table, 1998; Popescul and O'Brien, 1999; Chalecki, 2000; Read et al., 1994). However, most simply report this phenomenon and do not link it to constraints to PEO and communication.

Another strong congruence between participants' perceived barriers to communication and the literature, noted in the previous chapter, was their confusion on the causes of climate change with stratospheric ozone depletion, weather and climate, and what constitutes the greenhouse effect (e.g. see Read et al., 1994; Bostrum et al 1994). Even after participating in the workshop one interviewee repeatedly referred to 'climate change' as daily and seasonal weather conditions.

5.2.2 Information challenges

'Informational challenges' is indicative of the inadequate quality and quantity of climate change information that is given out and/or received by the general adult population in the RMBR. Two main secondary categories of this theme provide further clarification:

- 1) 'Lack of easily accessible/available climate change information;' and,
- 2) 'Informational saturation.'

1) 'Lack of easily accessible/available information'

For most people living in the RMBR, especially those not affiliated with RMNP, climate change information is scarcely available or accessible. This appears to be more prevalent among farmers since, compared to RMNP employees, they generally have less contact with information sources pertaining to climate change and other environmental issues. This corresponds with the earlier reported finding that farmers are generally less familiar with and concerned about climate change than RMNP employees. However, this barrier is prevalent even among Park employees:

I don't ever really see it [climate change] in the newspapers or on the radio or on TV. I have never really seen it expressed a whole lot. And I guess I had to seek out the information, like go to the workshop, go to the website to get the information.

While extensive quantities of climate change information are available on the Internet, many living around RMNP are not believed to have Internet access or even own a computer. Unfortunately, Internet and computer usage data was not gathered as part of this study. However, an indicator of Internet use can be gleaned from Toombs (1999). He found that only thirteen percent of surveyed farmers (N=202) in the southern Agro-region of Manitoba had an Internet connection in 1998, and only one person had used it for accessing relevant weather related information. In fact most were found to use their Internet infrequently (Toombs, 1999). While some climate change information is available and is without doubt reaching RMBR residents (mainly through mass media

outlets), this study indicates that information does not appear to be reaching a large proportion of the adult population. Given all the other barriers described in this section, it is unlikely that people are racing to procure this information from local libraries, the Internet or other potential sources.

The Role of the Media

The role of the media contributed significantly to respondents' perceptions regarding the deficit of climate change information in the RMBR. 'Limited media coverage' represents an additional challenge to communications and, therefore, emerged as a strong sub-category of 'informational deficits.' Having attended the Rossburn workshop and receive a full day of climate change information placed the participants in a good position to make such evaluative comments on the media's coverage of climate change. The participants appeared to realize that the information the media impart is not sufficient. Respondents revealed this through their repeated observations that news stories about climate change presented only partial information on the issue. The media (newspapers, TV, radio in general) were observed to provide only the headlines on climate change for both farmers and RMNP employees. Interviewees' comments on the inadequate quality of media coverage on climate change can be elucidated with one farmer's perspective regarding the *Kyoto Protocol*:

So I think, you know, I think we're just kind of hearing the headlines but don't know the rest of the story type of thing. That's what's missing. And people need to be more aware of it. ...All were kind of hearing is the headlines where were hearing, you know, *Kyoto* and this agreement. But what exactly did it mean?

This barrier has implications to PEO research because the mass media are the principal means by which people in Canada and the RMBR appear to receive climate change information. Indeed, people tend to depend upon the media as a way through which they build their views of the environment (Good, 2000). In Manitoba this has shown to be true, at least to some degree, as 97% (N=224) of farmers in southern Manitoba were found to receive their weather information through TV or radio (Toombs, 1999). Given respondents' suggestions for using radio, TV and newspaper media outlets as a way to get climate change information out (see forthcoming text), this implies that many RMBR stakeholders currently receive this information through these sources.

The media constraints identified by the workshop participants reinforces the second credibility problem described by Andrey and Hackey (1995; see also Table 2.3). Many authors argue that the mass media present a barrier to communicating climate change information to the public (e.g. Meisner, 2000; Good, 2000; Halford et al., 1991). This is, however, where the similarities end. Many authors criticize the media on the quality of climate change coverage, most often on their balanced or two sided perspective on the issue (i.e. global warming is human caused verses the recent global warming is a natural phenomena) (e.g. Andrey and Hackey, 1995; Blair, 2001; Andrey and Mortsch, 2000; Soggi, 2000). However, results from this study underscore the lack of climate change information provided by the media. This may have occurred because the majority of the workshop participants likely do not maintain the same level of understanding that climate researchers maintain, nor have the time to study the issue at length, and, therefore, were not in a position to provide critical evaluation of media coverage. But it was a result of

workshop activities that participants appeared to gain an enhanced capacity to critique the information on climate change given by the media. The media-general public communications barrier has been reported to be the paradox of a media that are becoming more scientifically sound at a time when public faith in science is waning (O’Riordan et al., 1989; see also Meisner, 2000). Yet workshop participants did not discount the communicative potential of the media per se, and, as seen later, they seemed to appreciate the science based presentations. Rather, their post-workshop perspective made many realize the inadequacies of the information they have received from the media to date.

2) Informational saturation

We live in a society where we are constantly bombarded with various sensory information from a multitude of sources. In the RMBR the saturation of information that is directed towards area residents presents a competing challenge in effectively transmitting the climate change message. There simply exists cognitive limits to how much information one individual can receive and store at one time (Kearney, 1994). One interviewee describes informational saturation regarding the environment:

..you can bombard people with all information and soon they start blocking it out...People get bombarded for the last ten, ten years. You know the world is doing so poorly, blah, blah, blah. And no one has really been seeing any drastic changes. But the information is still out there. And we’re still being bombarded I guess. And so we’re just kind of becoming into it.

The reality of a society saturated with information as a barrier to climate change communications was revealed by RMBR stakeholders, verified through personal observation (discussed later) and also supported by the literature (Ungar, 2000). Ungar

notes that due to our current ‘age of information’ there is a ‘knowledge-ignorance paradox’ where people are becoming less informed about issues. This appears to be happening with stakeholders’ limited knowledge of climate change amidst other pressing information. Making climate change information more widely available and easily accessible in the study region through an intensive PEO and communications effort will further saturate the amount of information directed towards people, thereby only adding to the dilemma of too much information.

5.2.3 More Important Issues

The ‘more important issues’ stakeholders deal with represents yet another key constraint to climate change communications. Two sub-categories emerged from this barrier:

- 1) ‘Economic realities;’ and,
- 2) ‘Too busy.’

1) Economic Realities

The current farm income crisis or economic crisis holds far more short-term importance for farmers and, to a lesser extent among RMNP employees, than the issue of climate change. As one farmer succinctly pointed out:

Well, I think probably the more immediate concerns in farming is whether we can survive the next year or two, never mind any further down the line. That’s the whole thing right now with climate change [that it] has been overshadowed by the income crisis that has hit agriculture.

The immediacy and importance that so many researchers associate with climate change and its potential adverse impacts on agriculture in the Canadian Prairies and in Agro-

Manitoba are simply not a principal concern for farmers near bankruptcy. Rising production and input costs, low grain prices, and reduced government subsidies are all a part of the growing crisis (Newton, 2001) that has yet to be sufficiently addressed.

3) Too Busy

‘Too busy’ also emerged as an important secondary barrier or challenge to ‘more important issues.’ This barrier appeared to be more prevalent among area producers than RMNP employees. This may be a result of the lengthy time requirements for grain and cattle farming. However, being too busy is also applicable to RMNP employees, and most likely for other RMBR residents. Even in late January local public notice boards displayed an endless agenda of activities, meetings and events that were ongoing in the area. One farmer befittingly described this barrier:

We go to meetings. We go to socials. We go to hockey games. We go to curling games and we go to all that stuff. And you talk to neighbors and friends and people and you know what everyday talk is about.. and the environment isn't very often brought up except if it is too damn cold, or if it is raining or something like that....And as soon as they're finished farming, their doing something else, and when they're finished in town doing their business, they head out for the golf course and stuff like that.

Most people lead busy lives; they are not environmentalists and do not continually study the subject. For one farmer, the busy lives people lead was likely one of the main reasons that people who were aware of the workshop were not able to attend.

The barriers of economic realities and the busy lives people lead in the RMBR are also revealed by other authors (e.g. Andrey and Hackey, 1995; Ungar, 2000). Indeed, ‘informational saturation,’ the busy lives people lead, and ‘more important issue’ (i.e. the economic farm crisis other impending environmental concerns such as large-scale hog barn development), culminate to diminish the likelihood climate change information will be received through future PEO and communication efforts. These constraints to climate change communications were repeatedly voiced by respondents; however, there does not appear to be the same level of attention given by climate science researchers or even those involved with PEO and communication efforts. Rather, the focus among researchers, government and communicators sometimes seems narrowly focussed on the climate change issue exclusively. This gives further evidence of the gap in clearly defining a focus towards effective communications between the scientific research and PEO communities (see Bray, 2000), and the general public. There is a pressing need to bridge these gaps between researchers and the public.

5.2.4 Stakeholder Oriented Constraints

‘Stakeholder oriented constraints’ emerged as the fourth of five key barriers to climate change communications. This barrier theme reflects the individual and internally based constraints perceived by interviewees¹. This theme is further segmented into three secondary sub-categories:

¹ This theme emphasizes the barriers interviewees perceived at a personal level. As such, the secondary categories are believed to be caused mainly by internal forces, rather than factors that are external such as media coverage or policy related constraints.

- 1) 'Personal barriers to action;'
- 2) 'Abstract issue;' and,
- 3) 'Overall low salience'.

1) Personal Barriers to Action

'Personal barriers to action' reflect the personal constraints an individual faces in consideration of PEO and communication efforts. Two tertiary categories were developed: 'personal relevance' and 'sense of helplessness.' 'Personal relevance' is the challenge of making climate change relevant at a personal, individual level. It also includes the challenge of overcoming a lack of willingness to change. As a RMNP employee stated: "You have to find a way to make it relevant I guess to each individual... You have to make it relevant to me."

'Sense of helplessness' reflects an individual lack of perceived capacity to make any difference on the issue of climate change. For one respondent, this was a result of his/her thoughts that the rural population of RMBR is at the political control of the urban population who are the main producers of greenhouse gases and will create positive policy changes only when there is an impact on urban areas. For another respondent, taking mitigative action on climate change seems futile given the insignificant difference it would make in reducing greenhouse gases compared to industrial outputs:

Sometimes I feel frustrated that, you know, I'm doing all these actions but at the same time there are these huge institutions or industries that are polluting away. And it like just seems really futile to be doing stuff like that.

2) Abstract Issue

The underlying notion of ‘abstract issue’ among workshop participants is the common impression that climate change is an incremental, gradual problem of the distant future, not the next one, ten or even fifty years. As a result, there is little immediate concern or sense of urgency over the issue. As one RMNP employee put it, “ Like I guess one of the biggest problems with climate change is likely [that it is] so gradual no one seems to be worrying about it.” This was echoed by another who exhibited little concern over climate change due to what the respondent believed was a small change in temperature predicted over the next fifty years.

The issue of climate change becomes even more abstract when there is no perceivable deterioration of the environment as a whole despite years of information telling us such is the case. This notion was voiced by one RMNP employee:

People get bombarded for the last ten, ten years. You know the world is doing so poorly, blah, blah, blah, and no one has really been seeing any drastic changes.

Interestingly, the abstract issue theme was much more evident among the farmers than the RMNP interviewees. This suggests a connection between this barrier and ‘uninformed public.’ Those less informed on climate change would reasonably perceive it to be more abstract and less tangible compared to those who have a better understanding of the issue.

3) Overall low salience of the climate change issue

This theme represents the current low interest level, and lack of perceived relevance and desire to learn more about this issue. Unlike any other barrier, this theme refers more

specifically to the non-participants of the *Community Climate Change Workshop*, from the viewpoints of the interviewees. These non-participants were thought to be aware of the workshop through one or more of the advertising efforts, but still choose not to attend. To add some clarity to this theme, one RMNP employee explained why people choose not to attend the workshop:

..probably a lot of people read your information [promotional posters, etc]. They just didn't come because they wouldn't see it as being relevant to them, you know.

While 'personal relevance' refers to the challenge of overcoming the lack of relevance climate change imposes upon many stakeholders at the individual level, this theme underscores the lack of relevance, and interest on the issue. Again, it generally does not include the workshop participants since they elicited enough interest to spend an entire day learning about climate change and, moreover, completing two survey questionnaires. This was especially for interviewees who spent gave up to two hours of their time to further discuss the workshop activities and climate change.

3b) Generation Transition for Farmers

An uncommon but notable tertiary sub-component of 'low salience' is 'generation transition.' The fact that most farmers are near or at retirement age was reason for one farmer to strongly believe that they would be less concerned about climate change or any actions that may be needed in the future. This issue is supported by the demographics showing that many farmers in Manitoba are near or at retirement age (Newton, 2001).

The ‘personal barriers to action,’ ‘abstract issue,’ and ‘overall low salience’ themes share some broad similarities with three main barriers summarized in Table 2.4 (p. 22 in Chapter Two). First, at the individual level the issue of climate change is not relevant nor does it instill a sense that something can be done. These two notions are indicated when Andrey and Hackey (1995) discuss two barriers: 1) the sense of helplessness people feel on the issue (barrier # 5-Table 2.4); and, 2) the belief that individual action won’t make a difference (barrier #7). This classic example of a ‘tragedy of the commons dilemma’ and sense of helplessness seemed to be evident among many respondents. This is even more so when many implicated the federal government to take action on the issue, implying that the problem is out of their hands.

The ‘abstract issue’ and ‘overall low salience’ also has an association with the two barriers above. But there are likely stronger similarities when it comes to the lack of urgency described in Table 2.4. Certainly, the large-scale, indirectly experienced and abstract nature of the issue described by Kearney (1994) has relevance to all of three interviewee-derived themes. This has implications as a language constraint to improving understanding on the issue. This perpetuates the public’s sense of apathy on the issue. The barriers perceived at the personal level by many respondents such as the lack of risk salience, sense of helplessness and tragedy of the commons dilemma are also seen in the literature. These constraints to PEO and communication efforts are internally based but are influenced by external forces such as economic factors, implementation and policy challenges, and at the largest level, institutional limitations. Some of these constraints are represented in the discussion below.

5.2.5 Lack of Supporting Mechanisms

'Lack of supporting mechanisms' emerged as another primary barrier to climate change communications. This theme underlies the challenges placed upon future PEO and communication endeavors by the existing institutional, political, and organizational structure. As such, three important sub-categories comprise this barrier:

- 1) 'Organization barriers;'
- 2) 'Implementation barriers;' and,
- 3) 'Policy related barriers.'

1) Organizational Barriers

'Organizational barriers' represents the challenge of collaboratively bringing together all interested parties in the RMBR to address the issue of climate change, regarding both PEO efforts, but moreover, with respect to taking action on reducing greenhouse gases and adapting to climate change. Two specific constraints exemplify this sub-category. First, it was noted that the geographical nature of Riding Mountain National Park acts as a physical barrier to communications among people living on opposite sides of the Park, especially regions to the north and south of the park. People generally conduct their activities at the local level. As the respondent revealed:

A lot of stuff that happens in Gilbert Plains, Grandview, Dauphin region, we [south of the park] don't hear about, and they don't hear what goes on here a lot of times. ... it isn't a cohesive group even though it looks like it should be, but it ain't....There isn't the movement of information back and forth between the two areas. Park splits us up.

To illustrate, people in Erickson, located approximately ten kilometers south of the Park, read different newspapers, listen to different radio stations than those living north of the Park, such as in Dauphin (for town locations see Figure 3.2).

The second organizational difficulty is in coordinating potentially interested groups in the area (e.g. Ducks Unlimited, Conservation Districts) to work collaboratively on the issue of climate change given their differing and potentially conflicting mandates and/or policies. This challenge was a recurring response that became increasingly evident through a key observation made by one farmer:

Ducks Unlimited opened up a bunch of lakes up there [RMNP] last fall after heavy rains and didn't tell us [local Conservation District]. Therefore it left us having to handle water we didn't know about.

This example represents a monumental organizational challenge that has no easy resolution. The three levels of government, farmers, Conservation Districts, Ducks Unlimited, Manitoba Habitat Heritage Corporation, the RMBR Liaison Committee, and other stakeholders will need to cooperate and communicate with each other to effectively become more informed about the risks of climate change, and take subsequent preventative and adaptive action.

2) Implementation Barriers

'Implementation barriers' reflect the physical, logistical, timing, and monetary challenges in getting climate change information to the general adult population in the RMBR region. In a rural region, such as RMBR, where the population is distributed unevenly and over a large area, getting climate change information out may pose a considerable constraint to improving citizens' understanding on the issue.

Another difficulty is how to get people to participate in climate change events and activities, such as a workshop? These implementation barriers imposed by climate change communications are largely dependent upon the chosen method and process of communication. For example, the issue was raised whether climate change communications should be an inclusive or exclusive process. Who to include or target for the communications? Do you invite only the councilors, reeves and other community leaders to information events? Or is it better to invite all interested individuals and parties to voice their opinion and make the process fully participatory?

Another challenge is in delivering or providing climate change information in a timely manner to maximize receivership. Also very important is the amount of funding for a climate change education program. Without sufficient funds effective communications are severely compromised.

3) Policy Related Barriers

'Policy related barriers' encompass the absence of mechanisms and incentives in place for individual stakeholders and organizations to take action on climate change once they have become more informed. One RMNP employee noted that there are no initiatives or incentives established for visitors (mostly from urban centers such as Brandon and Winnipeg) to do anything about declining wolf populations in RMNP. This linkage in the process of increasing understanding leading to responsible action on an issue is even more absent with regard to the issue of climate change. One park employee echoes the deficiency of public education and outreach on climate change in RMNP:

Like even at the Park they don't really touch on that issue [climate change] because its not really in the mandate of the Park kind of thing. I think maybe they may touch on it in a very indirect way. But its never really brought out in front, you know. And you have thousands of visitors' come there, you know.

This lack of policy initiatives to promote improved understanding and behavior change for RMNP visitors also holds true for individuals in the RMBR. There is a lack of organizational support or policy mechanisms in place for positive reinforcement or feedback for an individual who chooses to reduce greenhouse gas production. While there are some national initiatives in place to direct community based action, for example the Federation of Canadian Municipalities (FCM) Partners for Climate Protection strategy, these initiatives have yet to be initiated in the RMBR.

The organization, implementation, and policy related challenges workshop respondents broadly described as barriers to future climate change communications in the RMBR have many sweeping similarities that could be discussed at length with other scholarly work. However, that is not a main objective of this thesis or even this chapter. Rather, the main purpose was to identify and explain the barriers pertinent to the RMBR region. Table 5.1 sets out the arrangement of these barriers in their respective category.

Nevertheless, the organization, implementation and policy barriers described above share similarity to Andrey and Hachey's (1995) barrier that mitigation and adaptation efforts will require cooperation among all involved (barrier #8). Notwithstanding other challenges, collaboration and communication among natural and social scientists has been observed to be a point of contention. For the RMBR, these mechanism based

challenges support the fact that researchers are still in the early stages of exploring the social dimensions of climate change (Chalecki, 2000).

Table 5.1 Barriers to climate change communications in the RMBR area

PRIMARY CATEGORY	SECONDARY CATEGORY	TERTIARY CATEGORY
Uninformed Public		
Informational Challenges	Lack of information Informational saturation	Media Limitations
More Important Issues	Economic Realities Too Busy	
Stakeholder Oriented	Personal Barriers to action Abstract Issue Overall Low Salience	Personal Relevance Sense of Helplessness Generation Transition
Lack of Supporting Mechanisms	Organizational Challenges Implementation Challenges Policy Related Constraints	

5.3 Congruence of Communication Barriers from Personal Observation

While in the study region engaging in research activities, subtle observations were made that support several of the communication challenges revealed by interviewees. The most common observation was evidence of much more important issues at hand. The strongest manifestation of this was that people often appear too busy to bother with the issue of climate change, or at least have conflicting demands. At the same time they are continuously saturated with other information. These two observations were revealed to me by the amount of information placed on public notice boards as illustrated below in Figure 5.1. In fact, it was found that most public notice boards were clogged with notices

of meetings, events and other activities and information, even in the middle of winter. This gives strong evidence that people are exceedingly busy and have large amounts of information directed towards them.

The preponderance of more important issues and the busy lifestyles many RMBR citizens lead was also made clear while promoting the workshop at council meetings and to the RMBR Liaison Committee. Some of the RM meetings were so busy and full of issues to address that they occur over two days each month. It was overwhelming to hear the number of items and issues on the agenda at most of these meetings, most of which were undeniably far more pressing than the issue of climate change. Case in point was in the RM of Straithclair where the issue of potential hog barn development easily out-weighted the workshop promotion in terms of immediacy and potential environmental impacts. Since there were so many meetings and other activities the councilors were committed to, many were unable to attend the workshop.

While presenting to council members and the Liaison Committee two other less critical barriers to communication appeared to surface. The first observation was made during presenting details of the Rossburn workshop to the delegations. It was here that the issue of climate change did appear abstract to many. As well, during some delegations my presentation failed to engender much interest or prominence among some councilors and stakeholders.



Figure 5.1 Public notice board at the Co-op in Rossuburn depicting the busy and information intensive lives people lead

5.4 Connections among the barriers to communications within the RMBR

The barriers to climate change communications do not act in isolation but in fact often work collectively to solidify or reinforce many others in a crosscutting manner. As an illustration, it can be shown that many barriers influence, or are influenced by, the challenge of an uninformed public in the study region. When climate change information is not available or not easily accessible to stakeholders in the RMBR, and is received in an insufficient quality and quantity, mainly through the media, the potential for improving understanding on climate change is severely compromised. In this manner ‘informational challenges’ may help to deepen or hold up the problem of an ‘uninformed public.’ If the information is not reaching residents or effectively invoking concern and a heightened awareness the personal communications in restaurants, meetings and on the

street are less likely to take place. As one farmer said, “And I think because of not having much information, its not talked about that much.” The general lack of concern, awareness, knowledge and understanding will ultimately persist since the information developed on climate change has not been made available to the RMBR on an extensive basis and in an engaging format.

Further, any future PEO and communication program on climate change initiated in the region would also have to compete with other information as part of the challenge our ‘age of information society’ presents. ‘Informational saturation’ is also a hindrance to receiving information and therefore becoming more informed on the climate change issue.

An additional constraint upon improving stakeholders understanding on climate change is the low regard and abstract perception held on the issue by many stakeholders. Climate change is an abstract issue and does not have prominence among much of the public in the RMBR. As such, these two challenges tend to positively reinforce each other.

Moreover, to surmount these challenges requires abundant quantities of information and education to enable improved understanding. Given all of the other constraints, this is a highly difficult task. Moreover, if there is a lack of organization among key stakeholders to initiate a larger education campaign in the RMBR region, a low understanding on the issue will likely prevail.

Lastly, an uninformed public that lacks the understanding of the potential impacts of climate change to agriculture, the environment, and socioeconomic conditions may not be

inclined, or be much less inclined to enact and support measures to reduce greenhouse gases or make appropriate adaptations. Improved understanding on the climate change issue is integral for informed decision-making among RMBR stakeholders, and all other members of the general public. Yet, there are many impediments to initiating an effective PEO and communication program. The real challenge is to surmount these barriers with innovative and consistent education efforts.

5.5 Towards Improved Climate Change Communications in the RMBR

With a partial understanding of the many barriers to undertaking future climate change communications in the RMBR, this chapter now presents workshop participants' perspectives on how to effectively proceed in getting climate change information out to people in the region. This is in accordance with the fourth objective of this study: *to suggest tools and methods for improved communication of climate change information with adult learners*. These suggestions came primarily from the interviews, but also from pre-survey and post-survey responses, providing a more representative assessment. These suggestions are first summarized in italicized text, followed by a brief discussion of each.

Who is responsible for taking action and how should these activities be coordinated?

Workshop participants indicated that no one group or organization is solely responsible to taking the lead in climate change communications. There was, however, an emphasized need for higher level co-ordination, financial and policy support from the federal government. Participants often identified existing organizations to lead communications in the RMBR. The local and regional organizations most commonly

proposed were the RMBR, RMNP, Conservation Districts, Prairie Farm Rehabilitation Administration, Rural Municipalities, farming groups and agricultural representatives.

These suggestions assigning responsibility to the federal government for organization, policy, and particularly money, underscore the need for more resources for climate change communications (Andrey and Hachey, 1995; Fishhoff, 1995; Socci, 2000). In doing so, the goals (Popescul and O'Brien, 1999; Rowan, 1994) and targeted audiences (Kearney, 1994; PEO Issue Table, 1998) also need to be defined. An understanding of the targeted audiences' perspectives also need to be gathered, as discussed earlier (see Andrey and Hackey, 1995, and Figure 2.3- guideline #3, p. 45). This is where organizational, implementation, and policy-related barriers identified through this study need to be addressed. This needs to be undertaken at the federal, provincial and especially the local level where stakeholders within RMBR could have the greatest level of involvement. Regional and local organizations already in place would serve well to address PEO efforts, since they are well known and likely seen as more credible and trusted than the federal government. RMNP has a potential role to play for educating visitors to the park, and in assisting policy development and implementation on climate change.

A unique suggestion on how to go about PEO and communication efforts in the future was that a multi-jurisdictional sub-committee of the RMBR could serve as a regional co-ordination and nerve center for interested stakeholders and organizations to communicate ideas. This center could also help develop regional and local strategies for

public education, mitigation and adaptation. This sub-committee framework has been implemented successfully in the past in the RMBR.

This nerve center could be guided by a multi-stakeholder steering committee consisting of RMNP staff, farmers, government and environmental representatives, to ensure the appropriate direction and dissemination of climate change information. The nerve center could also feed off other information and coordination centers such as the regional and sectoral nodes of C-CAIRN or the National PEO Steering Committee (see the PEO Issue Table, 1999). There are also regional organizations such as the Prairie Adaptation Research Collaborative (PARC) and the PEO hub recommended in the report by the Manitoba Climate Change Task Force (2001). This hub, implemented through the Fort Whyte Centre and the Manitoba Eco-Network, is currently in the early stages of developing a PEO strategy for Manitoba. Perhaps linkages and cooperation with other Biosphere Reserves in Canada could also be made with Canada's chapter of the Man and the Biosphere (MAB) program's Canadian Network for Environmental Education and Communication (EECOM) (Canada/MAB Program, 2001). This could also be an opportunity to take PEO and communication lessons from other reserves similar to RMBR. It is important that there is strong organization and that there are not redundancies in PEO and communication efforts. A multi-jurisdictional sub-committee would likely facilitate more informed front line workers, as suggested by Andrey and Hackey (1995). Such a committee could encourage local participation both at an organizational context and in using local experts to disseminate information.

It was repeatedly suggested that climate change communications should be linked with existing environmental issues and concerns to reduce redundancies and increase interest and awareness. The Conservation Districts within the RMBR could be used to communicate and implement “no regret” actions as a way to reduce greenhouse gas mitigation and adapt to climate change; these actions would simultaneously conserve the soil, water, air and other environment parameters. There was also an emphasized need for linking climate change communications to economic factors related to energy efficiency, reduced farming costs, credits, and incentives/disincentives related to mitigative and adaptive responses to climate change.

There is no need to create new organizations when existing ones can implement climate change communications effectively. This further elucidates the need for communication partnerships with other organizations. But the real opportunity with this recommendation may lie with piggybacking the climate change issue with other issues (Andrey and Hackey, 1995; Wilson, 2000; Strong, 2000; IPCC, 1995b; Luciuk and O’Brien, 2000). “No regret actions” that serve to address not only climate change but more pressing issues including, the conservation and improvement of air, soil and water quality, conservation of ecosystems and biodiversity at all spatial scales, can have multiple benefits that are highly visible and desirable for most people.

The local conservation districts (CD’s) that work in the study region to conserve and manage soil and water quality, based not on political demarcations but on watershed boundaries, were frequently selected among participants to be both a future leader in

climate change communications and implementing responsive actions. These perspectives may have been influenced by the depiction of the CD's engaged in these two roles in the climate change short story. Nonetheless, the CD's could use their brochures and publications to improve understanding on the issue and, in time, implement programs to mitigate greenhouse gas production in conjunction with soil conservation, perhaps using learn by doing "field day" events. According to the PEO Issue Table (1998) practical "Solutions in Action" are key to grassroots PEO campaigns, as this is how communities want to receive climate change information. Manitoba Habitat Heritage Corporation and Ducks Unlimited have similar opportunities that extend to the provincial and national level respectively. Within the RMBR tourism boards, RMNP, and rural municipalities possess communication opportunities with their brochures, networks and programs.

What information should be provided as part of a communication strategy?

Overall, people want to know how climate change will impact their personal activities at the local level, what needs to be done, and how to go about doing it. Information found most useful by workshop participants and also needed as part of future communications relates primarily to the potential biophysical impacts of climate change. This includes information on potential changes in temperature, precipitation, soil moisture, extreme weather events and their frequency; natural climate changes, and Boreal forest migration. Also needed is information on potential socio-economic implications and what actions can be taken at the personal and local to make appropriate adaptations to climate change and mitigate greenhouse gas emissions.

Perhaps this is where needed information on the implications of natural climate variability and change with adult learners could also serve as a catalyst or additional incentive to take adaptive measures against both geophysical and anthropogenic climate change. Even when faced with great uncertainty or skepticism regarding anthropogenic climate change predictions, variable and changing climates during recent human history elucidates the need for human activities to be less vulnerable and more resistant to such forces. Given the high costs attributed to adapting to current climate variability it makes sense to increase resilience to change by making current systems less vulnerable to such changes. This is needed to keep farming viable in Manitoba and ensure the sustainability of other socio-economic and environmental conditions in the RMBR including recreation and tourism.

What tools and methods are best for communicating climate change information?

Workshop participants suggested several communication techniques. These communication tools and mediums are described below in decreasing order of importance as emphasized by participants:

1. Workshops/meetings (being the most effective technique)

Workshops will work best when conducted over one day and drawing upon experts to present and discuss the issue in an interactive and personal manner. This provides sufficient time for those less informed to develop a fuller understanding of the issue.

This communication venue suggested by workshop participants includes the need for personal two-way communications among the targeted audience(s) and the main communicators. Results from the Blue Box, Ontario Green Communities and other similar PEO activities found that personal door to door communications were among the most effective in improving understanding and promoting behavior change (PEO Issue Table, 1998, 1999). With regards to US forest landowners, diffusions of innovations and mass communications were most effective using interpersonal and two-way interactions (West et al., 1988). Personal communications are also a primary method to implement the use of two way interactive communications promoted by Andrey and Hachey (1995). The workshop setting is an excellent means in which to facilitate interactive, personal communication most effectively. This arrangement would more likely enable a more inclusive and participatory engagement of stakeholders that would, therefore, allow greater public inclusion into evaluating PEO initiatives, as recommended for future PEO efforts (PEO Issue Table, 1999; Government of Canada, 2001).

Workshops that are a half-day or longer in duration, while difficult to attract people to, have some distinct advantages. Such workshops are long enough to enable the message of climate change to be broken down into digestible components, and for the knowledge base to be built up one step at a time, as suggested by some authors (Andrey and Hackey, 1995; Read et al., 1994; McBean, 2000). Workshops also allow more time for expert verbal communicators to meet communicative criteria, such as developing credibility (Andrey and Hackey, 1995; Bostrum et al., 1994; PEO Issue Table, 1998) and trust (see Rowan, 1994) with the target audience.

As indicated earlier, the Rossburn workshop not only improved participants' understanding of the climate change issue, it appeared to also improve their capacity to provide post-workshop perspectives by building the foundation upon which to make decisions. An additional benefit was the legacy the workshop left with some participants. On a few occasions interviewees noted that they began to discuss the issue of climate change with others in their community, as a direct result of participation in the workshop.

The workshop setting also provides an opportunity for stakeholders to meet and discuss climate change and other issues while receiving information through various media.

Workshops are a common occurrence in the area for a variety of other environmental issues, including climate change (Whitaker, 2001 *pers comm*). Future organizers of workshops in the RMBR region may benefit from implementing a workplan, such as the *Community Action Workshop Manual* developed by the Harmony Foundation (Iribarne, et al., 2000). This manual guides the facilitator and the participants through structured activities in the goal of developing community based action plans.

2. Mass media outlets

While the Television news medium was not seen as a highly useful communication method in this region, other mass media outlets such as radio and especially newspapers were suggested for engaging RMBR stakeholders with climate change information.

Despite participants' critical views on the coverage of climate change by the mass media, the mass media was frequently suggested to get information out following the workshop.

This is congruent with other findings of public opinion polls and studies summarized in the PEO Issue Table (1998). It also upholds research indicating the strong public reliance upon the mass media for environmental information (see Halford and Sheehan, 1991; Good, 2000; Meisner, 2000),

Newspapers are very common in the region and are reportedly read by a large number of people especially in the less busy winter months. It was for this reason that local community newspapers were used for workshop promotions. It was interesting however that only thirty percent of the workshop participants learned of the event through the newspapers while twenty-six percent found out through personal communications with neighbors or friends. Though indicated by respondents, this tends to underscore the communicative potential of interactive, personal forms of information exchange.

The mass media are known to affect how North Americans view the world (Meisner, 2000; Halford and Sheehan, 1991). Given their widespread influence, it would be beneficial for the scientific community to develop a communication partnership with the media to communicate the issue of climate change to the general public as suggested by Andrey and Hackey (1995). Perhaps some form of the media based communication strategy proposed by Good (2000) could be initiated. This would work to improve the credibility and accuracy of information communicated to the media, communities and policy-makers alike. Lessons learned from waste minimization awareness efforts in Manitoba using the media as a main communicator could also be employed (Action Plan: A Waste Minimization Strategy, 1990).

Use of newsletters/brochures

Workshop participants frequently identified newsletter, brochures, and to a lesser extent, other similar means, including pamphlets and publications, as effective communication tools for the RMBR region. The same existing organizations identified to be responsible for taking the lead in PEO and communication efforts in the region (as seen above), were seen as the most effective way to get the climate change message out. As well, toll free phone numbers should be listed for those interested in accessing more extensive free federal government information.

To be sure, communicating climate change using newspapers needs to be carefully designed in order to engage the readers attention. Perhaps this is an opportunity for the use of a catch slogan or graphic such as an Eco-logo like the one used for Blue Box Recycling as part of a “Branding” technique (PEO Issue Table, 1998).

3. Stories

In addition to the favorable feedback provided by workshop participants’ on the short story read during the workshop, this tool was frequently suggested for future communications.

Given the potential of narrative communications to engage readers, this tool has great potential, if used carefully, to heighten awareness and improve understanding on the issue of climate change amongst RMBR stakeholders. This could be done using various outlets such as local newspapers or the mass media (see Meisner, 2000). As indicated by the data presented in Chapter Four, the story format may be most useful for communicating

highly uncertain socio-economic aspects of climate change. Science based information may be better received and given more credibility if delivered by expert communicators.

4. Learn by doing or field days

Interactive, hands-on activities and events were identified as a useful way to communicate climate change information. For example, “field days” demonstrating on-farm adaptation and mitigation strategies may be a potential future tool once concern and knowledge on climate change increases. Climate change calculators could be given out showing how much individual activities reduced greenhouse gas emissions and simultaneously save money.

Field days were suggested by workshop participants as a good way to show people how to take action on climate change (mainly to mitigate greenhouse gases). Field days would also invariably contain the interactive, personal qualities described above.

Chapter 6: Conclusions: Towards an Effective Communication Strategy

6.1 Introduction

The purpose of this study was to develop an understanding of effective methods and tools for communicating climate change information with adult learners in the RMBR. The research objectives outlined in Chapter One were adequately achieved by applying an interactive and adaptive methodological approach. From the study results, several conclusions have been drawn. These outcomes have been applied to develop a set of suggestions for developing future public education and communication activities in the Riding Mountain Biosphere Reserve region.

6.2 Participants' Views of Climate Change and on the Workshop Activities

Perceptions and Understanding on the Climate Change Issue

This study reveals that workshop participants are concerned about the environment, and socioeconomic conditions in the area. They were also sufficiently concerned and aware about the climate change issue to attend the workshop. Therefore, the data attained in this study is likely representative of those more informed and concerned about environmental issues in general. The concern over the impacts of climate change, namely those associated with the local changes in biophysical parameters and socioeconomic conditions, increased as a result of workshop activities. While participants' knowledge of the climate change issue was seen to improve, the greater change, as revealed by the data, was their heightened awareness, concern and belief that something should be done. In fact, many indicated they intended to make mitigative

and/or adaptive changes to their lifestyle as a result of the workshop. These changes suggest that improved understanding was an outcome of this case study.

Information Evaluation

The findings from the information evaluation component conclude that all locally or personally relevant information on climate change is most useful to workshop participants, and indeed, probably for most RMBR citizens. This information elicits the greatest recall, concern, and improvement in understanding.

It was also found that participants wanted more information on the climate change issue, even after the intensive activities carried out during the workshop. For many participants, receiving information on climate change at the workshop was a catalyst for needing more information. Increased concern over climate change lead to a short-term desire for more information on the issue and impacts to their communities, way of life, and families.

Communication Evaluation

Participants found it easier to evaluate the communication component of the workshop activities. Thus, more and better qualitative feedback was gained from this evaluation component. Participants felt the workshop was a highly effective, engaging and educational experience. The workshop brought stakeholders together from the region to listen, read, hear and view information on climate change communicated using various methods and tools, in an often engaging and interactive manner.

Expert verbal presentations on climate change are among the most effective for improving understanding on the issue. But they should be clearly and confidently

delivered by a trustworthy source with good communication skills, detailing information that is relevant to the recipients in a step by step process. In addition, interactive, two-way, and personal communications with the recipients is also critical for greater communicative effectiveness. Future communications should further engage recipients by relating to their current socio-economic situation and connecting with their worldview and cognitive attributes. This research demonstrates that short stories have this communicative capacity.

It became clear that it is the combined communication package that determines how effective a PEO program is in improving understanding on climate change. The more positive communication qualities that are part of a PEO effort, the greater the improvement in understanding is likely to be. The Meteorologist and the story contained a large degree of these positive characteristics; the poster and government material contained very few, while the PFRA speaker maintained a modest degree of adherence.

Tools such as posters and short stories have fewer potential communication attributes than verbal expert or personal communications due to their limited communicative capacity. Therefore, these forms of communications must engage and hold the readers or viewers interest with the textual and visual qualities they contain. This is why it is even more important to understand the audience and design such education devices with due care. The *Winds of Change* poster only had the benefit of containing colorful and graphic displays and figures. Despite the valuable information on the poster, the visuals did not, for the most part, entice people to spend time reading it. The story was 1700 words-

textual material communicated only through reading. Yet the story was rather effective in engaging and informing its readers. Findings indicate that the effectiveness of the story was due to adhering to the principles of cognitive psychology, developing the content of the story to the local context, and placing the information in a story setting. The story hit home because it struck a cord with its readers on a local scale and socio-economic basis, activated their thought processes, and was communicated in a interesting, vivid, coherent and engaging manner in comparison to most other workshop tools. The story was found to be more effective than the PFRA speaker due to these powerful communicative qualities.

Barriers to Future Climate Change Communications in the RMBR

Five primary barriers to future climate change communications were derived:

1. *Uninformed Public*
2. *Informational Challenges*
3. *More Important Issues*
4. *Stakeholder Oriented Constraints*
5. *Lack of Supporting Mechanisms*

Four central findings related to these five primary barriers to climate change communications in the RMBR are concluded:

1. The barriers show strong similarities with those discussed in the literature;
2. The five primary barriers are synergistic. In this way they impose a greater impediment to effectively communicating and acting on the climate change issue; and,
3. The barriers are cross-cutting. The barriers influence at many levels including societal, governmental/institutional, regional, local and individual scales.
4. In addition to the 'lack of supporting mechanisms,' all other key barriers act as constraints for individuals to make mitigative and adaptive behavior changes.

6.3 Working towards Effective Climate Change Communications in the RMBR

In the preceding chapter, workshop participants who have lived and worked in the RMBR for many years provided many pragmatic suggestions for future climate change communications. Therefore, while the communication recommendations below considering other findings of this research and pertinent literature, they flow principally from participants' suggestions, namely, the perspectives of stakeholders and the results of the workshop evaluation.

1. Identify current needs, concerns, views, and perspectives of RMBR citizens and stakeholder groups on the issue of climate change and connected environmental and socioeconomic issues that currently concern communities, rural municipalities and the entire RMBR region. Such issues may include the economic farm crisis, large-scale hog barn development, sustainable farming, environmental conservation, and rural development. This may be done using workshops and conducting surveys and discussion groups. There is strong literature support underscoring the need to understand and characterize PEO and communication audience(s).

There should be a high level of stakeholder/public inclusion when gathering this information, as different groups are likely to have varying levels of understanding, concern and needs on the issue of climate change and other related issues. Public involvement in the decision-making process is increasing with regard to environmental conservation and resource management. This should include the issue of climate change, as the need for stakeholder involvement is taking on more

importance with respect to the climate change issue at the federal level. As well, the barriers to communications identified in this study should be further explored including the impediments to responsible environmental behavior change on climate change and other similar issues.

2. Identify existing organizations, groups, committees and other bodies that are well established and respected in the RMBR region. Assess their current activities and communication outlets. Once these organizations are identified, a multi-jurisdictional committee could be set up to oversee the communication and collaboration of these organizations. Work to link these organizations to federal programs, funding and other resources allocated for climate change, rural development, environmental conservation, agriculture and socio-economic sustainability. These conclusions are in line with other research that urges the need to take lessons from other disciplines and implement measures that benefit other environmental and socioeconomic issues. Organizations such as Manitoba's PEO/ information hub, the Prairie Adaptation Research Collaborative and the Canadian Climate Impacts Adaptation and Research Network could and should have a role in these efforts.
3. Following the above steps, climate change communications can commence in the region given sufficient resources and organization. A draft communication plan(s) should be developed that addresses the identified barriers to both learning and behavior change, and include mechanisms for ongoing evaluation-all of which are

integral components of a PEO program. The communication would be piloted on a local scale then expanded when greatest effectiveness was achieved.

A toolbox of communication methods and tools is the best way to get climate change information out to citizens and engage people on the issue of climate change. The implementation of these tools should be given careful consideration based on the perceptions of the target audience, information communicated, and the goals and objectives of the communications. Four key communication tools and methods outlined below were determined to be the most effective in improving understanding on the climate change issue:

1. Workshops/Forums/Seminars

This option allows for nearly all other forms of communications with stakeholders.

Workshops and other similar events allow expert verbal presenters to engage participants in an *interactive* manner, important when promoting effective communications (Andrey and Hackey, 1995; Bray-Palmer, 2000; West et al., 1988). Linking with stakeholders on a one to one or group basis helps improve the credibility of the communicator, develops trust and rapport between the two parties and can engage the recipient of the communications most effectively (see PEO Issue Table 1998, 1999).

Workshops are ideal for discussion, questions and debate on the issue and for providing additional information materials for people to take home and read at their own leisure.

Personal group communications such as ‘field days’ may be a good way to engage

support and initiate action with regards to changing farming and lifestyle practices through greenhouse gas mitigation and adaptation strategies. Workshops provide an excellent vehicle for nearly all of the other forms of communications detailed below.

2. Newsletters and Brochures

Workshop participants strongly support using the newsletters and brochures of existing organizations and groups to communicate the issue of climate change to area citizens. These organizations include the Conservation Districts, Manitoba Agriculture, Ducks Unlimited, Manitoba Habitat Corporation, RMBR committee, RMNP, Rural Municipalities, tourism and recreational boards or groups.

There are two key benefits to this approach. First, it enables climate change to be neatly connected with issues such as soil, water air, and entire ecosystem conservation, sustainable farming practices, tourism and recreation. Linking climate change with other currently salient issues helps to overcome the barrier of a largely uninterested public, and reduces the potential for increased information saturation in the region. The second benefit would be the savings in costs and time in developing and financing a separate information letter on climate change. In fact, connecting climate change with other issues and organizations in communicating for improved understanding and, in time, 'no regret' actions should be capitalized on in all communications where possible.

3. Short Stories

Using a short story to communicate the potential biophysical impacts of climate change and socio-economic implications to families and communities in the RMBR may be an excellent way to improve concern and understanding on the issue. Implementing a story to communicate climate change enables the use of analogs, examples, and comparisons in an easily digestible and engaging manner. These are some key qualities that stories impart upon readers (PEO Issue Table, 1998; Glantz, 1991; Kearney, 1994; Read et al., 1994). This method of communication is interesting and easily received by recipients, and can help make climate change important, less abstract, and more tangible for citizens without the technical, complex and information intensive language often used in climate change discourse. Stories are advantageous since they are inexpensive to develop and can be disseminated using several outlets such as workshops, brochures, newsletters and local newspapers and radio. This would be a way of getting more information out to people using the mass media through widely read and distributed daily and weekly newspapers.

4. Local Newspapers and Radio

Local newspapers and radio have great opportunity to get climate change information out to people in the RMBR. Given the well documented influence the media have on the publics' view of the world, as a result of their domination of information outlets and public reliance upon them for information, it would be wise for researchers and communicators to work with the media on climate change PEO efforts. In addition to journalists' articles on the issue, more resources should be put into buying newspaper space and radio time. This allows full control of the message communicated, allowing

among other things, short stories on climate change as discussed above. Collaboration among and between researchers, communicators, and the media can improve the quantity and quality of information given out. Researchers call for more credible quality; RMBR stakeholders need more information.

6.3 Concluding Thoughts and Future Research Needs

Aside from one other workshop, this research was the first known local event addressing climate change in the region for ten years. This research initiated the exploration of climate change perceptions and program evaluation in the RMBR s as part of a case study community workshop. It will likely not be the last PEO or research endeavor in the region as the issue of climate change is not likely to diminish greatly in the next several years. Given the infancy of climate change PEO and, specifically, communication activities, this research could have been expanded to a much greater extent.

Future research extending from this study would attempt to discern how all stakeholder groups in the area, including those from First Nations, recreation (skiing, hunting, etc.), and more farmers, feel about climate change and pressing salient environmental and socioeconomic views. More PEO and communication events (workshops, posters, media) and evaluations would also be developed to discern the most effective education campaign. The tools and information that were most effective at the Rossburn workshop would be tested first. Those who participated in the Rossburn workshop would also be assessed for any longer-term changes in attitudes and behavior as a result of those communications.

As more public education, outreach and communications on climate change increase with the organization of regional hubs, several research questions emerge from this case study that are applicable to the RMBR region and other areas of Canada. These key questions are as follows:

- What has been the relative effectiveness of various PEO and communication efforts in improving understanding on climate change and empowering citizens to reduce greenhouse gases and support policy change?
- What are the barriers to receiving information, and taking action on climate change, and supporting responsive policy changes among different publics or stakeholder groups? How do they differ?
- Should PEO and communication efforts endeavor to improve understanding on the issue of climate change, or strive primarily towards mitigation and adaptive education? Which process is more conducive to responsible environmental behavior?
- How can PEO and subsequent action on the climate change issue be effectively linked with existing environmental and socioeconomic concerns and the organizations that address them?
- What role should governments play in PEO and communication efforts?
- To what extent should the general adult population be involved in developing and delivering PEO programs?

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Personal Communications

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- Tyrchniewicz, A. 2000. Allen Tyrchniewicz is the former director of the International Institute for Sustainable Development (IISD) Great Plains Program.
- Whitaker, J., 2000. John Whitaker is a farmer and chair of the Riding Mountain Biosphere Reserve, and member of the Clean Environment Commission.
- Wright, R., 2000. Ronald Wright is the author of the best selling book *A Scientific Romance*. He lives in Ontario, Canada.

Appendix A Definitions and Concepts Associated with the Research

There are several terms commonly associated with the issue of climate change that need to be clarified. These definitions are provided below:

Weather: State or condition of the atmosphere with respect to heat or cold, wetness, or dryness, calm or storm, and clearness or cloudiness for a certain period of time [and for a certain location] (*modified from Environment Canada, 1997: 76*).

Climate: Climate is usually defined as the “average weather,” or more rigorously, as the statistical description of the weather in terms of the mean and variability of relevant quantities over periods of several decades (typically three decades as defined by the World Meteorological Organization). These quantities are most often surface variables such as temperature, precipitation, and wind, but in a wider sense the “climate” is the description of the state of the climate system. (Intergovernmental Panel on Climate Change Glossary. Found at: www.ipcc.ch/pub/gloss.pdf)

Climate Change: climate change is referred to in the observational record of climate occurs because of internal changes within the climate system or in the interaction of its component, or because of changes in external forcing either for natural reasons or because of human activities. It is generally not possible clearly to make attribution between these causes. Projections of future climate change reported by the IPCC generally consider only the influence of greenhouse gases and other human-related factors. (Intergovernmental Panel on Climate Change Glossary. Found at: www.ipcc.ch/pub/gloss.pdf)

Greenhouse gas: A gas that absorbs radiation [within the infrared portion of] the spectrum of radiation emitted by the Earth's surface and by clouds. The gas in turn emits infrared radiation from a level [or altitude] where the temperature is colder than the surface. The net effect is a local trapping of part of the absorbed energy and a tendency to warm the planetary surface. Water vapour (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄), and ozone (O₃) are the primary greenhouse gases in the Earth's atmosphere.

(modified from Intergovernmental Panel on Climate Change Glossary. Found at: www.ipcc.ch/pub/gloss.pdf)

Global Warming: Strictly speaking, global warming and global cooling refer to the natural warming and cooling trends that the Earth has experienced all through its history. However, the term "global warming" has become popularized as the term that encompasses all aspects of the global warming problem, including the potential climate changes that will be brought about by an increase in global temperatures. (*Environment Canada, 1997: 73-74*)

Greenhouse effect: A warming of the Earth's atmosphere caused by the presence in the atmosphere of certain heat-trapping gases (e.g., water vapour, carbon dioxide, methane). These gases absorb radiation emitted by the Earth, thereby retarding the loss of energy from the system to space. The greenhouse effect has been a property of Earth's atmosphere for millions of years and is responsible for maintaining the Earth's surface at a temperature that makes it habitable for human beings. (*Environment Canada, 1997: 73-74*)

Enhanced greenhouse effect: Today, humankind is contributing significant amounts of heat-trapping gases to the atmosphere. The increased concentrations of these gases are "enhancing" the natural greenhouse effect. It is the "enhanced greenhouse effect" that is expected to cause a large and rapid rise in average global temperatures. (*Environment Canada, 1997: 73-74*)

Adaptation: Adaptation [in the context of climate change] refers to the changes in a system (environmental, human, socioeconomic) that maintains or improves the viability of that system under variable or changing conditions (e.g., climatic conditions). Adaptation involves taking steps to minimize the negative impacts of climate change and to maximize the benefits. (*modified from Wittrock, 1999: 29*)

Mitigation: Mitigation is .. an anthropogenic intervention to reduce the sources of greenhouse gases or enhance their sinks. (*IPCC, 2001:3c*)

No Regrets: Measures whose benefits, such as improved performance or reduced emissions of local/regional pollutants, but excluding the benefits of climate change mitigation, equal or exceed their costs. They are sometimes known as “measures worth doing anyway.” (IPCC Glossary, Found at: www.ipcc.ch/pub/gloss.pdf)

Precautionary Principle: Avoiding a solution that is irreversible, because the assumptions on which the solution is based prove incorrect in favor of a seemingly inferior solution that can be reversed (IPCC Glossary, Found at: www.ipcc.ch/pub/gloss.pdf)

Sustainable development: Development which meets the needs of the present without compromising the ability of future generations to meet their own needs. (*WCED, 1984*)

Kyoto Protocol: An international agreement struck at the Third Conference of the Parties in Kyoto, Japan, where 159 developed nations agreed to set a legally binding treaty to reduce greenhouse gas emissions by an average of 5% below 1990 levels between the year 2008-2012.
(*Government of Canada-National Climate Change Program, 2000*)

Workshop explores climate changes

By LYNDENN BEHM
Brandon Sun

The impact of climate change on both farming and the Riding Mountain region will be examined at a workshop Saturday in Rosburn.

In addition to providing information through presentations, people who attend the workshop will also be surveyed for their views by a University of Manitoba student who will use this information as part of his masters thesis.

"The purpose of my research is to find out what people know and what they think," Randal Shymko.

"I want to give the public the opportunity to listen to information on climate change," said Shymko, who also organized the workshop. "They will also have the opportunity to give their own views on climate change."

One of the presenters will be Bevan Lawson, climate trends meteorologist for the Prairies and northern Canada. He said that computerized weather models provide some interesting information.

The most probable scenarios would have the temperature in the Manitoba prairies rising by an average of 2-3 C during summers and 3-4.5 C during winter over the next half century. This could have a big effect on agriculture, such things as what crops could be grown, he said.

"There are two things to look at if you are a farmer. One is risk. The other is opportunity," he said explaining that change provides new opportunities.

Complicating everything is that global warming will affect different areas of the world differently. For instance, it has been projected that North America will be affected more than the earth on average and that

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the Prairies will warm more than the rest of the continent, he said.

Climate change could affect such things as the length of winters and growing seasons and how quickly water runs off following melts. However, he said he didn't want to predict specifically how crops or natural vegetation would be affected because that wasn't his area of expertise.

A presenter from the Prairie Farm Rehabilitation Administration will look at the impact on agriculture.

The workshop is from 9:30 a.m. to 4:15 p.m. in the community centre hall in Rosburn. The workshop is sponsored by the Riding Mountain Biosphere Reserves, the Prairie Adaptation Research Co-operative and the University of Manitoba.

The deadline for pre-registration has passed, but registration will also be available at the door, Shymko said.

Appendix C Other Communication Guidelines Seen in the Literature

Below are communication guidelines for climate change that are listed by Andrey and Hackey (1995) and supported by various other authors (see Figure 2.3). While it is important to consider these communication guidelines as part of an entire PEO program, they were not well supported in the literature, and moreover, were not considered highly relevant with respect to the project analysis or conclusions. They are here to complement the information provided in Chapter Two, Section 2.10. As in Chapter Two, these guidelines are summarized by the report authors (Andrey and Hackey, 1995) and then given further elaboration by other supporting scholars.

Carefully Define Communication Goals

Despite the practice of identifying goals and obstacles in other fields (i.e. education) this is not known to be frequently conducted with regard to climate change communications. Popescul and O'Brien (1999) included this guideline in their documentation of eight general steps to preparing and implementing a climate change public outreach initiative.

Have Informed and Committed Front Line Workers

To improve risk communication on the climate change issue, public agency workers delivering the message of climate change need to hold a strong understanding of the issue, and possess presentation, listening and interaction skills.

Improve the Credibility of Communicators

Improved credibility among communicators incorporates trust and confidence. While slow to build, especially among the government, these and other organizations and communicators could gain credibility through mitigative and adaptive actions and by showing how past environmental issues were solved. Fischhoff (1995) adds to this point arguing that the recipients of information take time to assess the adequacy of the message and the credibility of the communicator(s). Thus, respect towards the targeted audience(s) is important. For scientists, building credibility and trust is a requirement in an ongoing effort to translate predictions, probabilities, and risk assessment into understandable terms (McBean, 2000). A credible message on climate change must be truthful and believable, address the language issue, and use a variety of stakeholders to communicate a common theme (PEO Issue Table, 1999).

Do Not Trivialize the Communication Challenge

To empower the public with the skills to make informed decisions and take action on climate change, iterative, lifelong learning and education are needed to create a consensus among the public.

Be Pro-active/Honest and Open About the Uncertainties

While the scientific gaps in understanding on climate change should be revealed, they should not be dwelled upon. The sense of a lack of urgency (related to a lack of scientific data and uncertainty), could be overcome by invoking the precautionary principle in the absence of formal scientific certainty. As such, climate change communications must also “instill” a sense of future responsibility on a global scale. Andrey and Mortsch (2000) agree with invoking the precautionary principle indicating that public climate change communications should emphasize points where consensus exists. For example, the greenhouse effect, the continual rise in greenhouse gases, “a discernable human influence on global climate”(p.WP 3), an increase in surface temperatures, and the adequacy of GCMs to depict general features of past and present climates.

Capitalize on Situational Opportunities

Major weather anomalies that gain the public’s attention need to be taken advantage of and then sustained when public interest wanes on climate change and apathy sets in. Technology advances and behavior changes on a small scale are ways to perpetuate responsive actions.

Do Not be Weary of Ethical/Justice Issues

Ethical and justice issues relating to climate change reveal that the negative impacts will be incurred by future generations. Therefore, climate change and related ethical issues include its anthropogenic source, the potential for catastrophes, and incidental risk exposure. Thus, capitalizing on peoples’ fundamental values on the legacies of climate change may be as useful as part of a PEO strategy (PEO Issue Table 1998).

Appendix D Promotions for Community Climate Change Workshop

I Cover Letter for Mail-outs

Dear Chief Administrative Officer,

I am a graduate student studying at the University of Manitoba researching the issue of climate change as it relates to public education and communication. To that end, I am organising a *Community Climate Change Workshop* for Saturday February 17, 2001 in Rossburn, Manitoba.

Back in late December I sent workshop advertisements and pre-registration forms for a January 25 workshop. However, due to logistical difficulties, **the date of the workshop has changed to February 17. Please accept my sincere apologies for any inconvenience this may have caused.**

Enclosed in the envelope are copies of the workshop advertisement and pre-registration form. If not inconvenient could you make a few copies of the registration form so those who wish to attend can pre-register?

To help promote the workshop to those who may be interested in attending from your area, I am making a request for the ad and pre-registration forms to be posted on your bulletin board for the public to see. Please replace the previous sent advertisement and pre-registration forms with the ones enclosed. Please tack or pin the pre-registration forms below the ad so that those interested in attending know they can take a copy to send in to the address or fax number below.

If at all possible and not inconvenient, could the ad and a few registration forms also be posted at one or two areas frequented by area residents (eg. Co-op, post office) to help ensure as many people as possible know about the workshop.

Any questions or comments about the workshop can be made by fax, phone, E-mail or by mail using the contact information below. I thank you in advance for your assistance.

Yours very sincerely,

Randall Shymko

Masters of Natural Resource Management candidate
c/o Natural Resources Institute
University of Manitoba
R3T 2N2
Phone:
Fax:
E:mail:

II Advertisement used for mail-out, newspapers and posters (modified to fit page)

Community Climate Change Workshop

All are invited to a free *Community Climate Change Workshop* to be held at the **Community Center hall in Rosburn, Manitoba on Saturday February 17, 2001 from 9:30 am to 4:15 p.m.** In the event of inclement weather or very poor highway conditions, the workshop will be held on Saturday March 3. Stayed tuned to your local radio station or CJOB (680 AM) for updates. Pre-registration is recommended but you can also register at the door beginning at 9:00 am with the **workshop commencing at 9:30 sharp.** The workshop is sponsored in part by the Riding Mountain Biosphere Reserve, the Prairie Adaptation Research Co-operative, and the University of Manitoba.

**** Please note **** the original date of the workshop was January 25. The date of the workshop has been changed to February 17 due to logistical difficulties and to allow for more people to attend. We give our sincere apologies for any inconveniences this may have caused.

Workshop Highlights

- A meteorologist presentation on climate science and possible future scenarios and impacts
- A presentation from a Prairie Farm Rehabilitation Administration representative on the issue of climate change and agriculture
- Opportunity for questions and discussion with the presenters
- A chance to see the *Winds of Change: Climate Change on the Prairies* poster
- **Free lunch** for those who pre-register by **filling out a pre-registration form below**
- Door prizes!!

The first goal of the workshop is to provide an open forum for the public to hear, see and discuss the issue of climate change in the Canadian Prairies, specifically the Riding Mountain Biosphere Reserve region of Manitoba.

The second goal of the workshop is to determine what climate change information is required and how to best communicate that information to the people living in this region of Manitoba. As such, the workshop will have a research component where participants will be provided the opportunity to give their views and perspectives on the issue of climate change, and rate the quality of the workshop by completing two fifteen minute surveys. However, the workshop is open to the general public so completing the surveys and participating in any workshop activities will be entirely optional. The results of the surveys will be used for the partial completion of a Masters thesis in Natural Resource Management.

Those interested in attending can register at the door. However, we cannot guarantee a free lunch for those who do not pre-register as lunch availability will be based on pre-registration numbers. Therefore, those expecting to attend are **strongly** encouraged to fill out a pre-registration form below and return by fax or mail. Alternatively, you can also pre-register by leaving your name at the **phone number below**, or e-mail your name at the **e-mail address below** and indicate your intent to attend the workshop.

Space is limited. The pre-registration deadline has been extended to Monday **February 12, 2001**. For more information or to pre-register send contact information to **Randall Shymko** by one of four ways:

1) Mail:

c/o Natural Resources Institute
University of Manitoba

Winnipeg, Manitoba, R3T 2N2

2) **Phone:**

3) **Fax:**

4) **E-mail:**

Appendix E Workshop Proceedings Schedule

Community Climate Change Workshop

Rosburn Community Hall, Rosburn, Manitoba, Saturday February 17th 2001

General Outline of workshop activities:

9:00-9:30 am	Registration and pick up workshop packages at the door
9:30-9:45	Welcoming and introductions -Issue of climate change and purpose of workshop
9:45-10:00	Pre-survey given out
10:00-10:05	Quick coffee and donut break
10:05-10:30	<u>Bevan Lawson (Environment Canada Meteorologist)</u> -What is climate change -Causes of climate change -Climate change from the past to the present
10:30-10:50	Break (refreshments provided)
10:50-11:30	<u>Second half of Bevan Lawson's presentation:</u> -Anticipated human induced climate change -Future impacts of climate change in Canada and the Prairies
11:30-11:45	Questions and discussion
11:45-12:00	<u>Winds of Change: Climate Change on the Prairies</u> poster introduced
12:00-1:00 p.m.	Lunch at N&L Restaurant
1:00-2:00	<u>Gerry Luciuk (Prairie Farm Rehabilitation Administration)</u> -On climate change and agriculture
2:00-2:20	Gerry Luciuk: Questions and discussion period
2:20-2:40	Break (refreshments provided)
2:40-3:00	Opportunity to read " <i>Climate change in Manitoba: Challenge and Opportunity</i> " -Feedback taken on usefulness of story as a communication style
3:00-3:30	<u>Discussion & brainstorming session</u> -Present and future information and communication needs on: 1) climate science, climate change and global warming 2) potential impacts to agriculture and southern Manitoba 3) adaptation to climate change and reducing greenhouse gas emissions
3:30-3:50	Post-survey given out
3:50-4:10	Closing statements; Door Prizes!!!

Appendix F Climate Change Short Story and Cover Letter

Dear Workshop participant,

The following is a short story of what the future climate and its impacts may be like for southern Manitoba in the year 2050. This story contains some information on the possible impacts of climate change from various scientific documents. However, this story is a fictional account.

The purpose of this story is to provide an alternative method of communicating climate change information that is interesting and engaging to read. The story is not a prediction of the future, nor is it intended to create fear. While leisurely reading through this short story please keep the above comments in mind.

Sincerely

Randall Shymko

“Climate Change in Manitoba: Challenge and Opportunity”

It was a mild and sunny day on February 5, and Tulips were poking out along a Manitoba farmyard. This was not unusual for this time of year, not for the middle of the 21st century. The year is 2050 on a farm south of Riding Mountain National Park, east of Rossburn. The temperature was 9 degrees Celsius. As Bill sat outside on his porch, his mind wandered back to when he began farming in 2005. He is still amazed that in such a short time the climate would have changed so much and the weather become so unpredictable.

As it turned out, predictions of global warming became a reality for many parts of the world, especially places like the Canadian Prairies. By 2050, temperatures had increased globally by an average of about 2 degrees Celsius, despite considerable greenhouse gas reductions. In southern Manitoba and much of the southern Prairies, the temperatures have risen even more, between 3 and 5 degrees Celsius.

Around 2001, climate scientists had gathered enough convincing evidence to conclude that human activities were primarily responsible for

the global warming phenomena. The scientists said that the main causes were too many people burning fossil fuels and changing the landscapes.

While there have been many implications of global warming, what has affected Bill and the family farm the most has been the increased variability and severity of the year to year weather. Temperatures have increased the most in winter and spring. In February, daytime temperatures near 8 degrees usually melt most of the thick snow-pack laid down by more frequent and severe snowstorms.

March is now more like early May was forty years ago. Even by the year 2030 there was a 50/50 chance for a snow free Christmas. Although more snow falls, much of it often melts or evaporates during frequent January thaws.

Now, in 2050, the snow usually starts melting by mid February. Rapidly rising temperatures often melt snow too rapidly to be absorbed, making soil and water conservation measures more difficult. Following the beginning of seeding in mid March colder arctic air occasionally plunges down to the southern Prairies bringing untimely frosts and freezing rains. Later in May, warm humid air from the Gulf of Mexico sometimes clashes with colder arctic air creating severe thunderstorms often with destructive hail and tornadoes. As predicted, tornado alley had extended northward into southern Manitoba. Now tornadoes are more frequent and more destructive when they occur. But the thunderstorms that spawn these tornadoes cause more damage to crops and infrastructure from their winds, hail and flooding downpours.

While Bill knows how variable the weather can be at any time of the year, he and many others are struck at how unpredictable the weather has become since 2005. This increased weather variability has not been restricted to the winter and spring. Summer is also increasingly unpredictable and unforgiving.

Summer rainfall is even more erratic than in the spring. The only constant reality seems to be a greater scarcity of water. This is because of the hotter and longer summers. The longer summers are a benefit as there are more heat loving crops to choose from such as Sorghum and corn. The benefit to agriculture has been improved yields and increased production from more heat and carbon dioxide fertilization. But the longer growing season has also increased the period of evaporation and crop water needs. The result has been less available water overall. Compared to forty years ago, drought frequency has increased by thirteen fold and the number of

days with temperatures over 30 degrees Celsius has doubled. But while drought is more frequent and intense, there have also been cycles of damaging wet spells. Some of these wet spells appeared to have been caused by human influences. Some of them have reflected sources out of the human domain.

In 2028, two volcanic eruptions, both larger than Pinatubo in 1991, ejected billions of tons of ash high into the upper atmosphere. For two years global temperatures cooled as the ash blocked a portion of the sun's energy from reaching the earth's surface. The following year, damp and relatively cool conditions prevailed over the eastern Prairies creating a haven for *Sclerotinia* and other moisture loving diseases, some of which have been able to migrate from the US in the past ten years due to the milder Manitoba winters. These conditions came as a surprise to many who were unprepared for the cooler wet conditions especially right on the heels of a three year drought. But that three year drought was mild compared to the one in the 2030's.

In 2034, five years of successive drought struck the southern Prairies. Crops wilted, dugouts dried out, weeds grew out of control, and the water table dropped as much as 3 meters. By 2038 agricultural and municipal water supplies were nearly dry. It's no wonder. Water quality and quantity has become scarcer since livestock operations have expanded and temperatures have increased in southern Manitoba. Legal battles over ownership of water rights are now common newspaper stories. Since water is now allocated and purchased by volume, more efficient pipeline irrigation systems have been developed to reduce both costs and water loss from evaporation and leakage.

Improved irrigation systems couldn't stop the extensive fires that broke out during the peak of the drought in the summer of 2038. Following a series of dry electrical storms, fires that started in tinder dry forests spread into the forage and bush lands both outside and inside the park. Infrastructure, forage crops, bales, shelterbelts and agroforestry operations, and livestock adjacent to the park were damaged or destroyed. The air became thick with smoke from the local fires and from huge fires in the US Rocky Mountains. Poor air quality from the smoke and from wind blown topsoil lead to more hospitalizations due to respiratory illnesses. The sick, young and elderly were forced to stay indoors. Increased temperatures and fluctuating weather since the fires of 2038 have prevented the reestablishment of trees both around the park and inside the park.

With increasing scientific predictions and the growing consensus of global warming by 2005, Bill believed the risks for maintaining the status quo were just too great. Instead of having to bear the economic costs of more extreme weather events and variability in the future, Bill decided to take proactive action to adapt to the anticipated changes. It made sense to adapt since farms were rather vulnerable to current weather variability and extremes such as drought, floods, frost and hail. And, where feasible, he also took steps to reduce his on farm production of greenhouse gas emissions.

Initially, making his farm more resilient to climate change seemed hopeless for Bill in 2005 given that many in the area didn't even foresee many family farms being around in 20 years because of the ongoing farm crisis. Low grain prices, high production costs, governments either passing the buck of responsibility or turning a blind eye to the state of agriculture in the Prairies were among the main challenges facing the family farm.

With the growing realization of the value and importance of the family farm, and the reality of global warming and other environmental concerns, policy makers began to take steps to reform agricultural policy and help farmers like Bill take action towards climate change and sustainable agriculture..

Instead of providing subsidies to farmers after the losses have occurred, governments redirected a portion of the funds and incentives for farmers who initiated proactive measures. Bill received assistance to diversify his farm to a wider variety of crops that were more tolerant of a typical prairie climate. By 2015, he had a rotation of Hemp, flaxseed, dry peas, lentils, mustard seed and buckwheat. Bill also moved towards more adaptable hay and pasture options such as wheat and fescue grasses. He also had his dugout deepened and enlarged to hold water even during severe multi year droughts.

While increased aridity and scarcity of water since 2008 has been attributable to global warming, the increasing presence of large-scale livestock operations, and pressure from the US to share Canadian water has become an additional incentive to conserve water quality and quantity for all users. Previously existing water and soil conservation programs were linked to climate change actions. Conserving soil moisture and preventing erosion by implementing zero tillage and planting trees also helped to reduce carbon dioxide losses to the air by keeping it in the soil and wood.

A national carbon credit program for farmers came into effect allowing income and property tax incentives for those who reduced their greenhouse gas emissions. This was done in conjunction with conservation agreements where Bill and other interested landowners would set aside marginal land for the sake of maintaining native plants and animals. Newer, more efficient technologies in fertilizer application helped reduce nitrogen losses to the air and to surface water. Technologies for injecting hog manure directly into the soil improved reducing both the smell and input costs in chemical fertilizers. Improved technology for fertilizer, manure, and other chemical applications reduced Bills costs, improved the quality of the air, and simultaneously reduced greenhouse gas emissions. By reducing his emissions of greenhouse gases to the air and water, Bill gained carbon credits and saved money. Some of the savings and carbon credits went towards the cost shared initiatives Bill undertook to make the family farm more adaptable to climate change. These short and medium term investments to reduce his on farm greenhouse gas emissions and make his operation more resilient to change have proved successful to Bill in the long run.

Bill knows this because, while he reminisces about the past, he watches his son in the distance on the same family farm that he bought 45 years ago. At the age of 67 Bill is retired from farming. But he still lives here to help his son farm the land. His son needs it. The climate continues to warm and become more and more unpredictable. But Bill and many other innovative farmers have persevered in the past during difficult times. The next 50 years are certain to provide even more challenges, but also more opportunities and solutions.

Appendix G Letter of Consents and Survey Instruments

I Letter of Informed Consent for Pre and Post workshop Survey Questionnaires

The issue of climate change is one of many environmental concerns today. The research being conducted today will contribute towards a Master's of Natural Resource Management degree at the Natural Resources Institute at the University of Manitoba. The title of the research project is "Assessing the Effectiveness of Climate Change Communications: A Case Study of a Community Workshop". This research is being undertaken by Randall Shymko, a graduate student, (phone _____) under the advisement of Dr. John Sinclair (phone _____). This study is conducted in association with the Riding Mountain Biosphere Reserve, the Prairie Adaptation Research Cooperative, and the University of Manitoba.

The aim of this research is to determine effective ways to communicate information about the issue of climate to the general public. Project objectives are to learn what people in the Southern Parkland region of Manitoba think and know about climate change, and what information needs to be communicated and how to best communicate that information. The results from this research will assist in understanding the social issues relating to sustainable resource management as part of the fulfillment of the Master's of Natural Resource Management degree.

During this workshop you will be asked to complete two fifteen minute surveys, one at the beginning of the day and one at the end of the workshop. Survey objectives are to learn what people in the Southern Parkland region of Manitoba think and know about climate change, and their views on what information needs to be communicated and how to best communicate that information. During portions of the workshop, the verbal communications between the workshop participants and the climate change presenters will be observed as part of the study.

Information contained in the surveys and verbally communicated during the workshop will be kept confidential, and your responses and comments will remain anonymous. Results from each survey and/or from the project findings can be requested in writing either in the surveys or by contacting the researcher. You may refrain from answering any question in part or full, and you may withdraw from the surveys at any time simply by not answering the questions

This research has been approved by the Joint Faculty Research Ethics Board of the University of Manitoba. Any complaints regarding the procedures may be directed to Dr. Wayne Talor, Acting Chair of the Ethics Committee at _____ or Dr. Wendy Dahlgren, Acting Chair, Natural Resources Institute at _____

II Pre-survey Questionnaire

“Climate Change in Southern Manitoba”

Climate Change is emerging as an increasingly important environmental issue. This survey explores your perspectives and views of the climate change and, specifically, the global warming issue. You may find some questions easy to answer, while you may be uncertain about others. Please try to be as candid and open as possible, and please use your best judgement when answering the questions. Carefully review the questions and response options available. Feel free to clarify or add comments. If you are uncertain or uncomfortable about answering a particular question, you may simply leave it blank. Confidentiality of your responses is guaranteed, as this survey is anonymous.

Section A: On the Issue of Climate Change

Q1. Approximately how long have you known about the climate change issue? Please check (✓) the best response.

- | | |
|---|---|
| <input type="checkbox"/> Less than one year | <input type="checkbox"/> 6-10 years |
| <input type="checkbox"/> 1-2 years | <input type="checkbox"/> 11-20 years |
| <input type="checkbox"/> 3-5 years | <input type="checkbox"/> More than 20 years |
| <input type="checkbox"/> Other-please specify _____ | |

Q2. Approximately how often do you come in contact with information about climate change?

- Never seen, heard or read anything about climate change
- Once or twice a year
- About once a month
- Once or twice a week
- Daily
- Other-please specify _____

Q3. In the space provided below, please describe your thoughts on the main causes of climate change.

Q4. For each pair of statements below, please check (✓) the one that you believe is most correct:

- A Climate includes the day to day temperature, humidity, wind, and air pressure conditions.
 Climate is the long-term average weather conditions seen in a particular region.
- B The greenhouse effect is a result of the ozone layer which keeps damaging ultraviolet radiation from reaching the earth's surface.

- The greenhouse effect is the warming caused by the reflection and trapping of the sun's energy within the lower atmosphere by the so called "greenhouse" gases.
- C
- Global warming is the increase in average temperatures caused by the depletion of the ozone layer.
 - Global warming is the phenomena in which increases in surface temperatures are caused by an "enhanced" greenhouse effect.
- D
- Climate change can be described as the result of changing weather conditions over many decades.
 - Climate change can be described as the result of changes in weather from one year to the next.
- E
- Climate change is caused only from human influences (eg. burning oil and coal, cars, agriculture)
 - Climate change is caused by both human influences (eg. burning fossil fuels) and natural change and variability such as volcanoes and solar cycles.

Q5. For this question, please rate how well informed you feel about the following climate change issues. Please use the five-point scale provided where 1 is "Not at all Informed" and 5 is "Very well Informed"

	Not at all Informed	2	Somewhat Informed	4	Very well Informed
a) Climate science in general (eg. wind & ocean circulation)	1	2	3	4	5
b) Natural climatic variability and change	1	2	3	4	5
c) Physical impacts of climate change to the Canadian Prairies (eg. temperature and precipitation)	1	2	3	4	5
d) Social and economic impacts of climate change to the Prairies	1	2	3	4	5
e) Strategies for reducing greenhouse gas production	1	2	3	4	5
f) Strategies for reducing the negative impacts of climate change and taking advantage of opportunities	1	2	3	4	5

Section B: Climate Change Information

****Please note:**

In this section (B) when asked about “*Information*” please think of the material content, for example, temperature predictions for the year 2050. In Section C when asked about “*Communication*,” please think of the style of presentation such as graphs, pictures and verbal interactions.

Q6. In the past, what **information** on climate change has made the biggest impression on you? Please briefly explain.

Q7. For this question, please indicate what level of information you would like to receive on the following climate topics:

	No more info		Somewhat more info		Much more info	
a) Climate science in general (eg. wind & ocean circulation)	1	2	3	4	5	5
b) Natural climatic variability and change	1	2	3	4	5	5
c) Physical impacts of climate change to the Canadian Prairies (eg. droughts, severe weather)	1	2	3	4	5	5
c) Social and economic impacts of climate change to the Prairies	1	2	3	4	5	5
e) Strategies for reducing greenhouse gas production	1	2	3	4	5	5
f) Strategies for reducing the negative impacts of climate change and taking advantage of the opportunities	1	2	3	4	5	5
g) Other _____	1	2	3	4	5	5

Section C: Climate Change Communication

Q8. How did you find out about this workshop? Please check (✓) the best response.

- | | | |
|---|--|---|
| <input type="checkbox"/> Local newspaper
specify | <input type="checkbox"/> E-mail message | <input type="checkbox"/> Meeting-please |
| <input type="checkbox"/> Poster advertisement | <input type="checkbox"/> Other- please specify | |
| <input type="checkbox"/> Neighbor/ by word of mouth | _____ | |

**** Please note:** for the remainder of this section please think of “*Communication*” in terms of the style of presentation, or example, using graphs, pictures, or verbal interactions.

Q9. Overall, what’s the best way to get the climate change message across to people in the southwestern region of Manitoba? (Please refer to Map A on page 5).

Q10. Climate change information can be communicated in a number of different ways. For this question, please rate how **useful** the following ways of **communicating** climate change information has improved your understanding of the issue:

	Not at all useful	1	2	Somewhat useful	3	4	Very useful	5
a) TV Programs	1	2	3	4	5			
b) TV news media	1	2	3	4	5			
c) Radio programs	1	2	3	4	5			
d) Radio news media	1	2	3	4	5			
e) Workshops	1	2	3	4	5			
f) Posters	1	2	3	4	5			
g) Books/magazines	1	2	3	4	5			
h) Internet Websites	1	2	3	4	5			
i) Newspaper	1	2	3	4	5			
j) Other _____	1	2	3	4	5			



Map "A" The southwestern region of Manitoba

Section D: Future climate in Southern Manitoba

Q11. How likely or unlikely do you think the annual average temperature will increase in the **Southwestern region of Manitoba** by the year 2050? (refer to **Map A**). Please circle the best response.

Very unlikely	No change	Uncertain		Very likely	Uncertain
1	2	3	4	5	√

Q12. For this question, please rate on how you think the annual average **precipitation** will change from the current average conditions in the southwestern region of Manitoba by the year 2050? (See **Map A**)

Decrease in Precipitation		No change in precipitation		Increase in precipitation	Don't know/ uncertain
1	2	3	4	5	□

Q13. If the annual average temperature were to increase between 3 and 5 degrees Celsius in the southwestern region of Manitoba by about 2050, many potential impacts from this change are anticipated. Please rate how important or unimportant you feel the following potential impacts would be to your activities within your community:

	Not Important		Neutral or Uncertain		Very important	
a) More extreme weather events such as droughts, floods, hailstorms, and heat waves	1	2	3	4	5	
b) Increase in drought severity and frequency	1	2	3	4	5	
c) Longer hotter summers	1	2	3	4	5	
d) More insects, weed pests and crop diseases	1	2	3	4	5	
e) longer growing season	1	2	3	4	5	
f) Increased evaporation and transpiration & decreased soil moisture	1	2	3	4	5	

Q14. For this question, please rate how important or unimportant the following issues are to you:

	Not Important		Neutral/uncertain		Very important	
g) Rural economic development	1	2	3	4	5	
i) Cooperation among stakeholders that live around Riding Mountain National Park	1	2	3	4	5	
j) Sustainable agricultural practices	1	2	3	4	5	
k) Environmental conservation	1	2	3	4	5	

Section E: Responsibility for taking action on climate change

Q15. Overall, what, if anything, should be done about human induced climate change? Please check (√) as many responses that are applicable to you.

- Do nothing even if global warming occurs
- Take action only when human induced climate change is absolutely certain to be occurring
- Do something now, but not at the expense of rural economic growth
- Take action now to slow down climate change by reducing greenhouse gas production
- Take action now to respond and adapt to changes in present and future climate
- Other _____
- Don't know or uncertain as to what should be done

Q16. What individuals, groups, or organizations, if any, are responsible for doing something about climate change in your region?

Section F: Background information for statistical purposes. Please check (√) the correct response.

Q17. Are you:

- Male female

Q18. What is your age?

- under 25 46-55
 25-35 56-65
 36-45 66 or over

Q19. What do you do for a living? Please try to be as specific as possible.

Q20. In which Rural Municipality, town, or city do you live?

Q21. Please use this space to provide any additional comments on any of the previous questions or anything that relates to climate change that is important to you.

II Post-survey Questionnaire

“Climate Change in Southern Manitoba: Part 2”

This second survey will once again assess your views and opinions on the issue of climate change, mainly with respect to the workshop materials that were presented to you today. Again, please be as open and candid as possible. As well, use your best judgement for questions you may be uncertain about. Please carefully review the questions and response options where available. If you feel that none of the provided responses match your view, then you may choose to leave it blank or else use the additional space to add comments. You can be assured that your responses are anonymous and confidentiality will be guaranteed.

Section A: On the Issue of Climate Change

Q1. Following this workshop, how would you now describe the causes of climate change?

Q2. Given the information that has been presented today, how certain or uncertain are you that a **human induced global warming will occur in the Southwestern region of Manitoba by the year 2050?** Please circle the response that **bests** fits your view.

Very Unlikely	Not Likely	Neutral	Likely	Very Likely	Don't know/ Uncertain
1	2	3	4	5	√

3. For each pair of statements below, please check (√) the one that you believe is most correct:

- A Climate includes the day to day temperature, humidity, wind, and air pressure conditions.
 Climate is the long-term average weather conditions seen in a particular region.
- B The greenhouse effect is a result of the ozone layer which keeps damaging ultraviolet radiation from reaching the earth's surface.
 The greenhouse effect is the warming caused by the reflection and trapping of the sun's energy within the lower atmosphere by the so called greenhouse gases.
- C Global warming is the increase in average temperatures caused by the depletion of the ozone layer.
 Global warming is the phenomena in which increases in surface temperatures are caused by an “enhanced” greenhouse effect.
- D Climate change can be described as the result of changing weather conditions over many decades.
 Climate change can be described as the result of changes in weather from one year to the next.

- E
- Climate change is caused only from human influences (eg. burning oil and coal, cars, agriculture)
 - Climate change is caused by both human influences (eg. burning fossil fuels) and natural change and variability such as volcanoes and solar cycles.

Q3b. Do you think you answered any of the above questions differently from the first survey? If so, what new source of information did you receive and from who or where did it come from?

Section B: On the overall Quality of the Workshop

Q4. What was the main reason you came to the Community Climate Workshop today? Please check as many responses that apply to you.

- I am concerned about climate change and want more general information on the issue.
- There is not enough information on how climate change will affect my family.
- I want more information on how climate change may affect agriculture in my region
- I came mainly because there was a free lunch
- Other-please explain _____

Q5. What is the main message that you will take from this workshop? Please briefly explain.

Section C: On Climate Change Information

Q6. During this workshop you were provided with information (material content) on six themes related to climate and climate change. Listed below are the six main themes that were presented today. For each theme, please indicate what information was **most useful** and **least useful** in improving your understanding of climate change. Below each response please briefly indicate why.

Please note that “*information*” is defined as the material content such as anticipated temperatures for Manitoba in 2050. In Section D on page 4, “*Communication*” will

be defined as the style of the presentation, for example, pictures, graphs, or verbal interactions.

a) What **information** on the possible physical impacts of climate change to the land (eg. temperature, precipitation, etc) was:

Least useful _____

Why? _____

Most useful _____

Why? _____

b) What **information** on the possible social and economic impacts of climate change was:

Least useful _____

Why? _____

Most useful _____

Why? _____

c) What **information** on ways to reduce greenhouse gases was:

Least useful _____

Why? _____

Most useful _____

Why? _____

Again, please note that "*information*" is defined as the material content for example, the anticipated temperatures for southern Manitoba in 2050.

d) What **information** on ways to adapt to climate change was:

Least useful _____

Why? _____

Most useful _____

Why? _____

e) What **information** on natural climatic change and variability was:

Least useful _____

Why? _____

Most useful _____

Why? _____

Section D: On Communicating Climate Change Information

Q7. During this workshop climate and climate change information was given out in 6 main styles or presentations. They were:

- 1) Meteorologist
- 2) PFRA speaker
- 3) Winds of Change Poster
- 4) Climate Change Story
- 5) various governmental sheets and brochures
- 6) News paper articles

Listed below in parts a to f are the 6 main themes that were addressed today. For each theme, please indicate which presenter or communication style/method listed above was **most useful and least useful in improving your understanding of climate change**. Below each response, please briefly explain why.

Please note: **communication** is how the information was presented in terms of style and method.

a) What presentation or **communication style** on general climate science was:

Least useful _____

Why? _____

Most useful _____

Why? _____

b) What presentation or **communication style** on natural climatic change and variability was:

Least useful _____

Why? _____

Most useful _____

Why? _____

c) What presentation or communication style on the physical impacts of climate change (eg. temperature and precipitation) was:

Least useful _____

Why? _____

Most useful _____

Why? _____

d) What presentation or communication style on the potential social and economic impacts of climate change was:

Least useful _____

Why? _____

Most useful _____

Why? _____

e) What presentation or communication style on the ways to reduce greenhouse gas production was:

Least useful _____

Why? _____

Most useful _____

Why? _____

f) What presentation or communication style on ways to adapt to climate change was:

Least useful _____

Why? _____

Most useful _____

Why? _____

Q8. Overall, which presentation or communication style was most useful and least useful in **improving your understanding** of climate change?

Most useful: _____

Least useful _____

Section E: Rating the Quality of Agricultural Presentations

Q9. Overall, what communication style/presentation was most useful in improving your understanding about potential **impacts of climate change to agriculture**? Please check (✓) the best answer.

- | | |
|---|---|
| <input type="checkbox"/> Meteorologist | <input type="checkbox"/> Climate story |
| <input type="checkbox"/> PFRA speaker | <input type="checkbox"/> Discussion session with other participants |
| <input type="checkbox"/> Climate poster | <input type="checkbox"/> Brochure and other hand out materials |
| (please specify) | |
| <input type="checkbox"/> Other (please specify) | |
- _____

Q10. Overall, what communication style/presentation was most useful in improving your understanding about **strategies to reduce greenhouse gas production in the agricultural sector**? Please check (✓) the best answer.

- | | |
|---|---|
| <input type="checkbox"/> Meteorologist | <input type="checkbox"/> Climate story |
| <input type="checkbox"/> PFRA speaker | <input type="checkbox"/> Discussion session with other participants |
| <input type="checkbox"/> Climate poster | <input type="checkbox"/> Brochure and other hand out materials |
| (please specify) | |
| <input type="checkbox"/> Other (please specify) | |
- _____

Q11. Overall, what communication style/presentation was most useful in improving your understanding about **strategies to adapt to climate change in the agricultural sector**? Please check (✓) the best answer.

- | | |
|--|---|
| <input type="checkbox"/> Meteorologist | <input type="checkbox"/> Climate story |
| <input type="checkbox"/> PFRA speaker | <input type="checkbox"/> Discussion session with other participants |

Climate poster
(please specify)

Brochure and other hand out materials

Other (please specify)

Section F: On Intent to Act on the Climate Change Issue

Q12. Based on what you have seen, read or heard today, do you intend on changing your lifestyle or activities to **reduce greenhouse production**. Please briefly explain why or why not.

Q13. Based on what you have seen, heard or read today, do you intend on changing your lifestyle or activities to **adapt** to climate change. Please briefly explain why or why not.

Q14. Please use this space to add additional information from any of the above questions or provide additional comments regarding today's workshop, climate change or that is important to you.

Section G: Background information for statistical purposes

Q15. Are you:

Male

female

Q16. What is your age?

under 25
 25-35
 36-45

46-55
 56-65
 66 or over

Q17. What do you do for a living? Please be as specific as possible.

Q18. In which Rural Municipality, town, or other city do you live?

Q19. Would you like a summary of the survey results?

- Yes No

Q20. Would you like a copy of the summarized project results?

- Yes No

Q21. Would you be interested in further discussing these issues in a follow up interview?

- Yes No

If you yes what type of interview would you be interested in?

- Personal interview**
 Telephone interview

If you answered yes to any of the above three questions please provide your name, address, and phone number below. Contact will be made within 30 days.

Name: _____

Address: _____

Phone number: _____

****Please hand this page in separate from the rest of the survey**

Thank you for taking the time to complete this survey!
Your views and perspectives on this issue are important

III Letter of Informed Consent for follow up interviews

The issue of climate change is one of many environmental concerns today. The research being conducted today contributes towards a Master's of Natural Resource Management degree at the Natural Resources Institute at the University of Manitoba. The title of the research project is "Assessing the Effectiveness of Climate Change Communications: A Case Study of a Community Workshop". This research is being undertaken by Randall Shymko, a graduate student, (phone _____) under the advisement of Dr. John Sinclair (phone _____). This study is conducted in association with the Riding Mountain Biosphere Reserve Committee, the Prairie Adaptation Research Cooperative, and the University of Manitoba.

The aim of this research is to determine effective ways to communicate information about the issue of climate with the general public. Project objectives are to learn what people in the Southern Parkland region of Manitoba think and know about climate change, and their views on what information needs to be communicated and how to best communicate that information. The results from this research will assist in understanding the social issues relating to sustainable resource management as part of the fulfillment of the Master's of Natural Resource Management Degree.

During this interview you will be asked to answer questions on the issue of climate change. The interview will take approximately one hour. The purpose of the interview is to learn about your perspectives and views of climate change and suggestions to help determine better ways to get the required information across to the public in your region.

Your responses to the questions will be kept confidential and remain anonymous. Results from the interviews, each survey and/or from the project findings can be requested verbally during the interview, or by contacting the researcher using the phone number on this form. You may refrain from answering any question in part or full, and you may withdraw from the survey at any time by indicating you do not wish to continue.

This research has been approved by the Joint Faculty Research Ethics Board of the University of Manitoba. Any complaints regarding the procedures may be directed to Dr. Wayne Taylor, Intern Director of the Human Ethics Secretariat at _____ or Dr. Wendy Dalhgreen, Director of the Natural Resources Institute at _____

I have read the above statement regarding the study entitled "Assessing the Effectiveness of Climate Change Communications: A Case Study of a Community Workshop". I agree to participate in the interview,

Signature of respondent

Date _____

Signature of the researcher

Date _____

IV Confirmation letter for Personal and telephone Interviews

Dear (Name of Interviewee),

At the end of the Community Climate Change Workshop you attended on February 17 2001, you indicated your intent to participate in an interview to further discuss the issues about climate change.

I am writing you now to confirm the time of our appointment on (date) at (time) at (location if personal interview). I look forward to hearing your perspectives on this important environmental issue. I will confirm any quotes taken from the interview. As well, you can be assured that your responses are anonymous and will be kept confidential.

Results from interviews will bring the research full circle allowing results from the Pre survey, Post survey and the interviews to be combined and assessed. Your views on this issue are very important in better understanding how to get the required climate change information across in your region. Information that is more effectively communicated is more cost effective.

If you have any questions about the research or our meeting, please do not hesitate to contact myself at . I thank you in advance for your time and assistance and look forward to our appointment.

Very sincerely yours,

Randall Shymko
Graduate Student
Masters of Natural Resource Management Candidate
Natural Resources Institute
University of Manitoba
430 Dysart Road,
Winnipeg, Manitoba
R3T 2N2

Phone:
E-mail:

V Interview Schedule for Climate Change Workshop Participants

Section A: General Questions and Background

1. How long have you been living in the area?
2. What do you do for a living?
3. How long have you been involved in your current activity?
4. How familiar or unfamiliar would you say you are with the issue of climate change in general?
5. May I use your name in my thesis to list as one of the interviewees? If I use information from the interview, it will be aggregated or combined with other data, and your name will not be used. (I will confirm all direct quotes used in the thesis with you prior to printing)

Section B: Perspectives on Climate Change

1. As an individual, what is your main concern regarding the issue of climate change as it relates to your personal activities?
2. What, do you think, are the views of others in your occupation on this issue?
3. Independent of human caused climate changes, what are your thoughts on the influences of natural climate variability, if any, on your personal activities?

Section C: On the Rossburn Community Climate Change Workshop

2. On reflection, please briefly describe the portion of the workshop activities, if any, which were most useful in improving your understanding of the climate change issue?
3. On reflection, please briefly describe the portion of the workshop activities, if any, which were least useful in improving your understanding of the climate change issue?
4. On reflection, what are your overall thoughts on the usefulness of the Climate change short story in improving your understanding of climate change?
5. On reflection, what are your overall thoughts on the usefulness of the Winds of Change poster in improving your understanding of climate change?

5. On reflection, what are your thoughts on the usefulness of the Meteorologist's morning presentation in improving your understanding of climate change?
6. On reflection, what are your thoughts on the usefulness of the PFRA speaker afternoon presentation in improving your understanding of climate change?
7. Did you read or look at any take home materials provided at the Rossburn workshop?
8. If yes to question 7, what were they and what are your thoughts on their usefulness in improving your understanding of climate change?
9. Please explain whether or not any workshop materials improved your understanding of the issues and strategies involved to make adaptations to climate change?
10. Please explain whether or not any workshop materials improved your understanding of the issues and strategies involved to reduce greenhouse gas production?
11. Based on the presentations and materials given out or provided at the workshop, please explain whether or not you intend to change your activities to adapt or reduce greenhouse gases?¹

Section D: Information Needs on the Issue of Climate Change

Please note that for the purposes of this research, *information* refers to the material content related to climate change, such as temperature and precipitation changes. The term *communication* used in Section E refers to how the information is given out (eg. Verbally, posters, using text or pictures).

1. What information, if any, would you personally like to have in the future on the following climate change topics:
 - a. the background science of climate such as ocean and wind circulation
 - b. the influences of natural climatic variability and change to your activities

** Please note for some of the remaining interview questions:

When referring to the Riding Mountain Biosphere Reserve (RMBR) region, please think of both Riding Mountain National Park, and the 18 Rural Municipalities that surround the park on all sides.

¹ This question was not asked of all interviewees as it was only later determined to be an important criteria for effective workshop communications

- c. the potential physical impacts of global warming such as changes in temperature, precipitation, and soil moisture, etc to the Riding Mountain Biosphere Reserve region.
- d. possible social impacts of climate change to people and communities in the Riding Mountain Biosphere Reserve region.
- e. possible economic impacts of climate change to people and communities in the Riding Mountain Biosphere Reserve
- f. ways to reduce greenhouse gas emissions [eg. on the farm/in the home/in RMNP]
- g. ways to adapt to climate change [eg. on the farm/in the home/in RMNP]

Section E: Communication of Climate Change Information

Communication is a process of getting information out to people. Communication is more effective when the information is given out clearly, accurately and in a way that is easily understood by the targeted audience. Often there are difficulties in communicating information effectively. Two examples of difficulties with communicating climate change information may 1) there may be “more important issues of the day” or 2) “a sense of helplessness to climate change-to do anything about it”)

1. In your opinion, what are the main difficulties in communicating climate change information to stakeholders (i.e. farmers and/or other RMNP employees) living in the Riding Mountain Biosphere Reserve region as a whole?
2. In your opinion, what are the main difficulties in communicating climate change information to you personally?
3. In your opinion, what, if anything should be done to overcome any communication difficulties that relate to you or in the whole Biosphere region?
6. In your opinion, please describe the best way(s) overall to communicate the required climate change information in the Riding Mountain Biosphere Reserve region? What about in the park? In the surrounding RM's?
7. Please describe what individuals, groups, or organizations, if any, should be taking the lead in the communication of climate change information to other stakeholders in the Riding Mountain Biosphere Reserve region?

- 6a. Please explain whether you agree or disagree that climate change information be communicated to improve your understanding on how to reduce greenhouse gas production?
- b. If yes to above question, then how should the information be given out?
- 7a. Please explain whether you agree or disagree that climate change information be communicated to improve your understanding on how to adapt to climate change?
- b. If yes to above question, then how should the information be given out?
8. How should climate change information be communicated, if at all, to best help other area stakeholders adapt to climate change and to reduce greenhouse gas emissions?
9. Is there a way that stakeholders within the Riding Mountain Biosphere Reserve could be working together to adapt to climate change and reduce greenhouse gas emissions?
10. Are there any other final comments or suggestions you would like to make on the information, communication, or public education regarding climate change in the RMBR?
12. Would you like a copy of the summary interview results?
13. Do you know of anyone else who may be a valuable source of information and who may be interested in discussing these issues?

**Thank-you for taking the time to responding to my questions
on climate change!**

Your perspectives on this issue are very important