2013-07-10

A Case Study of Carbon Capture and Storage Development in Three Communities: Understanding the Role of Community and Sense of Place in Local Risk Perspectives

Boyd, Amanda Dawn

UNIVERSITY OF CALGARY

A Case Study of Carbon Capture and Storage Development in Three Communities: Understanding the Role of Community and Sense of Place in Local Risk Perspectives

by

Amanda Dawn Boyd

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE

DEGREE OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF COMMUNICATION AND CULTURE

CALGARY, ALBERTA

JULY, 2013

Abstract

Carbon capture and storage (CCS) has emerged as one potential strategy to reduce greenhouse gas emissions. It refers to the capture of carbon dioxide (CO_2) emissions from industrial sources and the long-term storage of this CO_2 in stable underground reservoirs. One factor in the successful implementation of CCS is support from residents who live near proposed or operational CCS projects, as these residents will likely have a strong impact on the development and deployment of the technology. This study uses the theoretical framework of interactional field theory to examine how the factors of 'community' and 'sense of place' influence residents' perceptions of CCS in their area. The objectives of this study are to 1) examine community views of key issues surrounding CCS; 2) investigate factors that contribute to perspectives of CCS; and 3) to ascertain how local residents view CCS or other energy developments especially in regards to community (perceptions of their place and local relationships).

Data for this study was collected using in-depth individual and group interviews, participant observation and secondary data collection. One hundred and twenty residents in three Western Canadian communities were interviewed between May and November 2011. The case study communities included: 1) Priddis, Alberta where a University research project was planned but cancelled due to local opposition; 2) Weyburn, Saskatchewan which hosts one of the world's largest and earliest demonstrations of carbon storage in an Enhanced Oil Recovery project; and 3) Fairview, Alberta where there is no proposal for CCS. The three case studies provide an opportunity to examine perceptions of CCS in areas at different stages of implementation and offer a unique comparison of the local contexts that shape the support for or opposition to energy developments.

The factors that influenced community perceptions of CCS included: 1) place-based knowledge and experience; 2) demographic and community sustainability characteristics; and 3) interactions and relationships among residents. Results suggest that 'sense of place' and 'community' are important when examining how residents view energy deployments. Collective risk perceptions are influenced by the interrelationships and communication between people about a place of shared concern.

~Where The Great Peace River Flows~

There's a river that is flowing down towards the northern sea,
'Tis not famed in song or story, still it holds a charm for me.
It has called me from the southland where the starry banner blows,
And I've settled down forever where the Great Peace River flows.

We have come from every nation, they have sent their very best
To uphold the flag of freedom in this great and glorious west.
And no foreign feet dare trample on our pretty prairie rose;
'Tis the emblem of our country where the Great Peace River flows.

Where the Great Peace River's flowing, where the pretty bluebell grows,
Where our prairies they are glowing with the beauty of the rose,
Here the sun is always shining, no one sits down here repining,
And the clouds have silver linings where the Great Peace River flows.

Lay me down when life is over where the prairie roses bloom,
And the robins sing their carols every eve about my tomb.
When the sunny days of summer they are drawing to a close,
May they gild my grave with sunshine where the Great Peace River flows.

When I get the final summons from that courthouse in the skies,
And the Judge of all the Judges, may He deem it no surprise,
If I ask him just one favour— He may grant it, no one knows—
Send me back to Fair Alberta where the Great Peace River flows.

-John Sweeney
Fairview (Vanrena) Resident

Acknowledgements

I would like to acknowledge a number of people who have made this dissertation research possible. Appreciation goes to the residents of Fairview, Weyburn, Priddis and Goodwater. Thank you for welcoming me into your communities, answering my questions, and sharing your knowledge and experiences with me.

I would like to extend a sincere thank you to my PhD supervisor for her support, patience and guidance during my studies. Her encouragement and feedback were invaluable and challenged me to think about new ideas:
Dr. Edna Einsiedel - Department of Communication, University of Calgary

Thank you to my Dissertation Committee members for their thought-provoking questions and support throughout my PhD studies:
Dr. David Keith - School of Engineering and Applied Sciences, Harvard University
Dr. Frances Bowen - School of Business and Management, Queen Mary University of London

Thank you to my Dissertation Examination Committee for their constructive comments and feedback during my defence:
Dr. Cooper Langford - Department of Chemistry, University of Calgary
Dr. Dianne Draper - Department of Geography, University of Calgary
Dr. Stephen Hill - Environmental and Resource Studies, Trent University

I would like to thank a number of people in the Carbon Capture and Storage field who have provided advice and feedback on my work. I am grateful to Dr. James Meadowcroft (School of Public Policy and Administration, Carleton University) and Dr. Don Lawton (Department of Geoscience, University of Calgary) for their advice and direction on the research project. Special thanks goes to those in the CCS community for answering my questions or providing me with recommendations: Dan Burt, Kali Taylor, Monica Lupion, Lauren Fleishman, Gabrielle Wong-Parodi, Jacqueline Sharp, Lori Gauvreau, Peta Ashworth, Elizabeth Wilson, Jennie Stephens, Carmen Dybwad, Joe Ralko, and Norm Sacuta.

Thank you to my graduate student colleagues and friends from the Department of Communication and the Institute for Sustainable Energy, Environment and Economy at the University of Calgary. I would especially like to thank Ashley Mercer and Meaghan Brierley. Thank you to Dr. Chris Furgal (Trent University) and the Health, Environment and Indigenous Communities Research Group for your support and encouragement and welcoming me to the East.

My family has been a big part of my support system and have shaped my views of community and place. Thank you to my parents (Ruby and Neil Boyd) and brother (Curt Boyd), along with all of my other family members for always being a source of support and encouragement when needed. Finally, I would like to thank my partner Travis Paveglio for being a never-ending source of love, support and understanding – thank you.

Funding Acknowledgement

This dissertation research was funded through grants from Carbon Management Canada and the Institute for Sustainable Energy, Environment and Economy for the project [Towards Effective Engagement: Assessing Stakeholder Attitudes and Public Controversy Surrounding Greenhouse Gas Mitigation Energy Systems, EF Einsiedel, PI]. Amanda Boyd was also the recipient of a Social Sciences and Humanities Research Council (SSHRC) Canadian Graduate Student Doctoral Scholarship from 2008-2011.

~To my brother, Jay-Bo (1985-2005),
in memory of his love of community and the land

Table of Contents

Abstract ii
Acknowledgements v
Dedication vii
Table of Contents viii
List of Tables xii
List of Figures xiii
List of Images xiv
List of Abbreviations xv

CHAPTER ONE: INTRODUCTION 1
Study Background 1
Research Purpose and Objectives 3
Overview of the Research Methodology 6
Community Case Study Selection 6
Overview of Case Study Methodology 7
Significance and Contributions of the Research 8
Overview of the Dissertation 11

CHAPTER TWO: CARBON CAPTURE AND STORAGE IN CANADA 13
Introduction 13
Overview of CCS 14
Description and History of EOR and CCS 14
CCS and GHG Emissions in Canada 17
Factors that Affect the Development and Implementation of CCS 19
Health and Safety Concerns 19
Costs of CCS Technology 20
Environmental Concerns Associated with CCS 21
Regulation and Legislation 22
Government Investment in CCS 23
Environmental Non-Governmental Organizations 25
Additional Canadian Factors 26
CCS in Western Canada 27
Chapter Summary 29

CHAPTER THREE: PERSPECTIVES OF ENERGY SYSTEMS AND CCS 32
Introduction 32
Risk Perceptions 33
Same Hazard, Different Understandings 34
Factors in the Perceptions of Energy Systems 36
Factors Influencing Local Communities' Support or Opposition to Energy Projects .. 37
Trust in Developers, Government and Information Sources 38
Fairness, Equity and Justice of Implementation and Development 40
Ownership of Project, Stigma and Socio-Historic Context 42
Risks and Benefits to the Community 44
Cultural systems 45

Social systems 45
Biophysical and health systems 46
Psychological Systems 46
Economic Systems 46
Agreement with Broad Policy Objectives and Environmental Values 47
Perceptions of Carbon Capture and Storage 48
Perceptions and Knowledge of CCS in Canada 49
Affected Populations and CCS 50
Chapter Summary 56

CHAPTER FOUR: COMMUNITY STUDIES AND RISK 60
Introduction 60
Overview of the Concept of 'Community' in Risk Research 61
Conceptions of Community 62
Community as a Geographic Area 64
Community as a Local Social System 66
Community as a Type of Relationship 69
Community as an Interactional Field 70
Community, Risk Perception and Management 72
Sense of Place and Place Attachment 72
Critique of the "Not-in-my-backyard" Phenomenon 75
Community Perceptions and Agency 77
Examining Risk Perceptions from an Interactional Field Perspective 79
Chapter Summary 80

CHAPTER FIVE: RESEARCH METHODOLOGY 81
Introduction 81
Research Design 82
Description and Summary of Case Study Research Design 82
Case Study Selection 84
Data Collection 87
Interview Methodology 89
Overview of Interviews 89
Interviews with Community Members 90
CCS Project Stakeholders 90
Rationale for Individual and Group Interviews 91
Participant Recruitment 93
Information Provided During Interviews 97
Interview Questions 98
Observation and Journal Entries 101
Summary of Interviews and Participants 102
Data Analysis 104
Chapter Summary 106

CHAPTER SIX: COMMUNITY PROFILES, HISTORY OF ENERGY DEVELOPMENTS AND CCS PROJECTS 108
Introduction 108

Priddis, Alberta 108
Community Overview and Present Local Economy 109
History of Industry and Developments 112
Proposed University of Calgary Geoscience Field Research Station 114
Opposition to and Cancellation of the Geoscience Field Research Station 115
The Cross Family Speaks Out 115
Local Media Reporting and Project Cancellation 116
Weyburn and Goodwater, Saskatchewan 118
Community Overview and Present Local Economy 118
History of Oil Industry 122
Weyburn-Midale Enhanced Oil Recovery and CCS Project 124
Alleged Leak at Weyburn-Midale CO_2 Project 125
Fairview, Alberta 126
Community Overview and Present Local Economy 127
History of Gas Extraction Industry and Other Energy Developments in the Area 130
Natural Gas Extraction 131
Other Proposed Energy Projects 131
Chapter Summary 132

CHAPTER SEVEN: COMMUNITY PERSPECTIVES OF CCS PROJECTS 134
Introduction 134
Examining Local Risk Perceptions Through the Lens of Place and Community 135
Case Study: Priddis, Alberta 137
Awareness of Carbon Capture and Storage 137
Community Perspectives of CCS 138
An Examination of Factors Influencing the Perspectives of CCS 140
Interactions and Relationships Among Residents 140
Demographic and Community Sustainability Characteristics 144
Place-Based Knowledge and Experience 147
Case Study: Weyburn and Goodwater, Saskatchewan 153
Awareness of Carbon Capture and Storage 153
Community Perspectives of CCS 155
An Examination of Factors Influencing the Perceptions of CCS 157
Interactions and Relationships Among Residents 157
Demographic and Community Sustainability Characteristics 161
Place-Based Knowledge and Experience 163
Case Study: Fairview, Alberta 172
Awareness of Carbon Capture and Storage 172
Community Perspectives of CCS 173
An Examination of Factors Influencing the Perceptions of CCS 175
Interactions and Relationships Among Residents 175
Demographic and Community Sustainability Characteristics 179
Place-Based Knowledge and Experience 183
Chapter Summary 192

CHAPTER EIGHT: ANALYSIS AND DISCUSSION OF LOCAL RISK PERCEPTIONS ABOUT CCS 195

Introduction 195
A Review of Support for or Opposition to CCS in Case Study Communities 196
Assessing Perceptions: A Comparison of Three Communities 196
Interactions and Relationships Among Residents 198
Demographics and Community Sustainability Characteristics 203
Place-Based Knowledge and Experience 208
Towards a Theory of Community Risk Perceptions 216
Conclusions About Collective Perceptions About Place and Community 218
Comparison with Other 'Locally-Affected Community' Research About CCS 219
Critique of the 'NIMBY' Argument 222
Chapter Summary 224

CHAPTER NINE: CONCLUSION 228
Introduction 228
Research Findings and Theoretical Implications 230
Contributions to Risk Perception Theory and Research 230
Community 230
Sense of Place 231
Community Risk Perceptions 232
Contribution to Theory 233
Limitations of the Dissertation Research 235
Future Areas of Study 237
Recommendations for the Public Understanding and Communication of CCS 239
Recommendations for Policy Implementation or Industry Best-Practices 242
Recommendations for Locally Affected Communities 244
Concluding Statements 246

REFERENCES 247

Appendix A: Attributes of the CCS Projects Discussed in Dissertation 264
Appendix B: Advertisement for Focus Group Participants in the Fairview Post 265
Appendix C: Advertisement for Research Participants in the Weyburn Review 266
Appendix D: Interview Consent Form 267
Appendix E: Meetings or Gatherings Attended During Case Studies 269
Appendix F: Fairview Stakeholder Interview Protocol 271
Appendix G: Priddis Stakeholder Interview Protocol 273
Appendix H: Weyburn Stakeholder Interview Protocol 275
Appendix I: Timeline of Kerr Farm Testing, Media Reporting and Final Reports 277
Appendix J: Summary of Perceived Risks and Benefits of CCS by Community 278

List of Tables

Table 5.1. Synopsis of Case Study Locations 86
Table 5.2. Summary of Participant Demographics, Location and Job-Type 94
Table 5.3. Summary of Recruitment Methods for Communities 96
Table 5.4. Questions based on Interactional Field Theory 99
Table 5.5. Questions based on Perceptions of Energy Systems and CCS Literature 100
Table 5.6. Summary of Participants in Research Project by Community 103
Table 6.1. Gender, Age and Education Demographics for Priddis, M.D. of Foothills and Province of Alberta 110
Table 6.2. Residents' Occupation and Industry for Priddis, M.D. of Foothills and Province of Alberta 111
Table 6.3. Gender, Age and Education Demographics for City of Weyburn, R.M. of Weyburn, R.M. of Lomond and Province of Saskatchewan 119
Table 6.4. Residents Occupation and Industry for City of Weyburn, R.M. of Weyburn, R.M. of Lomond and Province of Saskatchewan 121
Table 6.5. Gender, Age and Education Demographics for the Town of Fairview, M.D. of Fairview and Province of Alberta 127
Table 6.6. Residents Occupation and Industry for the Town of Fairview, M.D. of Fairview and Province of Alberta 129
Table 7.1 Priddis Residents' Perspectives of Positive and Negative CCS Attributes in the Community 139
Table 7.2 Weyburn and Goodwater Residents' Perspectives of Positive and Negative CCS Attributes in the Community 156
Table 7.3 Fairview Residents' Perspectives of Positive and Negative CCS Attributes in the Community 173
Table 8.1 Summary of Interactions and Relationships Among Residents 199
Table 8.2 Summary of Demographic and Community Sustainability Characteristics 204
Table 8.3 Summary of Place-Based Knowledge and Experience 208

List of Figures

Figure 2.1. Illustration of CCS Process 15
Figure 5.1. Case Study Research Process and Interviews 88
Figure 5.2. Description and Illustration of CCS 98
Figure 8.1. Diagram Illustrating Factors in Community Perceptions of CCS 198
Figure 8.2. Diagram Demonstrating Process of Shared Community Risk Perceptions..... 217

List of Images

Images 5.1. Location of Case Studies 85
Images 6.1. Entering the Hamlet of Priddis 109
Images 6.2. Western Wheel Article on Cross Family Concern About CO_2 Storage Project 116
Images 6.3. Entering the City of Weyburn and the Hamlet of Goodwater 118
Images 6.4. Location of the Alleged CO_2 Leak from the Weyburn-Midale CO_2 Project 125
Images 6.5. Entering the Town of Fairview 126
Images 7.1. Location of the Proposed CO_2 Injection Research Project near Priddis 138
Images 7.2. Events in the Priddis Area 141
Images 7.3. Ann and Sandy Cross Conservation Area 143
Images 7.4. Priddis Land Value and Proximity to Calgary 145
Images 7.5. Water from a Natural Spring 149
Images 7.6. A Herd of Elk in Priddis Area 151
Images 7.7. CO_2 Injection in Weyburn Field 153
Images 7.8. CO_2 Education in the City of Weyburn 154
Images 7.9. Events in the Weyburn Area 158
Images 7.10. Remnants of the 2011 Spring Flood 160
Images 7.11. Wor-kin Shop Truck 163
Images 7.12. Landscape of the Weyburn and Goodwater Area 165
Images 7.13. Oil and the Landscape 165
Images 7.14. Old Farm Building 167
Images 7.15. Weyburn Inland Terminal 171
Images 7.16. Events in the Fairview Area 176
Images 7.17. Communities in the M.D. of Fairview 181
Images 7.18. Natural Gas and the Landscape 182
Images 7.19. Pipeline and H_2S Gas Warning Signs 184
Images 7.20. Landscape of Fairview Area 185
Images 7.21. Early Days in Fairview 188
Images 7.22. Agriculture in Fairview 191

List of Abbreviations

Symbol	Definition
AB	Alberta
BC	British Columbia
CCS	Carbon Capture and Storage
CO_2	Carbon Dioxide
DOE	Department of Energy
ENGO	Environmental Non-Governmental Organization
EOR	Enhanced Oil Recovery
EPA	Environmental Protection Agency
FV	Fairview
GDP	Gross Domestic Product
GFRS	Geoscience Field Research Station
GHG	Greenhouse Gas
H_2S	Hydrogen Sulfide
IEA	International Energy Agency
IEA GHG	International Energy Agency Greenhouse Gas Research and Development Programme
IPAC-CO2	International Performance Assessment Centre for Geological Storage of Carbon Dioxide
IPCC	Intergovernmental Panel on Climate Change
Km	Kilometer
LULU	Locally Unwanted Land Use
M.D.	Municipal District
Mt	Megatonnes
MWh	Megawatt Hour
NETL	National Energy Technology Laboratory
NIMBY	Not-In-My-Backyard
NGO	Non-Governmental Organization
NRCan	Natural Resources Canada
PMRA	Priddis and Millarville Residents Association
PR	Priddis
PTRC	Petroleum Technology Research Centre
RAO	Rothney Astrophysical Observatory
R.M.	Rural Municipality
SK	Saskatchewan
TEK	Traditional Ecological Knowledge
UCG	Underground Coal Gasification
U of C	University of Calgary
U.S.	United States
WG	Weyburn and Goodwater
WTI	West Texas Intermediate

CHAPTER ONE: INTRODUCTION

Study Background

Energy production is critical to the Canadian economy. Canada is not only the fifth-largest energy producer in the world; it is also one of the highest per-capita consumers of energy (Natural Resources Canada, 2010). Canadians' high energy use can be attributed to individuals' long travel distances, a cold climate, an energy-intensive industrial base, relatively low energy prices and a high standard of living (Environment Canada, 2005). Along with this high level of energy consumption comes a high level of greenhouse gases. Canada has about 0.5% of the world's population but contributes to approximately 2% of its total greenhouse gas (GHG) emissions. In 2010, approximately 20.3 tonnes of GHGs were emitted per person in the country[1] (Environment Canada, 2012). Research about GHG concentrations and the environment has led to evidence that the climate system is warming and the majority of this increase in average temperatures is "very likely due to the observed increase in anthropogenic GHG concentrations (IPCC, 2007, p.5)." As a result, international protocols have set out targets for countries to reduce their level of carbon dioxide (CO_2) and other GHG emissions to a level that will prevent dangerous anthropogenic interference in the earth's climate patterns (UNFCCC, n.d.).

Carbon dioxide capture and geological storage (CCS) is one potential strategy to reduce GHG emissions. It refers to the capture of CO_2 emissions from industrial sources and the long-term storage of this CO_2 in stable underground reservoirs (Parson and Keith, 1998). One of the principal reasons for implementing CCS is to mitigate climate change (NRCan, 2006; Griffiths et

---

[1] This was the latest figure available at the time of submission.
[2] The project was cancelled before I initiated data collection.
[3] Interactional field theory is also called the 'interactional approach to community.'

al., 2005), yet the CO_2 captured from these industrial sources also has the potential to increase the amount of oil extracted through "enhanced oil recovery" (EOR). Enhanced oil recovery can provide an economic benefit; however, EOR also encourages the continued depletion and extraction of fossil fuels, which ultimately may increase GHG emissions.

There has been growing technological development, research and investment in CCS during the past decade, yet some members in the public, industry and policy makers regard the technology as controversial (Ashworth, 2010; Bäckstrand et al., 2011). Some proponents see CCS as a climate change mitigation technology that will be essential to reducing CO_2 emissions. Others view CCS as an environmentally risky, technologically complex, and expensive end-of-pipe-technology that is resource-intensive, promotes the continued extraction of fossil fuels and competes with renewable energy investments (Stephens, 2011; Bielicki and Stephens, 2008).

Public opinion on any controversial technology can factor into successful introduction or implementation. Social research can help us understand how public judgments about technology are made, how these views evolve, and the factors that help explain the reasons for these judgments (Bradbury, 1994). One of the most important factors in CCS implementation is public support and acceptance of the technology (Ashworth, 2010). This includes risk perceptions associated with CCS. As a report from Natural Resources Canada states, "success depends on creating the conditions that support the first and subsequent waves of CCS investment while gaining the public's support for CCS as an acceptable way to meet the carbon challenge (2008, p.9)."

There has been insufficient research in Canada exploring public knowledge of and attitudes towards CCS. This dearth applies to both the general Canadian public and communities where the technology will be deployed. It is important to examine the general opinion of the

Canadian public to understand the broader opinions of CCS, yet it is particularly crucial to examine those who may be directly affected by a nearby CO_2 storage site. Existing research suggests that these locally affected areas will likely have a strong impact on the development and deployment of CCS (Curry, 2004). The research reported on here explores the views of three different communities regarding CCS. Two communities have had experience with CCS proposals or developments. A third community has no current or proposed CCS project, yet can be examined to understand the residents' perceptions of CCS.

The remainder of this chapter: 1) outlines the objectives and the significance of this research; 2) provides an overview of the research methodology and community selection for case studies; and 3) presents an outline of the following dissertation chapters.

Research Purpose and Objectives

The primary purpose of this study is to **investigate public perspectives about geological carbon storage initiatives** in communities where developments are currently operational or have been planned. A third community without plans for a CCS project will provide insight into how a 'typical' Western Canadian community may view CCS and other energy projects such as nuclear, hydroelectric and fossil fuel extraction. Key research objectives include the following:

1. To examine community views of key issues surrounding CCS.

2. To investigate factors that may contribute to perspectives of CCS.

3. To ascertain how locally 'affected' populations view CCS or other energy developments especially with regard to their ideas of 'community' and sense of 'place' (ties to area and local relationships).

Two major events relevant to CCS occurred during the course of this study and provided additional research opportunities to examine the factors that may influence community views of CCS. First, one of the communities I planned to examine, which was the site for a planned CCS project, opposed the proposal.[2] This provided a unique opportunity to contrast the perceptions of communities who did and did not support a local carbon storage project. Second, within this study's timeframe, the world's first public allegations of a CO_2 leak at a CCS project were made at the Weyburn-Midale CO_2 Project. These allegations provided a novel event that could influence residents' views about CCS. Notwithstanding the original criteria for community case selection, these unanticipated events are part of the case community contexts and in fact may be viewed as providing additional dimensions for exploring community views and further research opportunities.

The research objectives are guided by interactional field theory.[3] This theoretical approach has roots in rural and environmental sociology and takes into account the importance of community relationships and "attachment to place" in understanding how local residents view a development in their area that could potentially be regarded as a hazard. This is particularly important for residents who live in an area where CCS is proposed or currently operating as these people may have more stake in the technologies or be affected disproportionately by associated risks and benefits. Most Canadians may never tangibly experience a CCS project, yet there will be individuals in "locally affected" communities where risks or benefits are more concentrated. It is possible that individuals and groups in these areas may be more critical or more accepting of

---

[2] The project was cancelled before I initiated data collection.
[3] Interactional field theory is also called the 'interactional approach to community.'

CCS projects and have the ability to stop a project from being developed thorough localized collective action (Ashworth, 2010) or alternatively, welcome such a project.

Place attachment refers to the positive affective bonds that people associate with a specific place and are based upon the interactions they have in that location. This attachment and sense of community reinforce and reflect the social construction of risk in the local environment and can be seen as central to the basis by which people select and interpret risks such as those associated with technological developments (Masuda and Garvin, 2006). An important and often neglected focus in risk research is how people *collectively* perceive or respond to hazards (Bridger and Luloff, 1999). This does not dismiss the importance of research on individual risk perspectives or methodologies. Rather it provides another scale at which to understand where these perspectives come from, how they interact with larger social systems and how they determine the collective action that is often the basis for policy, industry and government decisions related to technological development.

The simple fact of the matter is that people do not act alone. Their considerations, behaviors, views and positions stem from *somewhere*—a geographical area, a collection of experiences, the norms and values that emerge among shared lives or the people they choose to form bonds with. The concepts of community and place attachment – as both a perspective of and an explanation for collective human behavior – can teach us much about the ways characteristic groups of people will perceive developments in the places that matter to them.

Overview of the Research Methodology

Community Case Study Selection

Carbon capture and storage deployment at a large scale is still in its infancy in Canada. Therefore there are relatively few communities that are applicable to this study. Three communities were ultimately selected for study. Selection of these communities were based on two main criteria: 1) They were all located in Western Canada and had experience with local energy developments; and 2) The communities had CCS projects that were at different stages of implementation.

The first community of Weyburn, Saskatchewan was selected because it was near an established CCS project. The project, named the IEAGHG Weyburn-Midale CO_2 Monitoring and Storage Project (hereafter referred to as the Weyburn-Midale CO_2 Project), was established in 2000 (PTRC, 2012). The company running the project (Cenovus, formerly Encana) holds regular community meetings and has little community controversy. In January 2011, a farming couple residing near the project publicly reported an alleged leak. Following the allegations, there has been some controversy and an increase in media reporting (Boyd et al., 2013). The second community was selected because it was in an area where a CCS project was proposed.[4] A location in Canada that met this criterion was Priddis, Alberta. Proposed by the University of Calgary, this small carbon storage research project was located just outside of the City of Calgary. The final community that was studied did not have a CCS project planned at all and functions as a control site. Lessons regarding public response to energy controversy can be derived from the Fairview, Alberta case study, as there is a run-of-the-river hydro project

[4] The project proposed by the University of Calgary was later abandoned due to lack of local support.

proposed nearby, a proposed but cancelled nuclear power plant, and the presence of a large natural gas extraction industry.

The case study communities selected for this study provide an opportunity to examine CCS in locations where the technology was supported and opposed. It also allows for an understanding of why some energy development projects receive community opposition while others receive community support. Put another way, the research described here leads to practical understanding of what factors are important at a community level for the acceptance or positive views of a project. General lessons have been gleaned through examining these three communities and how they view CCS.

Overview of Case Study Methodology

This research uses a mixed-method approach to examine the perspectives and understandings of CCS or energy developments in three communities. The case study data was collected by conducting one-on-one or small group interviews with 120 members of three communities from May to November 2011. This included interviews with those who lived in the community *and* had a particular stake in the CCS events. This included, for example, those who were involved in the development of the existing Weyburn-Midale CO_2 Project, made allegations of leaks, or were involved in the unfolding of the University of Calgary research project in Priddis. Interview protocols included: 1) Community focused questions (e.g. how the community residents solved problems, sense of community and the interactions between community members); 2) Place specific questions (e.g. residents' relationship with the land and desire to change or protect landscape); 3) Carbon capture and storage questions (e.g. perceived risks and benefits of CCS in the area, how it would affect views of their landscape or interactions with

community members); 4) General energy system and climate change questions (e.g. views of energy systems and perceived need to reduce GHG emissions). While an overarching framework was used to guide the research, the methodology was tailored to suit each community selected for study. The differences in methodology were based on the demographics, suitable recruiting methods and on the stages of CCS or energy development in each area. This is discussed further in chapter five, which focuses on methodology.

Participant observation was conducted at community events, meetings and everyday activities to examine community functioning and interrelationships. Notes on these observations were recorded in a journal. All interviews were transcribed and imported into a qualitative data analysis program (N-Vivo 9) for review and analysis. Interviews were analyzed using a constant-comparative and concept-development approach based on emergent themes that evolved through the course of the research (Strauss & Corbin 1995).

Significance and Contributions of the Research

This research extends the work that has been conducted on perceptions of CCS in Canada and internationally. It is imperative to study the Canadian perspective (particularly Western Canada) as this area has a dependency on fossil fuels and a stated official commitment to greenhouse gas (GHG) reduction – at least during the study period. It also expands understanding of rural Canadians' views and perspectives on climate change and energy preferences in Canada. An understanding of the role of community and place attachment and how these concepts interface with energy and community development may also be extended with insights from the case studies. The contributions to research are further discussed in the following five points.

1. The Research Presented is Timely - Research is needed to assess the public perspectives of CCS as a number of projects in Alberta and Saskatchewan had been started or were set to begin in the next few years. While the current political and economic environment has changed in terms of industry interest and government support, the research presented here could provide valuable lessons for risk communication and management of similar current and proposed projects.[5]

2. Canadian Community Context - There has been relatively little Canadian research on public perceptions of CCS largely because the technology is at an early stage and there are few examples for the public to draw upon. Existing research demonstrates that the most critical challenges to the acceptability of CCS projects may stem from the perceptions and preferences of communities near selected CCS sites (Bradbury et al., 2009). For that reason the research is not only important to understanding the views of community members near proposed CCS projects, but also contribute to the research on how to conduct social science studies and outreach programs about technological risks in other communities in Canada.

---

[5] Over the course of this dissertation there has been a change in industry and government interest in CCS. There has been a change in status of two of the original four projects proposed for Alberta. In April 2012, TransAlta announced the cancelation of Project Pioneer. More recently the SwanHills Synfuel project has been deferred. A recent article in the Calgary Herald demonstrates this change: "Five years ago, the Alberta government touted its climate change plan as "transformative action" to sharply cut greenhouse gas emissions and fundamentally reshape the face of the province's energy-fuelled economy…The Tory government pinned its hopes on capturing carbon and storing it underground, but acknowledged overall greenhouse gases would rise for another dozen years before new technology would bring the situation under control. But the strategy has suffered setbacks since its inception – including the admission last year the province won't meet its own targets to reduce greenhouse gas emissions, and the cancellation of two of the four carbon capture and storage programs." (Derworiz, April 15, 2013)

3. Original Research on CCS - There has been little research that compares a CCS project cancelled due to public concern *and* a CCS project that has been successfully implemented.[6] In addition there has yet to be research on how a negative focusing event,[7] that is, the 'alleged' leak at the Weyburn-Midale CO_2 Project, can affect perspectives of CCS. This study examines how the allegations of a leak can contribute to the debate on deploying CCS in rural communities. The results are linked to other energy and technological developments to extend the practical understanding of perspectives towards this type of focusing event.

4. Contribution to the Literature on Community Studies and Place Attachment -Much research has focused on how individuals' perspectives factor into the acceptance or rejection of an energy system. Fewer research studies have examined how factors such as the importance of community or ties to the land influence views of energy systems or other 'risky' developments. In this research I examine how community dynamics and sense of place can shape collective risk perceptions. This research contributes to the literature by focusing on the above factors and how a community can react to a development.

---

[6] During 2011 and 2012 two projects emerged that compare the support for or opposition to CCS projects (see Oltra et al., 2012 and Dutschke, 2011). These studies are discussed in the literature review.

[7] A focusing event can be defined as "an event that is sudden, relatively rare, can be reasonably defined as harmful or revealing the possibility of potentially greater future harms, inflicts harms or suggests potential harms that are or could be concentrated on a definable geographic area or community of interest, and that is known to policymakers and the public virtually simultaneously" (Birkland, 1997, p.22).

5. Policy Implications and Information Needed for CCS Communications - Public opinions of CCS could slow development and deployment of the technology in Canada (Griffiths et al., 2005). The results and conclusions of this research may provide practical examples of how to improve industry practice and policy with regards to site selection and public outreach activities. This is critical in Canada, as industry and government plan an approach for deployment of large-scale CCS projects.

Overview of the Dissertation

The dissertation is structured as follows: In chapter two I provide a brief overview of carbon capture and geological storage. I discuss the purpose of CCS and review some of the risks and benefits of geological storage of CO_2 in deep underground reservoirs. Chapter three consists of a literature review and discussion of past research on risk perspectives of energy systems. My review of the literature highlights the factors that influence public perspectives of energy systems and focuses on the local community level (rather than the general public level). In chapter four I discuss the importance of examining "community" (i.e. relationships among people who live in the same area) and "attachment to place" (i.e. the importance of an area to local residents) as factors in the opposition or support of energy developments. In this chapter I clarify how community is conceptualized in this research study and discuss how interactional field theory guides and informs the research. This section distinguishes gaps in the literature and how this research can contribute to the fields of risk perception and community studies.

In chapter five I describe the methodology used for the study and how the research was carried out. This chapter also describes the recruitment and data analysis techniques utilized.

Chapter six includes a description of the three case study communities, the Weyburn-Midale CO_2 Project and the University of Calgary carbon research project.

In chapter seven I discuss the analyses and the findings. In this chapter each of the three case studies is examined based on the stage of CCS or energy development in the area. Chapter eight includes a discussion of the general findings regarding perspectives of CCS and the implications for community and place factors in siting energy projects. In chapter nine I discuss how conclusions from the study can inform policy and communication regarding CCS and energy development. I close by outlining potential areas for future study.

CHAPTER TWO: CARBON CAPTURE AND STORAGE IN CANADA

Introduction

Debates surrounding the implementation of technical solutions for carbon reduction are inevitable as society faces increasing environmental concerns and political pressure to act on global climate change. Carbon capture and geological[8] storage has emerged as one potential strategy to reduce greenhouse gas emissions, specifically carbon dioxide. The strategy has been particularly intriguing to countries such as Canada, which utilize fossil fuels and are seeking ways to reduce their GHG emissions. It has already been implemented in countries as diverse as Norway, Algeria, Australia, and the United States.[9]

Successful implementation of CCS requires an understanding of many technical and social factors. Scientists have increasingly accepted that technological change is shaped by the social context in which it is designed and used. Such views reject the notion of technological determinism—that technology develops as the sole result of an internal dynamic, is unmediated by any other influence and drives changes in the society where it is developed (Winner, 1986). Hence the success of a particular technology will not necessarily be based only on its performance, because a system is not purely technical; its real-world functioning has technical, economic, organizational, political and cultural elements (Wajcman, 2002). Therefore, technical and economic assessments must be considered within the current political, cultural and social

---

[8] There are a number of storage options for captured CO_2 including ocean storage or mineral carbonation. However, I focus on geologic sequestration (which includes storage in depleted oil and gas reservoirs, saline aquifers or deep coal beds), as this storage option is presently the main focus of developments in Canada (Meadowcroft and Langhelle, 2009).

[9] This is not an inclusive list of countries where CCS has been implemented.

context in order to fully assess a development (Stephens and Jiusto, 2010; Wustenhagen et al., 2007). By examining how CCS is understood within society, we can better understand not only the technical processes that inform policy making, but also how controversial technologies are shaped and accepted by the public (Bijker and Hughes, 1987). In the first section of this chapter I provide a brief overview of carbon capture and geological storage. The second half of the chapter examines several technical, economic, political and social factors that may influence the development and public perceptions of CCS.

Overview of CCS

Description and History of EOR and CCS

One of the main objectives of CCS is to prevent carbon dioxide from being released into the atmosphere, and thus minimizing the contributions of anthropogenic influences on climate change (GCCSI, 2012). Figure 2.1 provides an illustration of the CCS process. The technology includes three major steps: 1) capturing the CO_2 produced at large industrial plants and separating it from the other gases produced when fossil fuels are combusted for power generation or other industrial processes; 2) compressing the CO_2 and transporting it to a suitable storage site; and 3) injecting the CO_2 into deep underground rock formations often at depths of one kilometer or more.

Figure 2.1 Illustration of CCS Process

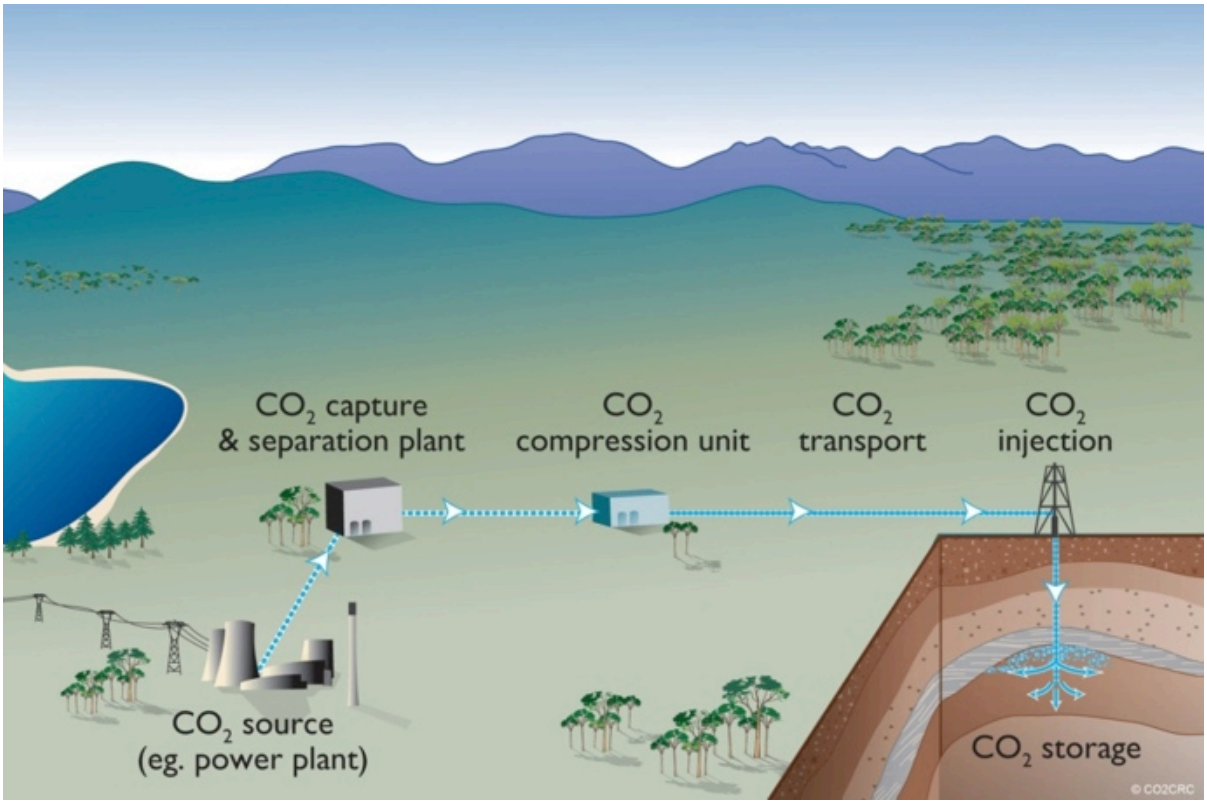


Figure Source. CO2CRC (2010)

The injection and storage of CO_2 has a long history in North America. The original goal of CO_2 injection was to increase the amount of oil that could be extracted from conventional oil production processes (DOE, 2011). Research into the use of CO_2 for enhanced oil recovery (EOR) processes began primarily in the United States during the 1950's (Donaldson et al., 1985). The first commercial attempt at CO_2-EOR began in 1972 in Scurry County, Texas (DOE, 2011) and early CO_2 sources used for the purpose of EOR came from both natural and industrial sources (Donaldson et al., 1985).

It was not until more recently that the capture, injection and storage of CO_2 was discussed seriously as a climate change mitigation strategy. The idea of capturing CO_2 from fossil fuel emitters and storing it underground had been discussed in the late 1970's (Marchetti, 1977), but work on CCS only gained the attention of international policy makers and the scientific community in the mid-1980's, when concern of climate change began to increase (Meadowcroft and Langhelle, 2010). The first major international conferences on CCS were held in the early 1990's and this is also when active international work from industry, academia and government began to accelerate the work on this technological approach to climate change mitigation (Meadowcroft and Langhelle, 2010).

In 1996 the first large-scale storage project began in Sleipner, Norway. This project involves separating CO_2 from natural gas and re-injecting it offshore under the North Sea (Shackley and Dutschke, 2012). Even though research and demonstration projects had begun, CCS still had little serious recognition for CO_2 reduction until the beginning of the century (Meadowcroft and Langhelle, 2010). However, in 2001, the Seventh Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC) requested that the IPCC investigate CCS. The resulting IPCC Special Report (2005) presented relatively favourable evaluations for the emissions reduction potential of CCS (Meadowcroft and Langhelle, 2010). This report spurred a greater profile for CCS among the international community and developed significant interest in the use of this technology as a climate change mitigation strategy.

CCS and GHG Emissions in Canada

Canada produces a large amount of CO_2 and other GHG emissions. In 2010 the total GHG emissions in Canada were 692 megatonnes (Mt) and about 81% of these emissions were generated from energy sources. The remaining 19% were generated primarily by agricultural sources and industrial processes (Environment Canada, 2012). Canada has made a number of commitments to reduce emissions. Canada's Kyoto commitment was based on a 6% reduction in emissions relative to 1990 levels (Environment Canada, 2008). Yet the projected emissions in a 2008 Canadian Government plan would result in non-compliance with the Kyoto targets and produce average excess emissions of 189 Mt/year. More recently Canada has agreed to a 17% reduction in GHG emissions from 2005 levels (by 2020) as outlined in the Copenhagen Accord (Government of Canada, 2010). Proponents of such targets argue that technologies that can reduce large quantities of CO_2, such as CCS, are required to fulfill this commitment (Pembina, 2009). While there are a number of alternatives that may reduce CO_2 emissions over the long term (e.g. through efficiency and the development of renewable energy sources), this does not address the already established large point source CO_2 emitters such as coal-fired power plants (IPCC, 2005).

Canada has a large fossil fuel endowment, including oil, natural gas, coal and oil sands. The strong base for extraction of these resources and the high certainty of revenue in national and international markets warrant that these Canadian industries will persist in the near future (Langhelle and Meadowcroft, 2009). A number of government and industry stakeholders are interested in CCS (Government of Alberta, 2008), although this interest can wax and wane with changing economic fortunes and other political interests. Many of these industries currently utilize or extract fossil fuels and are large sources of CO_2 emissions (ICO2N, 2010). Some

suggest that with the help of CCS technologies, industries may be able to cut emissions while continuing to use these fuel sources, at least in the short term (Tjernshaugen and Langhelle, 2009).

In addition, oil extraction industries may have a financial interest in CCS technology because injecting carbon dioxide in oil fields could enhance recovery beyond conventional water flooding. EOR involves the injection of CO_2 to increase the amount of oil recovered while also storing CO_2 in underground reservoirs. Cenovus (a Canadian based oil company) foresees a 50% improvement in the oil recovery rate at the Weyburn-Midale CO_2 Project area, resulting in incremental production of 130 million barrels during the next 30 years (NRCAN, 2008).

A number of other industries also have shown interest in implementing CCS technology. This includes chemical and fertilizer manufacturing industries such as an Agrium-owned fertilizer plant that plans to capture and store the CO_2 from its ammonia production for use in EOR projects (Agrium, 2008). CCS also can be integrated with coal-fired power plants (Bohm et al., 2007). Such a project integrating CCS with a coal-fired power plant was planned for Alberta. The project (Project Pioneer) headed by TransAlta near Wabamun, Alberta was cancelled in April 2012 (discussed further in a later section). The recent project planned for Estevan, Saskatchewan also integrates CCS with a coal-fired power plant in the Boundary Dam project managed by SaskPower. It is possible to incorporate CCS with other large point source industrial facilities such as cement facilities (IPCC, 2007). Such industry support and interest in CCS is an important factor in its development as it will be necessary to have continued funding and documented benefits, should the technology move beyond demonstration projects (van Alphen et al., 2009). The use of CCS is not limited to fossil fuels or industrial producers of

chemicals.[10] Carbon capture from biomass-based energy production could technically lead to net negative carbon emissions. Biomass energy can often be considered carbon neutral because CO_2 is taken up as a crop grows and if the emissions from a biomass plant are captured and stored, it could result in the removal of CO_2 from the atmosphere (Rhodes and Keith, 2005; 2008).

Factors that Affect the Development and Implementation of CCS

This section examines some of the technical, economic, political and social factors that may influence the development of CCS. It also provides a foundation for understanding the perceptions that the general public and affected residents may have about CCS developments.

Health and Safety Concerns

While there are undeniable benefits to CCS technology, many risks and uncertainties remain. There is the possibility of acute or chronic release of CO_2 from a CCS storage site (Bachu, 2007; West et al., 2005). Risks at a local level could impact both workplaces and communities at sites of CCS implementation. These risks could involve groundwater contamination as well as human and ecological health impacts if CO_2 accumulates in confined areas (Wilson, 2004; Siirila et al., 2012). Factors that impact the chances of acute CO_2 release include the nature of the geological formation (i.e. geological stability, presence of faults), site operation, long-term monitoring and the quality of well-sealing and abandonment procedures (Griffiths et al., 2005). The IPCC Special Report on CCS states that while "storage projects are now in operation and being

[10] Other options for CCS include directly capturing CO_2 from the atmosphere (Keith, 2009) and would allow for the decoupling of CO_2 capture from the emission source; emissions could be captured from small or mobile sources; or from sources in other countries. These strategies could assist in the further reduction of CO_2 from the atmosphere, should accumulation of CO_2 rise above a desired level (Keith et al., 2006).

carefully monitored, time is too short and overall monitoring too limited to enable direct empirical conclusions about the long term performance of geological storage (IPCC, 2005, p. 246)." The IPCC also suggests that leakage rates would be very small among well selected and operated storage venues. Overall estimates suggest that more than 99% of stored CO_2 is likely to remain isolated in storage for 100 years (IPCC, 2005).

There has been one public allegation[11] of a CO_2 leak at a carbon storage site. On January 11, 2011 a farm couple living near Weyburn, Saskatchewan alleged a leak associated with the Weyburn-Midale CO_2 Project. Reports from Cenovus and IPAC-CO2 stated that CO_2 found on the property was not anthropogenic (Cenovus, 2011; IPAC-CO2, 2011). However, there was an increase in media reports about the possibility of leaks from CCS and the impacts on future developments remain uncertain (Boyd et al., 2013). The context surrounding these allegations will be discussed further in the community profile chapter (chapter six).

Costs of CCS Technology

The costs of integrating CCS with industrial-scale projects are significant and require large investments (Alberta CCS Development Council, 2009). CCS implementation will involve not only large capital investments but also ongoing energy and resource inputs (MIT, 2007). The precise costs of CCS implementation are uncertain as costs can vary greatly among different sites, but it is known that the capture, transportation and storage of CO_2 will require significant expenditure (IPCC, 2005). Carbon dioxide transportation would require the construction of an

[11] A CO_2 breakthrough occurred at the In Salah project located in Algeria (Wright, 2011); however, there was little public attention focusing on the leak. The leak (approximately 0.1 tonnes of CO_2 had escaped) was discovered from a suspended exploration well (Wright, 2011). The leakage occurred in an area where there was little vegetation, residents or wildlife (Government of California, 2011).

extensive network of pipelines[12] that connect CO_2 sources with underground reservoirs that are suitable for CO_2 storage (ICO2N, 2010). Transportation would involve additional costs (construction and operating); however, identifying major CO_2 sources that are in close proximity to storage sites can minimize costs. Even though the costs associated with CCS are significant, some would argue that the costs of inaction and the negative impacts of climate change are higher (European Environment Agency, 2007).

The current economic downturn and the low international price of oil have created additional challenges for CCS. Oil has fallen from its peak of approximately US $140 per barrel in 2008 to less than US $40 per barrel in 2009. More recently, the price is around US $85 in June 2012[13] (U.S. Energy Information Administration, 2012). A number of oil sands projects have been delayed or cancelled, which has reduced the opportunities for CCS investments (Suncor, 2011).

Environmental Concerns Associated with CCS

Some question whether CCS will actually provide the reduction in CO_2 claimed by its proponents. Others criticize certain contexts for its use, including EOR. For example, the Pembina Institute has generally supported CCS development but not necessarily for enhanced oil recovery because of the "uncertainty of the net environmental benefit of using CO_2 for EOR (Pembina, 2009, p.2)." Many are similarly skeptical about the use of CCS in conjunction with the oil sands, questioning whether the technology actually provides a net reduction of GHG or

---

[12] Transportation of CO_2 can also be achieved by truck or ship. However, I focus on pipelines, as this transportation option is presently the main focus of development in Canada.
[13] This reporting is based on West Texas Intermediate (WTI) crude oil.

allows for the high emissions of oil sands to be rationalized by its producers (Bergerson and Keith, 2010). There is some evidence that using CCS in oil sands production could reduce emissions. However, it is estimated that 60-80% of emissions would still occur if the bitumen were eventually combusted in a vehicle (Charpentier et al. 2009).

The process of capturing CO_2 and compressing it for transportation requires substantial energy. In terms of power generation, the IPCC has stated that capture and compression require about 10-40 percent more energy than an equivalent plant without CO_2 capture potential (IPCC, 2007, p.22). This suggests that the amount of CO_2 emissions that can be avoided by a CCS integrated power plant could be less than the total CO_2 sent for storage (Meadowcroft and Langhelle, 2009). Other concerns associated with CCS development include the environmental impacts associated with the construction and maintenance of the infrastructure needed to capture, transport and store the CO_2. Equipping a power plant with CCS means that a larger installation is needed to produce the same power output (IPCC, 2005). Such expansion requires greater material inputs (such as water and fuel) and produces greater solid waste (McFarland and Herzog, 2006). All of these are likely to impact the local environment. However, research has also demonstrated that continued technological improvements in capture technology would likely decrease the need for as many inputs (Rubin et al., 2007).

Regulation and Legislation

One of the significant barriers to CCS throughout *most* of Canada is the lack of a comprehensive policy, legislative and regulatory framework for its implementation (Bachu, 2007). Alberta is one exception (discussed in a later section). For the rest of Canada, procedures regarding the

monitoring, reporting and inspection of CCS still need to be developed (Jaccard and Sharp, 2009).

There also are issues of uncertainty with regard to who is liable should leaks occur, who owns storage sites and who monitors them (Griffiths et al., 2005). These concerns will need to be addressed thoroughly and in collaboration with potentially affected stakeholders in order for CCS implementation to make significant progress. Other uncertainties include the clarification of accounting options for long-term CO_2 storage. This includes ownership and markets for GHG emission credits (Griffiths et al., 2005).

Government Investment in CCS

Government is under pressure to both reduce environmental impacts *and* maintain economic sustainability. As Jaccard and Sharp (2009) state: "Only CCS could allow the country's political leaders to argue that Canada could both ramp up its production of fossil fuels, especially oil sands, while also being a responsible member of the global community by agreeing to aggressive GHG reduction targets (p.79)." Natural Resources Canada suggests that the financial burden entailed has been one of the barriers preventing the commercial application of CCS projects. The Federal Government and some Provincial Governments have invested in CCS development in order to advance implementation (Alberta CCS Development Council, 2009). For instance, the Government of Alberta introduced legislation in 2008 that includes $2 billion in investments for carbon capture and storage. The Carbon Capture and Storage Funding Act, Bill 14, would help provide support for Alberta CCS projects.

The Canadian Federal government has also stated that CCS would be a part of CO_2 mitigation options. Prime Minister Stephen Harper described CCS as an "integral part of the

Government of Canada's GHG emissions reduction strategy" (Harper, 2009). One of the steps in the 2009 Canada Economic Action Plan was to support "clean energy research development and demonstration projects, including carbon capture and storage (Government of Canada, 2009)," and the federal government has provided $375 million since 2006 to support the development of CCS in Canada.

Continued advancement of CCS implementation requires continued development of policy and regulatory frameworks that encourage industry incentive and ability to apply CCS (Meadowcroft and Langhelle, 2009). Some have suggested that it is necessary for a strong regulatory push or significant price associated with carbon emission credits in order to further develop commercial CCS applications (Meadowcroft and Langhelle, 2009). For instance, the Alberta CCS Development Council (2009) has stated that Alberta will require "fair carbon dioxide (CO_2) emission compliance costs and financial support" (p.7) for continued CCS development. As well, Canada has yet to introduce a GHG cap-and-trade system or an emissions tax. As Langhelle and Meadowcroft (2009) state: "Although Canada has long been an active participant in international processes around climate change, it has had great difficulty translating publicly proclaimed emission reduction goals into meaningful policy" (p.239).

While there has been some policy development and support from governments in key Canadian jurisdictions, the industry incentives or regulation of carbon-based incentives remain undeveloped. Most notably, the lack of a significant price on carbon could be a hindrance to the widespread commercial development of CCS in Canada (Meadowcroft and Langhelle, 2010; ecoENERGY Carbon Capture and Storage Task Force, 2008). This was one of the factors in the cancellation of an Alberta CCS initiative – Project Pioneer. Industry partners with the project state that "although the technology works and capital costs were in line with expectations, the

market for carbon sales and the price of emissions reductions were insufficient to allow the project to proceed (Project Pioneer, 2012)."

Environmental Non-Governmental Organizations

It has been suggested that Environmental Non-Governmental Organizations' (ENGO) communication of CCS may contribute to public and community views toward this new technology and could be used to help increase support for the technology (Wong-Parodi et al., 2008). Existing research demonstrates that the general public often places greater trust in information from ENGOs than industry or government (Jepson, 2005). Thus it will be important to understand ENGO positions concerning CCS and their views on the policies or regulations required for CCS deployment. There are some Environmental Non-Governmental Organizations (ENGOs) who provide qualified support for CCS and others who oppose the underground storage of CO_2 as a climate change mitigation strategy. For instance, the Pembina Institute has made the following statement about CCS:

> CCS is one of a number of technologies that can contribute to reducing greenhouse gas (GHG) emissions on the scale required to combat dangerous climate change. It is critical that CCS be considered as part of a portfolio of solutions… (Pembina, 2009, p.1)

Nevertheless, Pembina maintains that attention should still be focused on developing more sustainable, low-impact energy systems such as renewable energy and an increase in energy efficiency. Other environmental organizations concerned more with conservation (e.g. the Sierra Club and the World Wildlife Fund) appear to have lukewarm views towards CCS – both claiming that CCS could be supported as long as the focus is still on energy efficiency and renewables (Sierra Club, 2010;World Wildlife Fund, 2010). Conservation groups such as

Greenpeace remain opposed to CCS because they believe it is too expensive and detracts from the development of other energy options such as increased energy efficiency or renewables (Greenpeace, 2008). The David Suzuki Foundation also remains opposed to CCS for a number of reasons, including the possible dangers to protoplasm (single-celled organisms that live underground) and debates about the actual potential of the reduction of CO_2. They also suggest that money should go towards renewable energy and conservation (David Suzuki Foundation, 2009).

Additional Canadian Factors

There are a number of additional factors that play into the development of CCS in Canada. These include the economic benefits of marketing CCS technology and international pressure to develop technologies that reduce GHG emissions. CCS is partially framed as a commercial enterprise and it is suggested that being a competitive player in the CCS market could benefit Canada in the future (Stephens and Jiusto, 2010). Markets such as China, India and other emerging economies will require both economic development and a reduction of emissions (NRCan, 2008). Development of CCS technology can further contribute to economic growth through the prospect of job creation and regional prosperity in regions where CCS (particularly EOR) is best suited (Jaccard and Sharp, 2009).

International pressure on Canada to reduce GHG emissions, especially from oil sands, is another possible reason for investing in CCS technologies. The Seattle Times quotes U.S. President Barack Obama as stating, "I think to the extent that Canada and the United States can collaborate on ways that we can sequester carbon, capture greenhouse gases before they're emitted into the atmosphere, that's going to be good for everybody (Gilles, 2009)." There

remains pressure from the American government to promote activities that lead to a cleaner environment because America is a major importer of Canadian oil and gas (ObamaBiden, 2008; Government of Canada, 2012). The United States is Canada's major market for oil sands and states such as California suggest that production of emissions from oil sands should be accounted for. Fear that Alberta's oil sands might not be allowed as an export to the United States because it produces 3 to 5 times as much GHG emissions in its production stage as a barrel of oil from a conventional oil well could be a powerful motivator (Jaccard and Sharp, 2009).

CCS in Western Canada

This dissertation focuses on Western Canada and more specifically Alberta and Saskatchewan. This section provides an overview of the social and technological context of CCS in Western Canada. I include a brief discussion of geological conditions, the high reliance on fossil fuels in the region, experience with injecting CO_2, and the existence of a regulatory framework.

Canada has ideal geological conditions for CCS, including the stable sedimentary rock formations of the Western Canadian Basin (Bachu and Stewart, 2002). Alberta and Saskatchewan not only have potential for geological storage, but also contain major sources of industrial CO_2 (Bachu and Stewart, 2002). These two provinces account for a large amount of GHG emissions in Canada[14] and this is expected to increase in the future. Both Alberta and Saskatchewan have relatively high levels of emissions from the energy sector due to the use of coal to produce electricity (Government of Alberta, 2010b; IEA, 2008).

[14] In 2010 Alberta produced 233.3 megatonnes (Mt) of carbon dioxide equivalent and Saskatchewan produced 72.1 Mt of carbon dioxide equivalent.

Alberta has been the focus of much of the discussion around CCS: "With its oil sands production plants and coal-fired power plants, Alberta's production of CO_2 dwarfs even that of Saskatchewan, such that Canadian discussions about the potential for CCS focus especially on that province (Jaccard and Sharp, 2009, p.77)." In 2008, the Government of Alberta had outlined the Province's target to reduce its emissions by 200 Mt/year by 2050 over business-as-usual and originally expected 70% of the reduction to be from CCS (Alberta CCS Development Council, 2009). However, despite growing technological development, research and investment in CCS during the past decade, large-scale CCS deployment has been slower than many had envisioned five or ten years ago (Bäckstrand et al., 2011).

The economies of both Alberta and Saskatchewan are heavily tied to fossil fuel resources (Jaccard and Sharp, 2009). The amount of oil reserves (mostly found in the oil sands) ranks second in global crude reserves, and therefore it is likely that fossil fuel extraction will continue in the near future (Government of Alberta, 2010c). The revenues from the fossil fuel industry and the contributions of the energy sector to Alberta's GDP increase the reliance of the province on fossil fuels and make CCS an attractive implementation option.

The Western provinces have experience injecting and storing CO_2 underground through both the Weyburn-Midale CO_2 Project and through acid gas injection sites (Bachu and Gunter, 2004). Acid gas is a mixture of hydrogen sulfide (H_2S) and carbon dioxide, with minor traces of hydrocarbons. Since the early 1990's the oil and gas industry has been reducing emissions of H_2S—produced from "sour" hydrocarbon pools—by injecting them underground (Alberta Geological Survey, 2009). By the end of 2003 2.5 Mt CO_2 and 2.0 Mt of H_2S had been injected into deep saline aquifers and depleted hydrocarbon reservoirs in Western Canada (Bachu and

Gunter, 2004). The Alberta Geological Survey (2009) states that there is the possibility to learn from these acid-gas injection operations and apply them to CO_2 geological storage:

> Large-scale injection of CO_2 in depleted saline aquifers is one of the most promising methods of geological storage of CO_2, and in this respect, it is no different from acid-gas injection operations. Thus, the study of acid-gas injection operations in western Canada provides the opportunity to learn about the safety of these operations and about the fate of the injected gases, and represents a unique opportunity to investigate the feasibility of CO_2 geological storage.

Alberta was the first (and so far only) province to pass comprehensive legislation for CCS. Alberta's Bill 24, the "Carbon Capture and Storage Statutes Amendment Act, 2010" was passed in December 2010 and would require that the Alberta government accept long-tem liability for the sequestered underground CO_2 once the government is provided with data that demonstrates CO_2 containment (Legislative Assembly of Alberta, 2010). Prior to this Bill, critics argued that the lack of a legislative framework for CCS was a major hurdle to development. However Bill C 24 has the potential to advance the possibility of developments as it clarifies the definition of pore space ownership and has created a post-closure stewardship fund for the ongoing monitoring and remedial work (Legislative Assembly of Alberta, 2010).

Alberta and Saskatchewan have an ideal geological area for storage, already host many large industrial sources for the capture of CO_2, contain large fossil fuel industry investments, and have experience with CO_2 injection and legislative frameworks. These factors will continue to influence CCS developments and public perceptions of the technology in these provinces.

Chapter Summary

Chapter two summarized the origins and purpose of CCS and discussed several technical, economic, political and social factors that could influence the development and public

perceptions of CCS. The origins of CCS stem from the development of enhanced oil recovery processes. CO_2 injection is still used in EOR projects around the world. More recently, carbon capture and storage has emerged as a potential strategy to prevent carbon dioxide emissions from entering the atmosphere. The primary steps involved in capturing CO_2 from large-source emission points, transporting it to a suitable storage site and injecting it into stable underground reservoirs. CCS and other technological strategies for reducing GHG emissions have been particularly attractive to Alberta and Saskatchewan as these provinces have a large fossil fuel endowment and industrial base that produce large amounts of CO_2 emissions. More recently, the interest in CCS as a climate change strategy in the Western provinces has changed and a number of projects have been postponed or cancelled. Despite these recent trends, interest remains in this technological approach to reducing GHG emissions.

The successful implementation of CCS technology requires a number of technical and social factors. While there are potential benefits of CCS for communities and society, there also are a number of risks and uncertainties associated with the technology. In this chapter I discussed a number of (often related) issues that serve as barriers to the implementation of CCS in Canada. These barriers can include health and safety concerns such as the possibility of acute or chronic release of CO_2 from a CCS storage site. Concern for health and safety is an important factor in the perceptions of those who live near operating or proposed CCS projects. There also can be concern about the costs of integrating CCS with industrial-scale projects. CCS projects are expensive, involve significant capital investments, and require ongoing energy and resource inputs. Conversely, some argue that the economic benefits of CCS from EOR activity and the potential to develop and market the technology to an international market outweigh these costs. Other potential influences on CCS development discussed in this chapter include international

pressure to develop cleaner energy sources, environmental concerns associated with the continued use of fossil fuels and the lack of a comprehensive policy, legislation and regulatory framework in areas of Canada.

Discussion of CCS development has focused on certain areas of Canada, mostly in Alberta and Saskatchewan. The last section of chapter two focused on the landscape of CCS in these regions and why the technology has been proposed for the area. Alberta and Saskatchewan account for a large amount of GHG emissions in Canada, partially due to their dependency on coal for electricity production. The economies of both provinces also are tied heavily to fossil fuel industries. Alberta and Saskatchewan have an ideal geological area for storage. They already host many large industrial sources for the capture of CO_2, contain large fossil fuel industry investments, and have experience with CO_2 injection and legislative frameworks. These factors will continue to influence CCS developments and public perceptions of the technology in Alberta and Saskatchewan – the two provinces I focus on in this dissertation. The next chapter will review the literature surrounding public perceptions of technical developments, particularly the factors that impact those at a local community level.

CHAPTER THREE: PERSPECTIVES OF ENERGY SYSTEMS AND CCS

Introduction

This chapter focuses on two sets of literature that provide context to the examination of populations that may be affected by potentially 'risky' developments nearby, including carbon storage projects. These literatures include: 1) risk perception and communication of risk, and 2) public opinions on energy sources and technology. The first portion of this chapter includes a general description of 'risk' with regard to how the term is used in this research. The chapter also provides background on the study of risk perspectives and communication.

The second focus of this chapter concerns research on the factors considered by publics when making decisions about energy systems. I review and evaluate factors that influence residents' decision-making on and perspectives of energy sources. The review focuses on what I term 'locally-affected-community' factors, which refers to factors that are specific to the area where the proposed development will be sited. Such factors include, but are not limited to, conceptions of health and safety related to technological development, economic benefits or concerns about the impact of development on community stability. I provide a literature review of past research on perceptions of communities affected by other technological developments. While these perspectives are presented separately, I discuss how the various topics complement each other and provide a cohesive framework for my dissertation research. The literature discussed below also provides insight into the methodological approaches that are used in this study.

Risk Perceptions

The field of risk studies is broad, interdisciplinary and is approached using many viewpoints and frameworks. For this reason the interpretation of risk can be somewhat elusive. Risk is often viewed and assessed differently in the physical sciences and the social sciences (Breakwell, 2007). Historically, those in the physical sciences perform quantitative risk assessments which, for example, can be calculated as the probability of a particular adverse event occurring during a period of time (Breakwell, 2007; Kumamoto and Henley, 2000). Yet it is unlikely that the general public would use calculations or probability factors to think about or judge a risk (Breakwell, 2007). Social science research demonstrates that the majority of the public rely on intuitive risk judgments, called "risk perceptions" to think about hazards (Slovic, 1987).

There are many factors that affect how the public can perceive risks. Research on expressed preferences have shown that characteristics such as familiarity, control, catastrophic potential, equity and level of knowledge influence the relationship between perceived risk, perceived benefit and risk acceptance (Slovic, 1987). These factors "play a large role in determining levels of concern, worry, anger, anxiety, fear, hostility, and outrage, which in turn can significantly change attitudes and behavior" (Covello et al., 2001, p.384). In this dissertation I focus on participants' *risk perceptions* as described above. When I question residents in my study communities about how they judge a risk, I do not ask them to calculate a probability based on hazard and exposure factors. Instead, I ask them about their feelings, judgments, and beliefs (see Slovic, 1987). I regard 'risk' as something that is assessed and understood by people depending on their knowledge, experiences, worldviews, cultural intuitions, trust in communicators and roles played in the risk issues.

Risk perception and communication research has predominantly focused on developing a better understanding of how the public makes decisions about risk and how this compares to expert assessment (Fischer, 2004; Breakwell, 2007). This has led to a historical dominance of research on how the public can make more informed decisions (Morgan et al., 2002), often guided by the notion that the 'scientifically illiterate' public requires more information to make increasingly 'rational' decisions (Miller, 2001). Risk perception researchers have begun to shift their focus from examining deliberate, conscious and mechanistic methods of probabilities and payoffs with regard to risk. The emerging paradigm in risk perception research is one that takes into greater account the variety of social contexts that shape risk and the variation in perceptions among individuals and groups (Gurabardhi et al., 2004). More specifically, researchers have shifted from purely cognitive approaches of risk perception by integrating approaches that better take into account social and cultural influences (Slovic, 2010; Douglas, 1983). This is particularly important to the study of those who live in locally affected areas. Locals not only take into account the physical hazards associated with a risk, but also other factors such as possible economic loss (e.g. though loss of tourism) (Flynn et al., 1992; Slovic et al., 1991), the breakdown of social networks (Unger and Wandersman, 1985; Wakefield and Elliott, 2000) or the feeling of stigma of being located nearby a potentially problematic project (Masuda and Garvin, 2006; Venables et al., 2012).

Same Hazard, Different Understandings

Scientists, policy makers and the general public will employ different, though equally legitimate reasoning when evaluating and generating knowledge about a risk (Garvin, 2001). Experts generally utilize technical language (characterized by probabilities, statistics, and terms common

to disciplines such as toxicology, epidemiology and others) and employ specialized scientific knowledge about a risk (Powel and Leiss, 1997). The general public approaches risk assessment by drawing on everyday experiences within a specific social and cultural context (Douglas and Wildavsky, 1983; Breakwell, 2007; Lupton, 1999; Slovic, 2010). For instance the public might base their judgments on responses to the following hypothetical questions: Can I trust the developers or regulators? Will a development affect my social well being and relationships with others? Who will fund and carry out research? Have I had a say in a development? Who bears the costs and who gains the benefits? These and many other considerations made by those at risk have been found to contribute to a risk judgment (Divine-Wright, 2005; 2009).

Seminal risk studies have derived common factors that influence risk judgments (Star, 1969; Fischhoff et al., 1978). For example, risk perception research regularly demonstrates that risk acceptability is positively related to the perceived benefits to be derived from the hazard (i.e. activities that are judged high in risk tend to be judged low in benefit) (Star, 1969; Slovic et al. 1990). Research commonly finds that if exposure to a hazard is voluntary, then the risk is more likely to be acceptable (Slovic et al., 1990); and 'new' risks tend to be judged as less controllable (Fischhoff et al., 1978).

Both practical experience and research demonstrate that individual members of the public can experience risk differently. For instance Douglas and Wildavsky (1983) contend that the experience of risk is as much about the characteristics of the individual(s) who may be exposed as it is about the occurrence, likelihood or potential impact of the event in question. Acknowledging the inescapably social character of risk, whether it be the personal morals or values of an individual making risk decisions, or the social norms that dictate collective action, means that the reality of any risk cannot be a unidirectional process of assessment passed down

from the "knowledgeable." Breakwell (2007) summarizes this sentiment by stating that risk is likely to be tacit, experiential and individualized for the public.

A hazard may affect an *individual*, but it can also be experienced by a collective group of people (Flint el al., 2008). A group of people can perceive a risk to their community or the area they live in. Consequently a community may have the collective ability to act against or in support of a development perceived as potentially dangerous This concept of "community" and how a group of people view a risk has received little attention in the risk perception or communication literature, and is the focus of the next chapter where I examine community and group risk perceptions.

Factors in the Perceptions of Energy Systems

Perceptions of *technological risks* such as CCS have become an important arena for risk research. Beck (1992) argues that we exist in a risk society and places a heavy emphasis upon the novelty of our situation in relation to technological-scientific hazards. Risks associated with new technologies are ideal examples of the complex nature of these developments and attendant risk perceptions because of the risk-benefit tradeoffs involved (Perrow, 1999). For example, nuclear energy can provide the energy needed to power many items that we use on a daily basis. However, the same technology potentially exposes populations to the risk of radiation contamination associated with meltdowns and technical failures, as illustrated recently with the tsunami and associated nuclear issues in Fukushima, Japan.

Public opinion on any controversial technology can factor into successful introduction or development and this is especially true of energy systems (O'Hare et al., 1983). Public support (or opposition) of energy systems has been a factor in the development of energy infrastructure

throughout North American (Owens and Driffill, 2008). Social science researchers have found that public opposition is a factor in the decline of new nuclear power reactors since the 1970's and was a factor in the 1990's-era moratorium on offshore drilling along many coastal areas in the United States (Smith, 2002). Public opposition also stymied two proposed CCS projects near the community of Barendrecht, Netherlands[15] and the community of Beeskow, Germany.[16] In these communities, and potentially elsewhere, a lack of support for technological development can slow or stop the implementation of that technology (Rosa and Dunlap, 1994).[17]

Factors Influencing Local Communities' Support or Opposition to Energy Projects

In this section I provide a broad overview of some of the factors that influence a local community's support for or opposition to an energy development. I discuss literature of energy technologies (such as biomass, hydro, nuclear and wind) and also research on the siting of other technological facilities (for example the Swan Hills hazardous waste disposal site in Alberta). It is critical to note that the factors discussed throughout this chapter are not the *only* criteria that influence an individual's perspectives toward a given energy system. The factors I focus on are commonly cited as not only important factors to perceptions of energy systems in general but also CCS specifically.

---

[15] The Barendrecht CCS Project was a proposal to store approximately 10 million tonnes of CO_2 over a period of 25 years from Shell's Pernis Oil Refinery in a depleted gas field near the port of Rotterdam, under the town of Barendrecht. Reports from Bellona (2010) indicate that the project was cancelled "due in part to persistent opposition from the local community. This unfortunate outcome shows the extent public reluctance can represent a hurdle to CCS deployment."

[16] The Beeskow CCS Project was a proposal to store CO_2 from Vatenfall's Schwarze Pumpe coal station in Brandenburg, Germany and store it under the town of Beeskow. The project met with local opposition and was ultimately cancelled (Vatenfall, 2012).

[17] Appendix A provides a brief overview of the CCS projects discussed throughout this dissertation.

In the following section I present five factors that may influence locally affected residents' perceptions of energy developments (which can include CCS). These factors include: 1) trust in developers, government and information sources; 2) the perceived fairness, equity and justice of the energy system's implementation and development; 3) ownership of the project and the socio-historical context in which the project develops; 4) the perceived risks and benefits for the 'affected' community; and 5) views of the community towards broader policy objectives and environmental values. After I discuss these five factors, I focus specifically on presenting past research of residents' perceptions of CCS. Collectively, this review of influences on perceptions of energy developments and CCS serves two purposes: 1) it identifies gaps in the literature about residents' perceptions of CCS; and 2) it examines if CCS includes unique conditions that raise the profile of certain risk perception factors.

Trust in Developers, Government and Information Sources

Trust directly influences risk perceptions, which in turn can dictate attitudes towards infrastructure and stakeholders. Trust can be defined as the willingness to rely on those who have the responsibility for making decisions and taking actions related to the management of technology, the environment, or other realms of public health and safety (Siegrist et al., 2000). Affected publics, especially those living near a technological development, require confidence in those who are operating the technology and making decisions (Flynn et al., 1992). The absence of trust (or distrust) in developers or regulators often is a major reason for controversy over the development of technologies or the acceptance of hazard (see for example Poortinga and Pigeon, 2003; Bord and O'Connor, 1992). For these reasons it is important that developers, government and information sources not only engender trust but also maintain it. Trust is a quality that is

much easier to destroy than to create (referred to as the 'asymmetry principle') (Slovic et al., 1991).

Previous research has demonstrated that trust can affect whether a risk or technological system is accepted. There are many examples of resident opposition to development due to distrust in industry or policy makers. One of the most common examples in the risk perception literature is how lack of trust in nuclear energy and waste sites has halted the development of these projects (Erikson, 1995). Public and local community distrust has affected both the transportation of nuclear waste (Binney et al., 1996), sitting of nuclear waste facilities (Slovic et al, 1991; Slovic, 1993), and nuclear power plants (Slovic, 1993). Trust has also been a factor in the *successful* implementation of projects such as wind power in South Wales, United Kingdom (Devine-Wright, 2005) and a biomass electricity plant in North Wiltshire, United Kingdom (Upreti and Horst, 2004). Likewise, technological implementation in an area is likely to be influenced by trust in a number of stakeholders (Earle, 2010). This includes trust in regulatory sources (e.g. is the government trusted to regulate industry, technology, or siting regulations?); trust in the developers and industry (e.g. is industry trusted to implement development?); and trust in information sources (e.g. are the sources that provide information trusted?).[18] An example of the importance of trust between residents and project developers is demonstrated in the research of Walker and colleagues (2010). Walker et al. examined six renewable energy projects in different locations in the UK. The projects were selected to include a variety of renewable resources and technologies for heat and power generation, scales of development, spatial location (including solar, wind, biomass and geothermal). Results demonstrated that

[18] For more information on trust see the 2010 special edition of Energy Policy entitled: "The Role of Trust in Managing Uncertainties in the Transition to a Sustainable Energy Economy"

those who trusted the project organizers also tended to express support for the project. Conversely residents who felt distrust in project organizers were more likely to oppose the renewable energy projects (Walker et al., 2010).

Researchers often acknowledge a correlation between trust and fairness of implementation (Walker et al. 2010, Besley, 2010). For example, a study about local residents opposition to the Yucca Mountain nuclear waste repository found that a perceived lack of fairness in siting decisions was linked to distrust and opposition (Pijawka and Mushkatel, 1991). The factors of fairness and justice are discussed further in the following section.

Fairness, Equity and Justice of Implementation and Development

Fairness and justice are often considered the driving forces behind many disputes about technological and infrastructure developments. When the public believes an outcome to be fair, they are more willing to accept a decision (Besley, 2010). Conversely, if a procedure for implementation of a CCS site is not perceived as fair, just and equitable, there may be a lower prospect of acceptance and more local resistance to development (Ashworth, 2010; McLaren, 2012). Fairness can be defined as whether an individual perceives the result of a decision to be equitable (Lind et al., 1990). It can include whether people believe they have received an adequate amount of information related to a risk or decision (Besley, 2010; Besley and McComas, 2005).

Justice research draws on social psycological theory to emphasize that the process of decision making is just as important as its conclusion (Lind and Tyler, 1988). To that end, Besley (2010) describes four types of fairness that are important to the acceptance of a technological development:

- *Outcome* (also called distributive) *fairness*: whether individuals perceive the results (or outcomes) of a decision to be equitable or needed.
- *Procedural fairness*: whether individuals feel they have had a voice in a decision-making process (see McLeod et al., 1999). Research by Gross (2007) suggests that procedural justice is often just as (or even more) important as the actual outcome.
- *Interpersonal fairness*: the degree to which individuals perceive decision makers as trustworthy and respectful of their views (Besley and McComas, 2005; Besley, 2010). There is also a clear overlap in how trustworthy decision-makers appear to the public and how fairly the public perceives the decision-making process or its outcomes.
- *Informational fairness*: the degree to which people perceive that they have received an appropriate amount of information related to a decision. Some research places informational fairness within the category of procedural fairness (Gross, 2007; Maguire and Lind, 2003).

The issue of fairness stresses the expanded role of citizens in helping to determine and make sense of the decisions that affect their lives (Gurabardhi et al., 2005). Risk managers must now understand and incorporate the ideas of dialogue, conflict resolution, consensus building and relationship development among parties involved with or affected by the risk to reduce conflict over their continued operation (Heath et al., 2002; Leiss, 1996). Wolsink (2007) states that important questions regarding development should include who acquires the benefits and who shoulders the costs? Furthermore, it has been shown that: "People will often reject a technological development if they are being disadvantaged and conversely will also reject projects if they perceive that those who may be more vulnerable have been unfairly

disadvantaged, even if they themselves will gain personally from a project (Wüstenhagen et al., 2007, p.453)." This was demonstrated in a community in New South Wales, Australia where a windfarm devlopement had been proposed for the area (Gross, 2007). Gross (2007) found that community members' perception of "outcome fairness" among residents was an important factor in the support for windfarm develoments in the area, primarily in order to maintain social well-being. Outcomes that are perceived as being unfair can result in protests, damaged relationships and divided communities (Gross, 2007). This is especially true when decisions may benefit certain people in the community at the expense of others.

Ownership of Project, Stigma and Socio-Historic Context

Projects in which community members have a sense of ownership tend to observe less local resistance. This ownership may be a financial interest, an emotional connection to the development, or a sense of pride that the community is a part of the development process and/or its products (Hinshelwood and Tawe, 2000). It is critical to pay attention to the institutional, economic and social aspects of a development and understand how a community views the risks and benefits associated with a technology or 'risky' project. Some communities could view hazardous waste facilities with skepticism *or* the development may be perceived as a source of community stability (Kuhn, 1998). Successful projects such as the 'Swan Hills Hazardous Waste Facility' located in Alberta demonstrate that those living in an area may support (or in this case actively pursue) a project that other communities may not want (Rabe, 1991). Those living near the Swan Hills Waste Facility viewed the project as an asset to the community through diversification of the Swan Hills economy, which was previously reliant on fossil fuel extraction, and also as an attractive investment for long-term economic growth. Some residents even saw

the facility as way to provide safer methods of waste disposal and thereby invoked pride and the perception of locally created solutions (Rabe, 1991).

Whoever owns, operates, manages or regulates a project will affect how it is perceived (Slovic, 1993). Members of a community will base their perceptions of developments on the actions of previous managers/regulators/owners. As such, a question critical to examining future acceptance involves the question: what have developers done in the past? If a company has done something unfavorable in the past, there may be little chance for the company to be trusted in the future. The past actions of an industry as a whole also factor into the acceptance of a technology. For example, if an area has had a poor experience with a specific oil company, there could be a chance that a new oil company coming into the community would have difficulty gaining acceptance (NETL, 2009).

Another factor includes *community ownership* of a project. Community ownership may come in two forms: 1) *literally* the community (or community members) owns a share of the project; or 2) *symbolically* the community has had significant input and control in decision-making, implementation or monitoring of the project and *perceive* ownership.

It is unlikely that a large-scale nuclear or hydroelectric power plant will be *literally* owned by a community; it is more possible for full or partial ownership in wind, solar or run-of-the-river developments (INAC, 2007). Research demonstrates that full or partial ownership provides the community with some decision making power, perceived control and often results in greater support of a project (Warren and McFadyen, 2010; Devine-Wright, 2005). An example of this includes a comparison study of wind turbine developments in two communities in Scotland. Where wind turbines were owned by the community, they felt a strong sense of pride and connection with 'their' wind farm project and even named the turbines (a tradition

novel to Scotland but seen historically for Dutch windmills) (Warren and McFayden, 2010). In comparison, the Scottish community with no commercial ownership was less enthusiastic about wind farm development in their area.

A five-year longitudinal study by Aitken (2010) on a wind farm in central Scotland demonstrated that residents could *perceive* a sense of ownership through participation in decision making. Public participation in design or some form of decision-making was seen as a reason for the community to accept aspects of the project. It is often acknowledged that involving members of the community in implementation or planning (this is also related to perceived fairness) can increase support for a project (Breukers and Wolsink, 2007).

Risks and Benefits to the Community

A new development can bring economic advantages to a community; it can also bring about a host of non-economic aspects such as stigma (i.e. adverse perceptions that result in avoidance or other negative behaviors), pride and social upheaval, or conversely togetherness (Flynn et al., 1993). Opposition or concern can be an expression of the desire to preserve shared places, spaces, and interactions that are valued by community members. Not all community systems[19] are affected by developments in the same way.

Examining the impacts that technological development will have on a given community means considering more than just economic worth. It also means considering the biophysical, cultural, social and psychological *systems* that collectively determine whether and how "community" exists in a particular place (Freudenberg and Gramling, 1992; Gramling and

[19] Researchers from a number of disciplines have a number of names for this concept. Often these concepts are referred to as 'capitals,' 'resources,' 'endowments,' or 'systems.' Here I refer to the concepts as systems.

Freudenberg, 1992). More specifically, the following elements of community context need to be considered when studying nearby technological development:

- *Cultural systems*. Individual communities develop a unique blend of local meanings, customs, or traditions that may distinguish their reaction to future changes (i.e. technological development). For example, some Native Hawaiians opposed a local geothermal energy development partly due to their belief that it threatens the fire goddess Pele (Edelstein and Kleese, 1995).[20] Another example includes opposition to the MacKenzie Valley Pipeline in Canada by some Indigenous people because it may have disrupted traditional harvesting practices (Gamble, 1978).
- *Social systems*. Social systems (or social capital) generally refer to the degree of connectivity among people; and the quality and quantity of social relations possessed by a population (Harpham et al., 2002). Bourdieu (1983) defines social systems as "the network of relationships (that) are the investment strategies, individual or collective, consciously or unconsciously aimed at establishing or reproducing social relationships that are directly usable in the short or long term" (p.249). Impacts to social systems can occur as interest groups mobilize their resources in an attempt to promote or oppose a development. For example, residents in an Australian community were concerned about a wind farm development proposal partly because they were concerned about maintaining social well-being among residents (Gross, 2007). Social systems are discussed in depth in the following chapter on community and risk studies.

[20] In the Hawaiian religion, Pele is the goddess of fire, lightning and volcanoes (Edelstein and Kleese, 1995).

- *Biophysical and health systems*. Alteration of the physical environment to take advantage of future conditions and developments may have significant effects on nearby communities. Examples of alterations can include the deployment of technology, development of transportation systems, storage of hazardous materials, or renovations of facilities. There are many examples of biophysical or health risks as many energy or technological developments pose a hazard to local populations. For example, communities in California perceived storing carbon dioxide as a risk to their water systems and health (Wong-Parodi and Ray, 2009).
- *Psychological Systems*. The contentiousness of a development or its perceived threat to the local way of life can negatively impact the psychological health of local community members (Gramling and Freudenberg, 1992). For instance, possible risks from incoming technological projects can cause stress and anxiety among community members that pervades their day-to-day existence. For example, residents living near the Three Mile Island nuclear power plant were shown to exhibit high levels of emotional and physical stress (Collins et al., 1983; Baum et al, 1983).
- *Economic Systems*. Economic opportunities and detriments can both be outcomes of technological development. Opportunities could include increased jobs, business revenue or tourism. Negative aspects could include a decrease in real estate values. Undesirable developments can also stigmatize the community (in the eyes of the community members or outside populations). Likewise a development may be opposed if it could potentially detract from future economic development. For example, winegrowers and representatives of the tourism industry in Laguedoc- Roussillon, France formed a coalition against a wind energy development proposal for the region (Joubert et al.,

2007). Winegrowers were concerned that the wind development would give an "industrial" image to the territory and lower wine sales and the tourism representatives worried that visitors in search of natural authenticity would not visit the region.

Agreement with Broad Policy Objectives and Environmental Values

An important factor relevant to whether a community accepts a new energy technology is whether they view it as matching the broad policy objectives they support (Parfomak, 2008). Regarding energy systems, this can include opinions about what energy systems should be supported or funded and how potential impacts of the energy system are consistent with their environmental values.

- *Environmental Values*. Public attitudes regarding climate change impacts and environmental values will have a direct effect on the acceptance of initiatives to develop low-carbon energy technologies (Stern et al., 1995; Shackley et al., 2004). For example, residents in a community in Vermont, United States, supported local wind farm development primarily because they thought that wind power produces fewer emissions than other sources (Palmer et al., 1997).
- *Broader Policy Objectives*. Stakeholders' views of an energy system or infrastructure and how it coincides with local populations' preferences for a broader policy objective also are a factor in a community's support for the technology. For example a community opposed a proposed coal gasification power plant in Indiana because residents believed investments would be more effectively allocated to energy efficiency initiatives and development of renewable resources (Parformak, 2008). Another example is of the opposition of a proposed Liquefied Natural Gas terminal because it would encourage the

dependence on foreign fossil fuel supplies (Parformak, 2008). The project must fit within the perceptions of energy system preferences.

Based on the discussion of communities and risk to 'locally affected' populations, there is a greater possibility of acceptance in an area where: 1) regulators and developers are trusted and transparent in their decision making (Frewer, 2004); 2) there has been fairness and justice in the decision making process, outcomes and information (Besley, 2010); 3) the credibility of developers and industry is high (Slovic et al., 2010); 4) the perceived benefits to the communities outweigh minimal costs (Kunreuther and Easterling, 1990); and 5) where the proposed project is consistent with their broader policy objectives and environmental values (Parformak, 2008).

Perceptions of Carbon Capture and Storage

The following section includes a review of research on public perceptions of carbon capture and storage. I begin with a review of research that has been completed in Canada. Most social research on CCS has focused on broader populations (e.g. Canada). Less research has focused on the perceptions of locally affected populations. Research on broader Canadian populations will provide initial context for this research study. The second part of this section will review global research (i.e. outside of Canada) focusing on how locally affected populations view CCS. I conclude by situating the research in this project among other projects completed around the globe and discuss how my work addresses the dearth of research about CCS perceptions among those most affected by the technology.

Perceptions and Knowledge of CCS in Canada

There has been relatively little published research on perceptions of CCS in Canada. Three studies[21] that have examined CCS in Canada include Sharp (2005), Boyd and Einsiedel (2011) and a commissioned study by the ecoENERGY Carbon Capture and Storage Task Force (Ipsos-Reid, 2007). These studies are discussed here to provide a baseline of data on the larger public.

The study by Sharp (2005) indicated that only 10.5 % of Canadians had heard of CCS. However by 2007, approximately 31% of respondents expressed at least some awareness of CCS (Ipsos-Reid, 2007). In 2010, results of a third national survey indicated that 39% of respondents expressed familiarity with CCS (Boyd and Einsiedel, 2011). In 2005, only 5.6% of Canadians could correctly identify what problem the technology addressed. This increased to14% in 2007. Those who were at least somewhat aware of CCS were nearly twice as likely to support it (Sharp, 2005). In Sharp's (2005) survey, respondents were provided with 10 statements about CCS (5 positive and 5 negative). Respondents moderately agreed with the statement "one reason why this technology is good is that it can be a bridging technology to achieve short-term reductions in GHG emissions while we develop other long-term alternatives." Other statements respondents slightly agreed with were that CCS could "increase oil production," "may reduce GHGs faster and cheaper than alternatives," and "allows continued production and use of fossil fuels" (Sharp, 2005). In general, respondents were most concerned about the unknown future effects of CCS. They were also mildly concerned that there was a risk of leakage, contamination of groundwater and a risk to plants and animals. With regard to government support, 42% of respondents stated that the government should provide financial support for CCS, while a third

[21] A number of industries and universities have completed or are currently developing and administering public opinion surveys on CCS, however they are not yet publicly available.

(34%) said that the private sector should be left to develop this technology (Boyd and Einsiedel, 2011).

Affected Populations and CCS

Broader public views on CCS may vary from locally affected populations as the risks of CCS are more concrete and have a larger potential to impact residents nearby (Parformak, 2008, p.23):

> An additional challenge is that of engaging the public in the topic of CCS when the issues are generic and abstract — yet, as the history of facility siting has shown, this situation is likely to change when the issues become immediate and close to home....

Research on populations affected by CCS has been completed in a number of countries or regions, including the United States (Wong-Parodi and Ray, 2009; de Figueirdo, 2000; Bradbury et al., 2009), the UK (Shackley et al., 2006), Europe (Oltra et al., 2012), Germany (Dutschke, 2011), Australia (Anderson et al., 2012; Ashworth et al., 2010), and the Netherlands (Huijts et al., 2007; Brunsting et al., 2011; Terwel et al., 2012). Additional studies pose hypothetical questions about how people would be potentially affected by CCS (Ha-Duong et al., 2009; Miller et al., 2007; World Resources Institute, 2006; Krause et al., 2012). These studies found that many participants responded negatively to potential CCS development in their area. For example studies in California demonstrated that respondents were not supportive of a CCS site nearby (Wong-Parodi and Ray, 2009). A survey of those living near a proposed site in the Netherlands demonstrated that people "judge the idea of storage in general as slightly positive, but when the technology enters people's daily lives, as in storage nearby, the attitude becomes more negative (Huijts et al., 2007, p.2788)." A 2007 survey of French residents suggested that

approximately 40% "would be afraid if CCS was to be used near their community" (Miller et al., 2007).

The majority of these studies report that the risks defined by the community were both technical and social in nature, but social risks related to CCS development were of greater concern (Bradbury et al., 2009; Shakley et al., 2005; Wong-Parodi and Ray, 2009). The remainder of this section discusses both the technical and social factors that concerned communities in the preceding studies including: 1) technical risks; 2) community history with local industries and environmental harms; 3) risk to community; 4) overall views of CCS and broader policy concerns; 5) public confidence in industry and government; and 6) views on how CCS would affect the environment.

Technical risks included concern about the quality of expert knowledge (Wong-Parodi and Ray, 2009; Bradbury et al., 2009; Shakley et al., 2005), catastrophic leaks (Shackley et al., 2005) or induced seismicity (Wong-Parodi and Ray, 2009). A report issued by the National Commission on Energy Policy (2006, p.6) states: "public opposition remains inextricably intertwined with local concerns, including environmental and ecosystem impacts as well as, in some cases, complex issues of property rights and competing land uses." In the Netherlands participants of a survey were concerned about the possible personal health impacts of CCS. CCS was more supported if storage sites were to be placed outside urban areas. The desire to locate the project at a remote site was an important factor to UK participants as well (Shackely et al., 2005). In 2006 the World Resources Institute simulated a public hearing about a proposed CCS site and found that the community members did not want to be 'guinea pigs.' Overall sentiment among these participants was that the potential risks of CCS outweighed the potential

benefits. Participants in the UK study also were concerned about the experimental nature of the project (Shackley et al., 2005).

A community's history with local industries and its experience with past environmental harms also are a consistent factor in existing research on perceptions of CCS and willingness to host a site (Wong-Parodi and Ray, 2009). In the California study of CCS, residents had previous negative experiences with industry (not related to CCS) and this affected their views about additional industry development (Wong-Parodi and Ray, 2009). Residents likened the possible impacts of the CCS project with the past perceived inequities related to other developments. As such locals were concerned that the new developers would also fail to consider or address their concerns about potential risks from CCS, because past developers in the area did not adequately address community concerns.

Participants across existing CCS studies were concerned about who holds the benefits and who bears the risks of development. Participants in the UK suggested that any local community that accepted a CCS project should also incur some benefits from that development (Shackely et al., 2005). Residents in Spain (Hontomin CCS project) and in Germany (Ketzin CCS project) felt their community would benefit from attracting national and international visitors to the region (Oltra et al., 2012). Research from the Netherlands has demonstrated that CCS host community compensation may help reduce feelings of inequality and unfairness associated with CCS (ter Mors et al., 2012). Furthermore, participants in California wanted to know what benefits they would receive from the CCS development, including new jobs or better school buildings if there were to serve as host sites. Participants from Texas were focused on how they might receive a portion of the economic profit from EOR (Bradbury et al., 2009). Risks to the community include negative impacts such as decrease in tourism (de Figueirdo,

2000; Oltra, 2012) or increased traffic and possible decreased property value (Wong-Parodi and Ray, 2009; Shackley et al., 2005; Oltra et al., 2012; Terwel et al., 2012). Research in Alberta demonstrates that people in areas that are geologically suitable to CO_2 storage may be concerned that they will become 'dumping grounds' for industry (Einsiedel et al., 2013). Risks of projects often were specific to location. For example those in Hawaii were concerned about possible CO_2 contamination that would affect aquaculture and fishing businesses or tourism (de Figueirdo, 2000). The recognition that local context differs among sites as it relates to perceptions of CCS provides credence to the local approach taken in this study.

Existing research on CCS also demonstrates that perceptions can be influenced by public views about 'bigger picture' policy and environmental issues. Research by Shackley et al. (2004) found that support for a CCS project depends upon residents' concerns about anthropogenic climate change and the recognition of a need to reduce CO_2 emissions. Furthermore, de Figueirdo (2000) demonstrates that those living near a CCS research site may oppose the technology because they believe that it will not reduce CO_2 or that it is the wrong method for reducing GHG. Hawaiian residents stated that resources put towards CCS should be spent elsewhere (i.e. energy efficiency and renewables) and that CCS would just further reliance on fossil fuels. Results from a large group consultation in Alberta indicated that many participants recognized the reliance of the Western provinces[22] on coal-fired power plants for electricity production and the need for CCS as a bridging technology. However, participants also recognized the need for a suite of solutions, including efficiency and the development of renewable resources, to reduce climate change (Einsiedel et al., 2013). Participants in the UK

[22] The Western provinces that rely on coal-fired power plants for electricity production include Alberta and Saskatchewan (Government of Alberta, 2011).

recognized the potential of Underground Coal Gasification (UCG) (another form of CCS) as a secure source of energy for the future (Shackley et al., 2005). UK participants indicated that UCG could cut the costs of importing fossil fuels from less secure areas of the world and avoid UK power supply being subject to foreign political or economic fluctuations (Shackley et al., 2005). Furthermore, European researchers have found that the local debate around a CO_2 storage project may be influenced by broader issues such as the existing policy support for CCS, potential conflicts between CCS and renewable energy, the cost of CCS, and the debate around the perpetuation of the coal industry (Oltra et al., 2012).

Residents in Hawaii were concerned about possible environmental contamination potentially harming their way of life and culture. As de Figueirdo (2000) observed: "Another reason the ocean can be of concern is the Hawaiian culture. Some native Hawaiians feel that outsiders tampering with the ocean are committing acts of sacrilege (p.89)." Research on a proposed sequestration in Hawaii demonstrated that concern for the environment and about Hawaii sovereignty could be factors in support for development (de Figueirdo, 2000).

Trust is consistently cited as one of the most influential factors relating to support for CCS development among community members (Ashworth, 2010). Research in the UK about residents' perceptions of local developments demonstrates the importance of trust in regulators, developers and experts:

> Whether focused on risks to the environment, public health, property values, or other impacts, scientific assessments of potential risks and impacts are often challenged by a lack of trust in both the data and the institutions that develop them. Distrust of regulators, lack of confidence in experts, and the possibility of accidents caused by human error all contribute to a high level of public concern, even in light of low levels of assessed risk. (Schively, 2007, p.228)

Public confidence in industry and government were cited as an important aspect in public acceptance of CCS in California (Wong-Parodi, 2009), New Mexico, and Texas (Bradbury et al., 2009). Participants were especially concerned with surface owner rights, liability and ownership of injected CO_2. In Ohio the concerns related primarily to trust of the government and regulations designed to ensure their safety (Bradbury et al., 2009). In the Netherlands, trust in government appeared to have the largest influence on support for CCS (Terwel and Daamen, 2012) and was more important than trust in environmental NGOs or industry (Huijts et al., 2007).

Researchers comparing four major European projects found that research projects (located in Ketzin, Germany and Hanotomin, Spain) that were led by research institutions were more trusted and accepted than projects proposed by commercial operations (e.g. Barendrecht and Beeskow) (Oltra, 2012). Lack of trust in developers and government (e.g. Shell and the national government) was particularly influential in the opposition of the Barendrecht CCS project (Terwel et al., 2012). In a survey of 811 residents located near the proposed Barendrecht project, more than half of the participants stated they did not trust 'those who would the ultimately decide about the CCS plan' (Terwel et al., 2012). The large majority of survey participants felt that Shell and the National Government had too much influence in decision-making; and ultimately 86% of the respondents felt that the decision-making process about CCS was unfair (Terwel et al., 2012).

Related to trust is the importance of ongoing communication. Participants in California stated they would have more trust in developers if they received further consultation and information about CCS development at regular intervals (Wong-Parodi and Ray, 2009; Shackley et al., 2005). Case study research on the Beeskow CCS project demonstrates that one of the

reasons for local opposition was the perceived lack of information provided to locally affected residents (Dutschke, 2011).

While there has been research on local populations affected by CCS abroad, there has yet to be in depth studies in Canada. Many studies of community views toward CCS also are based largely on hypothetical CCS scenarios (Parfomak, 2008). Little research on CCS (and to a lesser extent, other technologies) discusses sense of place or how people's attachment to the land may be a factor in the development of technology. Sense of place and concern for the environment were mentioned as a factor in the rejection of the CO_2 sequestration project in Hawaii, yet this issue needs to be unpacked further and explored in other local contexts. Local resident empowerment is discussed to a lesser degree in research completed by Wong-Parodi and Ray (2009). In this research I seek to determine the factors that contribute to the support for or opposition to local CCS projects.

Chapter Summary

Understanding how individuals and communities view risk is critical to the deployment of energy technologies. Chapter three provided an overview of two sets of literature including risk perception and communication of risk and more specifically on public opinions on energy sources and technology. The chapter discussed the changing paradigm in which risk perception researchers have begun to shift their focus from examining deliberate, conscious and mechanistic methods of probabilities with regards to risk. The emerging paradigm in risk perception research is one that takes into account the fact that the general public does not always make judgments based solely on the impact and probability of risk. Rather risk "perceptions" of energy systems and other risky developments can depend on a number of factors. Research on CCS and other

energy systems demonstrate that acceptability of new technologies is multifaceted and more complex than just perspectives on the risks and benefits of the technology. Researchers have shifted from purely cognitive approaches of risk perception by integrating approaches that take into account social and cultural dynamics. This newer approach is particularly important to the study of those who live in locally affected areas. Affected residents not only take into account the biophysical hazards associated with a risk, but also other factors such as possible economic loss, the breakdown of social networks, the effect on cultural traditions, the impact on psychological health and stress or the feeling of stigma of being located nearby a potentially problematic project.

Local residents' perceptions of energy systems will also be influenced by a number of participation and development factors. Trust in developers, government and information sources have been shown to directly influence attitudes towards infrastructure and stakeholders. Residents who live near a proposed or current project want confidence in those operating the technology and making decisions or there is likely to be controversy over development. Fairness and justice are also considered to be important factors in the support for or opposition of a development. Research has demonstrated that *procedures* for implementing a project need to be perceived as fair, just and equitable. If the implementation procedure for a project is not perceived as fair, just and equitable, the prospect of local acceptance is decreased and local resistance towards a development is more likely. Residents need to feel that the results (or outcome) of a decision about where and how to develop the project is equitable; that they have had a voice in decision-making process; that decision makers were trustworthy and respectful of their views; and that they received an appropriate amount of information related to a decision.

There have also been a number of examples that have demonstrated that ownership (literal or perceived) has been a factor in community support of energy developments. Existing studies demonstrate that there tends to be less local resistance when community members feel like they have a sense of ownership in a project. This ownership may be a financial interest, an emotional connection to the development, or a sense of pride that the community is a part of the development process and/or its products.

It is important to examine the views of communities where a proposed or current CCS project is located, as past examples have shown that public opinion can be a showstopper for the technology. Similar to other technological developments, research has demonstrated that local communities can be concerned with biophysical risks and human health risks associated with a development. However, residents may also be concerned about any effects to their social or cultural systems (e.g. relationships and traditions). They also may take into account any possible economic gains or losses from a proposed development in the area. It is also clear that a community's history with local industries and trust in developers to implement and monitor the technology safely is a factor in risk perceptions. Perceptions of the technology at a local level are also impacted by individuals' views on climate change, on CCS as a climate change mitigation strategy and broader policy concerns.

This chapter has focused on understanding individual perspectives about risk or technological development. However, it is also critical to understand community perspectives as they represent one important scale at which potential action is likely to impact development. By providing a means to understand collective acceptance or opposition, a community perspective can contribute greatly to advancing our understanding of risk perceptions and the consequent management of risk. I contend that a community perspective will be particularly

important in advancing the development of energy technologies in or near communities because the siting of such facilities can be met with collective resistance that stems from community context. I continue and expand this concept in the next chapter on “community and risk studies.”

CHAPTER FOUR: COMMUNITY STUDIES AND RISK

Introduction

Human beings are inherently social animals. We form collectives of individuals tied to each other by common bonds ranging from our base needs (i.e. locality, necessity and interest) to our emotional or cognitive desires (i.e. shared interests, reciprocal relationships, family ties) (Carroll et al., 2006). A great deal of classic research in the social sciences has focused heavily on such groups of individuals while maintaining the belief that their collective functioning—whether the day-to-day actions that uphold their social reality or their response to significant stressors such as hazards—could provide great insight into the evolution of larger society. Subsequent research trajectories in many social science disciplines have since lost some of their reverence (or perhaps romance) for the concept of community (Wilkinson, 1991). Among some researchers, community has been relegated to a methodological consideration (i.e. the use of city limits for sampling); for others it has become a ubiquitous term conjured to emphasize the "localness" of a given concept, project, or effort.

In this chapter I draw on classic and contemporary literature from multiple disciplines to demonstrate how the concept of community can be revitalized in the study of risk and the ways this strategy can advance literature on the subject. Ultimately I argue that a focus on community in risk perception research fills a void concerning the ways social context defines individual and societal trends in risk management. The remainder of this chapter is outlined as follows. First, I concentrate on the diverse views of community and describe four broad approaches in which it has been conceptualized. Second, I discuss how a community perspective can contribute to our understanding of risk perception and the consequent management of risk. Third, I explore how

interactional field theory – an approach that explores both the importance of place and community – can be extended to examine local communities' views of technological developments and how this theory frames the methods and analysis used in this research. Lastly, I focus on how this research study fills a void in the literature regarding how an understanding of community can expand our understanding of risk perceptions.

Overview of the Concept of 'Community' in Risk Research

Regarding the study of risk, the concept of "community" did not receive as much attention or traction as a means for understanding human response to possible negative impacts. Some of this is warranted given that risk is, to some extent, a highly variable characteristic driven by social context (Douglas and Wildavsky, 1983). Yet this acknowledgement does not neglect the social reality of the factors that shape individuals, and thus the ways they conceptualize risk. Certain research traditions continue to demonstrate that risk research which has focused on largely cognitive, individual approaches has failed to account for the significant influence individuals or groups of individuals have upon each other in regards to risk—during its initial conception, in the strategies used to live with it, and in the actions they collectively enact to reduce it (Slovic, 2010). People not only assess risk as a danger to their individual well being, but also for the ways it will affect their social well being; their bonds with the locality they live in and the people who reside in it (Brennan et al., 2009). Those who investigate risk and technology could potentially gain much insight from the concept of community because it describes a scale of human settlement that is situated at the interface of society, technology and the environment (Jakes et al., 1998). When problems emerge, "communities" are often at the front lines in terms of effects, experience and mitigation (Flint and Luloff, 2007; Wilkinson, 1991). In this respect the concept

of community can provide a context for understanding how individuals and groups experience and negotiate risks.

The field of risk communication has a strong concentration in the disciplines of cognitive science and psychology, which both focus primarily on individuals (Lupton, 1999). Risk and behavioral science researchers typically examine individuals' perceptions of risk using strategies such as mental models (Morgan et al., 2002; Atman et al., 1994; Bostrom et al., 1994), cognitive risk perceptions (Slovic, 1987, 1992, 2000; Slovic et al., 1982), or risk rankings (Slovic, 1987; Sjoberg, 2000; Johnson and Tversky, 1983; Kahneman et al., 1982). These examinations of 'risk perceptions,' as discussed in the previous chapter, are a means to partially understand the views of the public on potentially 'risky' events and developments. Much less work has attempted to discuss how these individual perceptions are influenced, reinforced or created by the social networks individuals are a part of. As a result research is needed to better understand how communities perceive and support or oppose nearby technological developments because these factors will ultimately affect the outcome of a decision to implement a technology in a given locale (Freudenburg and Gramling, 1992). More research is also needed to better understand how the siting of new technologies alters community functioning (perceived or actual) in positive or negative ways.

Conceptions of Community

The concept of "community" is used in a variety of contexts when examining groups of individuals that share at least some common characteristics. Its meaning is both complex and continually changing, as evidenced in the variety of definitions attributed to the community concept during the past century. The evolving understanding of human communities is due in

part to the fact that many industrialized societies have transformed from small rural settlements into highly interconnected and urbanized ones; communication technology has made it easy to connect with others and transportation systems allow for greater ease of travel among regions (Meppem, 2000).

The crux of the community concept is defined by multiple and often conflicting perspectives. In this section I draw on classic community literature (including Wilkinson, 1991; Bender, 1978; Galphin, 1918; Tuan, 1977; Bernard, 1973) to describe four broad and often overlapping approaches for conceptualizing community. The three most utilized conceptions include: 1) "community as a geographic area," 2) "community as a local social system," and 3) "community as a type of relationship." A fourth conceptualization, "community as an interactional field," is an extension of rural and natural resource sociology that incorporates elements of the other three conceptions. This final conceptualization, "community as an interactional field," will be the underlying foundation on which this research study is built. I will discuss each of the four categories separately below after a brief overview of early research conceptions for community.

Tonnies' (1957) classic work on community volition is often cited as an origin for modern conceptions of community, including the four conceptualizations I will review below. Tonnies defined two types of volition, *Gemeinschaft* and *Gesellschaft*, that occur simultaneously during social interaction and which ultimately influence both individual behavior and the structure of society, including the emergence of community. *Gemeinschaft* (translated as community) occurs when individuals are drawn to form associations of relationships (i.e. family, friends, town) in order to gain access to resources, bear collective burdens, and form networks of support or interaction. Tonnies believed these relationships were "natural" and unconscious

among individuals—a fundamental part of human nature. Gemeinschaft has often been associated with the pastoral view of agricultural societies, but others (including Tonnies) suggest Gemeinschaft could also occur in a variety of social settings. *Gesellschaft* is the contrast to the "natural" state of Gemeinschaft in which "rational" will, post-industrial economies and bureaucratic governance at larger scales (e.g. nation state, federal government) lead individuals to act in their own self interest. The result is diminished incentive for individuals to form the relationships central to Gemeinschaft. Elements of Gemeinschaft and Gesellschaft are both present in any collection of human actors. As such, they are critical concepts to consider when examining how individuals and groups perceive of a new or future technological development because they form the social context that will influence individual and collective opinion. The following sections will provide examples of how this occurs.

Community as a Geographic Area

Geographic area is an important element in conceptions of community (Wilkinson, 1991; Masuda and Garvin, 2006). One community is often differentiated from other groups of people by defining its member "habitats," locality or area (Hiller, 1941; Cresswell, 2004). The importance of shared collective space among individuals was of early importance to community conceptions, in fact, the term "Gemeinschaft" originated from the German word for the common lands of the community and only later referred to the social aspects of a common life (Wilkinson, 1991). Community as a geographic area extends back to Galphin (1918) who delineated community boundaries based on the prevailing direction of ruts created by wagon wheels turning from the door yards of individual residents in the direction of one settlement or another.

Much economic analysis of community is geographically specific (Loomis et al., 2000). This is particularly true in the case of relatively isolated settlements whose economic means are linked to their physical locations: "People in a given locality share a common fate because they reside in a place having unique advantages and disadvantages as sites for capital investment" (Humphrey et al., 1993, p.172). Examples of such capital investment can include nearby forests, mines, and fossil fuel reserves (Parkins et al., 2001). Thus the geographic dimension of community is important for those who examine the impacts of resource allocation, resource extraction (i.e. resource dependent communities) and economic development or change.

While the conception of community as a geographic area takes into account physical and political boundaries of an area, it fails to meaningfully integrate the relationships among people residing there. A second limitation of this standpoint is that transportation, communications, large-scale organizations and other mechanisms now link people to multiple localities (Haythornthwaite, 2002). Gusfield (1975) once argued that some local territories used to embody a complete and distinctive community. More recently it is recognized that globalization and access to communication technologies increasingly allows people the opportunity to interact with or be influenced by others outside their local geographic community (Lichter and Brown, 2005; Kearney, 1995). The resulting need for new understandings of communities influenced by broader society eventually gave way to the third conceptualization of community—"community as a type of relationship." I will discuss this conception in a later section.

Additional focus on the concept of "place" as a *meaningful* location for human interaction has brought new dimensions to the study of community development (Cresswell, 2004). Place moves beyond conceptualizing community purely by its boundaries; it recognizes that groups of people can self-identify with geographic territory(ies) that are significant to them.

Significant places can also include the people who reside there. Place studies and the role of place in society have been reflected in anthropology, education, environmental psychology, geography, history, human health, native studies, philosophy, recreation, and sociology disciplines (Cresswell, 2004).

The significance of place to human existence has been recognized since early human history. Yet place, just like community, has been conceptualized in many ways. Aristotle described place as the inner surface that "marks the beginning of the outside world…it is the first thing that [a person] is" (Morison, 2002, p.142). Much later geographer Yi-Fu Tuan (1977) acknowledged that 'place' is more than a geographic territory; there was a universal biological, psychological, social, and spiritual human need for place. Gieryn and colleagues (2000) suggest that there is a need for case studies that define place and what it means to inhabitants, including how it facilitates the creation or maintenance of community. Select research discusses how peoples' ties to a given geographical area are a pervasive factor of social life that deserves consideration when managing risks (see for example Flint and Luloff, 2005; Beckley et al., 2002), but these studies remain the minority. This is especially true when determining how developments near a community (a geographic dimension) will be perceived by residents.

Community as a Local Social System

Those who conceive of "community as a local social system" concentrate on the interrelationships and interdependencies among people and social institutions (Lee and Carroll, 1991). This conception goes beyond examining a specific territory and focuses on the informal and formal interactions among people for goods, services and amenities (Falk and Kilpatrick, 2000). What "community as a local social system" *does not* recognize are the emotional

attachments people share with one another and the relationships among people in a place that has shared meaning (Bender, 1978). This view links to human volition through "Gemeinschaft" (community), as people form the associations needed to gain access to resources and develop networks of support and interaction.

"Community as a local social system" has been adopted by researchers who focus more on rural (as opposed to urban) communities because interdependencies in these settings tend to be more informal, visible, and personal among people (Brennan et al., 2009). Interrelationships can often extend beyond the boundaries of individual towns or settlements and towards regional areas, as one community must rely on another to supplement what the other lacks and vice versa (Shortall, 2004). This includes both horizontal linkages (i.e. within the community) and vertical linkages (external among the region) to broader social systems. A "micro-region" is created when individual communities consider other social groups while planning for goals and implementing programs (Shortall, 2004). Institutional cooperation and interdependence are important, especially amongst rural communities, because these interrelationships and micro-regions create strength and vitality for an area (Baker, 1990). A report by the Wilderness Society (1992) claims that "individual communities are not well equipped to address the multiple obstacles to economic development and diversification. Conversely, when small communities… begin to work together… important benefits accrue (p.17)."

The local social system provides a number of relevant functions for members of the community including: the production-distribution-consumption of goods and services, socialization, social control, social participation and mutual support (Lee and Carrol, 1991). It is most often necessary for individuals of a community to obtain (and distribute) goods and services from those outside the geographic area. The system also provides a way to ensure

socialization through the creation of shared norms and practices (i.e. provides an individual with the skills necessary to participate within their own society by inheriting customs and ideologies) (Stedman and Heberlein, 2001). Shared norms and practices in turn enable the mechanisms for social control, including ideas about how elements and individuals within the local social system (which is thus reified) should behave. These processes regulate individual and group behaviors (Falk and Kilpatrick, 2000). A functioning social system creates a method of social participation, which includes participation in political activities and social activities. Lastly, social systems can engender mutual support, including support for common goals or action (Flint et al., 2010). All these services function to define and maintain the social reality of community members and form the foundation of social context that is often casually mentioned in studies of risk. Much more effort, conceptualization and theory could be developed to provide detailed understandings of how specific elements of this social context influence risk perception.

Another advantage of using the "community as a local social system" approach in research is that it may go beyond the boundaries of one locale to describe a regional area (Lee and Carroll, 1991). The concept is important when examining local interactions with outside communities, particularly critical when people go outside of their local borders, but do not have mass communication and transportation methods that allow for ease of interaction. Limitations to this conceptualization include the omission of human relationships and the bonds shared amongst members. This limitation is remedied in the next conceptualization of "community as a type of relationship."

Community as a Type of Relationship

Bender (1978) contends that community can take many structural forms, but in any context it consists of "a network of social relations marked by mutuality and emotional bonds (p.7)." Proponents of this conception for community state that territorially based interaction represents only one idea of community, a pattern that is becoming less and less prominent in North American history (Crowe, 2010). Instead there is a need to look both inside and outside geographic boundaries, beyond system dimensions, in an attempt to understand community dynamics and consequences of events for communities. According to Wilkinson (1991), communities should be sought, not necessarily just in places, but in intimate networks, wherever these occur. Wellman (1979) expresses a similar sentiment in "The Community Question" by discussing the survival of primary ties in modern society and the need to look beyond localities for relationships. Webber (1964) argues in his essay on "community without propinquity" that outside networks can provide an escape from the bondage of local territory and can free people so that "their ties are not encapsulated in 'decoupled' little worlds" (p. 1202). To those of the "community as a type of relationship" perspective, community occurs when it is both recognized and responded to emotionally as a 'mutual sense of belonging.' This requires that recognition of "community ties" be shared amongst members, creating the basis for in-group, out-group dynamics that are central tenants of many sociological studies. Some proponents of this concept affirm that community serves as "communion" (Nisbet, 1953), whereby interaction among people enables them to build communities and commit themselves to each other (Frazer, 1999).

The advantage of the "community as a type of relationship" conceptualization is that it demonstrates the importance of human interaction. It can advance community beyond the idea of a geographic territory or a need for other people. The fact that this perspective rejects the

importance of geography is also a major limitation. In reality most people will live and have most of their interaction in local settlements (Wilkinson, 1991). Bernard (1973) states that:

> At the local community level there is confrontation, visual if not tactile, emotional if not intellectual. People still live next door to others, they eat, sleep, love, hate, avoid, or seek one another in a given locale. Whether or not they have much to do with their neighbors, they use the same grocery store or supermarket, attend the same movie houses, and patronize the same beauty parlors or barber shops. Owners or renters, they depend on the same community services such as, humble as they may be, garbage collection, street cleaning, and police protection. However emancipated from spatial barriers and however independent of locale the elite may be, it is still on the community scene that for most human beings interaction takes place. These phenomena cannot be just read out of the discipline. (p.187)

Community as an Interactional Field

The concept of community as an interactional field was introduced by the rural sociologist Harold Kaufman (1959) and expanded by Kenneth Wilkinson (1970). The two used the perspective to understand how communities respond to disruptions in natural resources (Kaufman, 1959; Kaufman and Wilkinson, 1967; Wilkinson, 1970; 1986; 1991). "Community as an interactional field" melds together aspects of the three conceptions of community described above by contending that community *emerges* from communication and interaction among people who care about each other and the place they live (Flint and Luloff, 2005). People in a locality "are tied to a place by their shared values, concerns, interests, and actions (Flint et al., 2008, p.528)." Thus *community* is both rooted in a specific locale *and* involves relationships amongst the community members. Likewise a specific locale is both geographic and defined by the relationships local people have with their environmental or social settings (i.e. "place"). Wilkinson's (1991) conceptualization is best understood as a process that is: 1) created by various social actors who interact frequently across interest lines to solve common problems, 2) rooted in a particular locale that social actors imbue with meaning, and 3) defined by various

social networks and interpersonal relationships that are agreed upon and valued by participants (Flint et al., 2010). These three key elements shape the framing of the analysis and results and are discussed further in the proceeding methodology chapter.

According to the interactional field theory, local citizens who share a common space, way of life and networks are able to overcome differences and special interests to recognize a common issue (Brennan et al., 2009). Wilkinson (1991) called this recognition the "emergence of a community field" and is the basis for the mobilization of collective resources (i.e. action) in regards to disturbance or change in a given area. This perspective can be used to better understand a collective community risk perspective. Such collective risk perceptions are a generally overlooked aspect of risk perception research or hazard management. Yet it remains an important aspect for managers to take into account when implementing technological infrastructure in an area because it can determine whether and to what extent communities will support or oppose development in the future. For example, research on the opposition to waste disposal sites demonstrates that it is critical to understand the complex interactions among individuals and groups in a community to understand the success of siting these developments (Walsh et al., 1993). Collective risk perceptions are further discussed later in the chapter.

In summary, the field of risk can greatly benefit from taking into account the preceding conceptions of community when examining the perceptions, acceptance and consequent management of technological development. Each concept of community has advantages and limitations, most of which depend on the context, area and goal of a study. For the purposes of studying how affected individuals or groups perceive a technological development in a given area, the final concept "community as an interactional field" is likely most constructive. This is because development will be located in a specific geographic area and there is the possibility for

collective perceptions among a group of people. The concept further allows for the influence of other community factors (i.e. the importance of human relationships, social system components, and emotional ties) when they are present among a given collection of individuals.

Community, Risk Perception and Management

Though it is necessary to understand individual perspectives about risk or technological development, community perspectives represent the scale at which potential community action is likely to impact development. In this section I discuss how the concept of "place attachment" factors into local perceptions of risk. I then discuss the need to reexamine the "not-in-my-backyard" phenomenon in a way that better recognizes the relationships among people in a given area and how those relationships influence their reactions to risk or technological development.

Sense of Place and Place Attachment

Place attachment or sense of place refers to the positive affective bonds that people develop with geographic locations (Hidalgo and Hernandez, 2001). People with place attachment or sense of place experience a sense of belonging to their geographic territory or the people that live there and thus have a vested interest in maintaining the local environment (social and ecological) (Tuan, 1977; Altman and Low, 1992). "Place attachment" reinforces and reflects the social construction of risk in the local environment and can be seen as central to the process by which people select and interpret risks such as those associated with technological developments (Masuda and Garvin, 2006).

Sense of place or place attachment is therefore concerned with the physical setting, human activities that occur there, and the social and psychological processes that are rooted in a

territory (Brandenburg and Carroll, 1995). Two social constructs influence the development of sense of place. These include: 1) the biophysical setting and residents' experience or history in that setting; and 2) the social relationships or culture that have developed and persisted in that place.

Role of Setting and Experience - Relph (2007) describes sense of place as the ability to grasp and appreciate the distinctive qualities of places. Characteristics of the physical environment may influence sense of place by acting as a basis of meanings, which in turn affects attachment and satisfaction (Stedman, 2003). The "quality" of the natural environment, the recreational experiences it affords and the presence of "wilderness" often play a significant role in the process of place attachment (Sebba, 1991). These factors can also be linked to economic growth for area residents (e.g. tourism in the provincial parks increases business in surrounding communities) (Wiggins and Proctor, 2001).

Role of Social Relationships - Researchers such as Marcus (1992) and Pellow (1992) suggest that social relationships are a significant contributor to the meaning people ascribe to places. As Altman and Low (1992) describe: "attachment to places may be based on or incorporate other people – family, friends, community, and even a culture" (p. 7). Places can both foster relationships and become symbols that represent the social experiences and relationships people share there. Thus, places become important to people by serving as the repositories or settings for the human interaction, memories and emotions people experience (Brehm, 2007). Many scholars contend that place is both influenced by and is the basis for a person's culture, including the way groups reproduce themselves (Brandenburg and Carroll,

1995; Rotenberg, 1993). The shared experiences, meanings, and collective memories of a culture form the framework for the development of sense of place (Riley, 1992; Shamai, 1991).

Place attachments involve psychological processes that "normally reflect the behavioral, cognitive, and emotional embeddedness individuals experience in their socio-physical environments" (Brown and Perkins, 1992, p. 279). Disruptions to place attachment can be caused by natural disasters, human-induced hazards or other development stressors (e.g. economic downturn, new development). When disruptions occur, they alter people-place relationships and the emotional or psychological connections behind them, often greatly impacting the greater functioning of community (Hidalgo and Hernandez, 2001). As mentioned previously, disruptions that threaten areas to which people are attached (or have where they have strong sense of place) will often result in collective action to mitigate such changes—whether the restoration of an environment or the opposition of a technological development (Brown and Raymond, 2007). Individuals struggling in the wake of disruptions can lose their ability to relate to and connect with one another, breaking the bonds that serve an important role in community maintenance (Brown and Perkins, 1992). In a recent CCS risk perception review paper, Mahon (2012) indicates that examining the role of place is particularly useful in understanding why publics in some locations respond to CCS in a way quantitative socio-economic data would not predict. When it comes to the opposition to a CCS project, it may not necessarily be the physical space that will be contested and the basis for concern but rather, the meanings that are attached to that space (Mabon, 2012). The dissertation presented here addresses these questions by examining the role of place in CCS risk perceptions.

Critique of the "Not-in-my-backyard" Phenomenon

Technological development often employs a utilitarian perspective by focusing on the broader impact to "society at large" (Brion, 1991). This may be the case with energy infrastructures such as carbon capture and storage as the largest benefit is to the nation or international community struggling with a global phenomenon (i.e. global climate change). While the benefits of CCS are focused on the broader society, this may be incompatible with the reality of those affected by its physical implementation in particular places or communities.

Proponents of the not-in-my-backyard (NIMBY) or locally unwanted land use (LULU) paradigm, suggest that local populations most often will not support a technological risk in their locality (Schively, 2007; Burningham et al., 2006). NIMBYs have been defined as "residents who want to protect their turf" (Dear, 1992). More formally, NIMBY refers to the protectionist attitudes of and oppositional tactics adopted by community groups facing an unwelcomed development in their neighborhood (Dear, 1992). The concept has been analyzed in cases of infrastructure facilities (e.g. the siting of nuclear power plants, offshore oil drilling, roads, etc.) and of social facilities (e.g. mental health care housing, nursing homes, etc.) (Wolsink, 2006).

Individual communities and their members may feel they have to bear an inequitable and undesirable burden for society when technological developments are built near their homes (Popper, 1985). This mindset can be the basis for collective opposition of such development. This has resulted in one common belief that those who are resisting the development are being parochial, irrational and selfish (Mazmanian and Morell, 1990). Others may argue that imposing risks on some (often those with fewer monetary resources or political power) for the advancement of broader society echoes historical patterns of hegemony throughout history (Gaventa, 1980; Lukes, 2005).

A number of academics have critiqued the NIMBY concept (see Devine-Wright, 2010). Devine-Wright (2005; 2009) recommends abandoning the concept altogether because: 1) it is a label that is used to discredit often well-founded objections by local residents (Burningham, 2000; Wolsink, 2006); 2) it is a simplistic description of very complex positions of support or objection (Ellis et al., 2007); 3) the concept does not account for cases that find positive views toward technology among people who live close to risks (Jones and Eiser, 2009); 4) it has led to a literature focused on objection and has neglected to explain supportive or neutral forms of response (Burningham et al., 2006; Ellis et al., 2007); and 5) research on NIMBY behavior often implicates the importance of *individual* (instead of group) conceptions for health concerns and property, or what roles local residents play in fostering opposition to facilities and developments (Steelman and Carmin, 1998).

These perspectives demonstrate that the NIMBY concept is not complete unless the concept explains when or under what conditions it manifests itself. Furthermore, local opposition is frequently influenced by shared community interests such as the preservation of social, cultural, or natural resources (Steelman and Carmin, 1998). Instead of presuming that people act solely with regard to their own interest, researchers suggest that it is important to recognize the influence of social context, cultural norms, and collective concerns on action (Mansbridge, 1990, Axelrod, 1986). The broader conceptualization of a community perspective provides a useful link between individual perceptions of risk and the ways those perceptions form the basis for broader social realities.

Community Perceptions and Agency

As described above, place attachment and community bonds are critical to understanding how those affected by the implementation of energy systems (or other "risky" developments) view and perceive the risks and benefits of those developments. This section introduces "community agency," "community risk perceptions" and describes how interactional field theory will be utilized to frame this research.

"Community agency" is a critical concept for the study of risk and technology because it helps describe the capacity for *action*, be it opposition to or support for future development. Similar and related terms include "community capacity" or "community capital."[23] Community agency refers to the coming together of people in a local community to address local needs. Flint and colleagues (2008) describe this "coming together" as the act of community, and focus on the ways the community makes choices as a result of the diversity within that group of individuals.

> Communities make choices and act on them. Knowing how these choices are made, what and how perceptions of local issues are constructed, and the ability of members of such communities to access and process information are essential elements in the utilization of economic, social, and natural resource endowments. (Flint et al., 2008, p.529)

Interactions among residents are vital in the manifestation of a shared risk perception – particularly the interactions that embody and express mutual interests in a local population (Wilkinson, 1991). Risk perceptions are partially shaped by the interactions and interrelationships people have with one another (Wildavsky, 1978). Social interactions among residents provide a source of community identity and provide the means to identify a collective

[23] The terms 'community capital' and 'social capital' are often unclear. To clarify these terms, I utilize the definition of community capital used by Callaghan and Colton (2008) and the definition of social capital by Bourdieu (1983). The term 'community capital' refers to the resources or various types of capital stock which community stakeholders contribute to and rely upon (Callaghan and Colton, 2008). Community capital takes into account: environmental capital, human capital, cultural capital and social capital. Social Capital refers to the degree of connectivity and the quality and quantity of social relations possessed by a population (Bourdieu, 1983).

risk. The process by which residents develop a shared understanding of risk can be described as "mutual minding" (Mead, 1934). In other words, residents come to understand the perceptions and meanings of others through the use of symbols (e.g. language, images, art). In this case the interactions that residents have with others in their community can reinforce and influence the ongoing development of community perceptions relative to changes in a community, including potential risks. This occurs through the sharing of experience, concern about well-being of community members or shared norms and values. This process stems from Mead's (1934) position that all social interactions involve shared meanings and an exchange of perceptions. Interactions and communications about "risky" technological developments such as CCS are one example of this process.

Community members are more likely to oppose[24] development or create policies that regulate development action when they perceive a risk to their collective community. This can be described as "community risk perception." A framework created by Flint and Luloff (2005) suggests that community action is influenced by: (1) a community's biophysical and socioeconomic risk context; (2) shared community perception or social construction of risk; and (3) the capacity to work together on community issues and problems. Their framework implies that a necessary precondition of community action, or a reinforcement of that action is the development of shared perceptions that motivate them to work together in pursuit of a common goal.

---

[24] In other CCS work, particularly research from the Netherlands, the term 'protest' is often used to discuss or examine community actions or 'NIMBY sentiments' (Terwel et al., 2012).

Examining Risk Perceptions from an Interactional Field Perspective

An examination of how *place* and *community* influence collective risk perceptions can increase our understanding of the reasons behind support for or opposition to technological developments. As discussed in the previous section, approaching research utilizing an interactional field theory approach to community means taking into account the importance of community, including social interactions, and the significance of place.

Flint et al (2010) contend that researchers who employ interactional field theory focus their efforts at a community (or regional) level of analysis. These units of analysis facilitate understanding of the intersections between society and the environment and individuals and society (Flint et al, 2010). The importance of community and place has recently been examined in the context of wildfire (Paveglio et al., 2009; 2010; Kyle et al., 2010) and forest disturbance (Flint, 2006; Flint and Luloff, 2007; Parkins and MacKendrick, 2007). These studies explored how communities are affected by ecosystem changes and how local residents perceive a risk to their community in the face of change and disturbance. Flint and Luloff (2005) utilized a mixed method (surveys and interviews) approach to examine community risk perceptions. They concluded that there are 'community risk perceptions' (discussed in the previous section) and that local response to changing landscape conditions are important to consider when making decisions about land use and local management (in this case bark beetle). A 'community risk perception' refers to a perceived risk to a group of people and the place they reside in and care for. The difference between a 'shared' (or collective) and an 'individual' perspective is that a shared perspective goes beyond just the perception of a risk to oneself. Rather it focuses on the risk to community and place.

Chapter Summary

In this chapter I have argued how a revitalized conception of and focus on *community* can advance the study of risk perceptions. Much of this discussion is related to the construction and perception of risks and benefits associated with technological development, but it could apply to other conceptions of risk as well (e.g. natural hazards, health concerns, etc.). An expanded focus on the concept of community in risk research provides a lens through which to better understand the social context that is reciprocally shaped and influenced by the perceptions of individuals (Brennan et al., 2009). As such, conceptual development of community for risk studies provides a bridge between the well established research on individual, cognitive approaches to such perceptions and broader societal trends regarding support or opposition to technological developments.

I have argued that understanding how people collectively perceive threats to wellbeing is best approached using interactional field theory and the concept of community. This perspective involves a locality, a local society and a process of locally oriented interactions (Wilkinson, 1991). It encompasses the resources community members have at their disposal, the attachments they form with place and the aggregate abilities they build or utilize while attempting to both sustain and adjust their community functions (Flint et al., 2008). Conflict over development is frequently a geographical issue. Residents use ideologies related to their spatial knowledge and experiences when considering the impacts of technological development (Cresswell, 2004; Tuan, 1977). Likewise, peoples' experiences with place may influence whether they perceive industrial development as a threat or opportunity. For that reason I utilize interactional field theory to structure the research presented in this dissertation.

CHAPTER FIVE: RESEARCH METHODOLOGY

Introduction

The methodology used in this dissertation is designed to explore how local communities perceive carbon capture and storage projects. This research employs case studies and mixed methods – including individual and group interviews, examining community demographic profiles, attendance at community events during my stay in the area and community observations. Participants from three rural Canadian communities with different experiences regarding CCS were selected as part of the research. Communities chosen for study are located in areas with either: 1) an established CCS project; 2) a CCS project that was planned; or 3) no plans for a CCS project. The University of Calgary Conjoint Faculties Research Ethics Board approved this research (#6391) on March 31, 2010.

Interactional field theory is used as the lens to explore residents' perceptions of 'place' and 'community' by uncovering the local factors that influence collective perceptions and how these factors affect the support or opposition of a CCS development in the area. In this chapter I operationalize the research goals and interview questions as guided by this theory. I discuss my research methodology, including interviews with community members and CCS stakeholders, observations and attendance at community meetings or other events during my stay in the area. I also describe the approach used to analyze data collected from the case study areas. The overall goal of this chapter is to provide an overview of the methodology used to examine how residents perceive that a CCS development will (or has) affect(ed) their community and the broader community influences on these perceptions.

This chapter is separated into three main sections. The first section describes the case study method explaining why I utilized case studies for the research and why the three study locations were chosen. The second section describes the methods used to gather data for the analysis, including the reasoning behind stakeholder, individual and group interviews, observations and attendance at key community events. It includes participant recruitment and the structure of the interview questions. The third and final section describes the approaches used to analyze the data. This includes the development of themes and coding.

Research Design

Description and Summary of Case Study Research Design

A case study approach can be defined as "an empirical enquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident" (Scholz and Tietje, 2001, p.13). The communities selected for study in this research are intended to illuminate the decisions and perceptions of locally affected communities regarding CCS. Case study research may contribute to theoretical development by providing insights into location-specific phenomena. Two additional benefits associated with case study approaches are discussed by Orum and colleagues (1991): first, case studies allow for the grounding of observations about perceptions, actions and social structures in natural settings. Second, the procurement of information from a number of sources permits a more complete understanding of the complexities of social networks and social action (Orum et al., 1991). Case studies are particularly useful in the context of this dissertation as I examine perceptions within complex situations and networks.

A case study is often purposively chosen for study based upon characteristics of interest (Scholz and Tietje, 2001). Case studies can include a "bounded system" such as an organization, network or specific place. Three specific locations were sought for this dissertation to examine how locally affected communities with diverse experience regarding CCS perceive the energy technology. There are two main ways to select cases: 1) choosing cases that are representative of the larger population (e.g. interviewing a random selection of residents from Canada to examine the general public's views of CCS); or 2) selecting theoretical, non-random populations based on the specific qualities that they have (Eisenhardt, 1989). In this project I utilize the latter method, given the limited number of communities with CCS experience and because the objective of this study was to examine the views of those who are locally affected by developments. When examining a specific phenomenon it is useful to choose potentially divergent cases in which the decision or interest is "transparently observable" (Pettigrew, 1988). In this instance, choosing case study communities where the experiences of CCS might suggest different contexts for understanding implications for community interactional fields was a primary consideration. Accordingly a multiple case study approach was chosen for this research based on the areas' experience with CCS projects. Insights about residents' perceptions of CCS or energy system development can be obtained by examining differences and similarities between cases.

Positionality of the Researcher

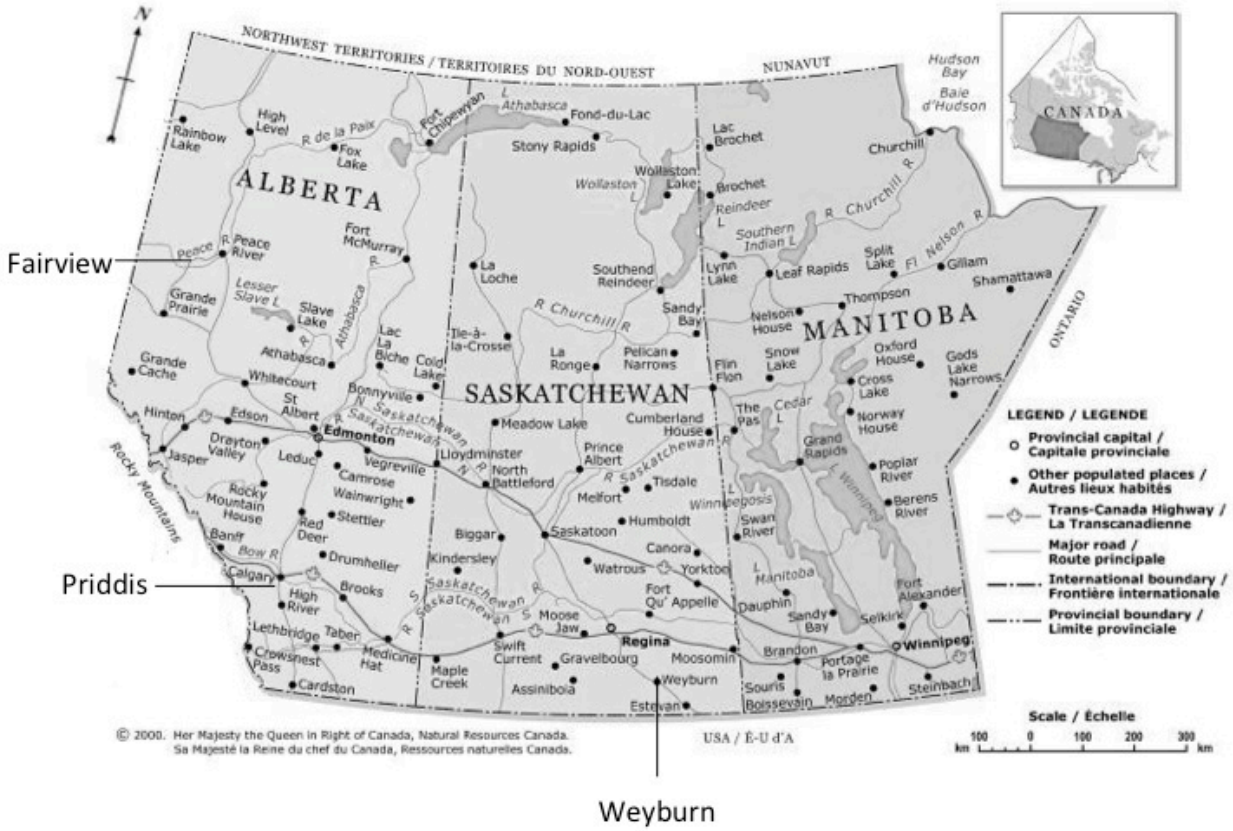
The purpose of this section is to provide a description of my background, particularly any factors that may influence my understanding and views of community and place. My interest in how place and community influences risk perceptions stem from my upbringing on a farm near a small community in Northern Alberta. I was born and raised on a cattle and crop farm and still

spend much of my time in rural Alberta. Our family farm was homesteaded in 1913 by my great-great grandparents. My family still farms and lives on this land. My grandmother is Dane-zaa (First Nation) from the Peace Country of Northern Alberta. My Dane-zaa-Metis heritage and background in farming has fostered an understanding and appreciation of the land. My interest in rural 'community' stems from my upbringing in Northern Alberta in the Municipal District of Fairview. This provided me with an understanding and informed view of rural community. This understanding was particularly useful when I was conducting research in Fairview (the case community where there was no CCS development). This unique identification with the area and community allowed for an understanding of culture and norms. This positioning allowed me to develop nuanced understandings of community and place based experience.

Case Study Selection

I chose to interview community residents in the three communities shown in Images 5.1 based on the status of CCS projects operating near those locations.

Images 5.1. Location of Case Studies



Map Source: Natural Resources Canada

The objective behind the selection of the three case studies is to determine: 1) whether the perceptions of CCS in each community differ, given that projects in each location are at different stages of implementation; and 2) how community members perceived the project will (or has) affect(ed) their community and sense of place and how these factors influence collective perceptions (see Table 5.1). Weyburn, Saskatchewan was selected as a case community because it has an existing carbon injection project. It is also the longest running carbon storage demonstration project in Canada. The Weyburn-Midale CO_2 Project was established in 2000. The company managing the Weyburn-Midale CO_2 Project (Cenovus, formally Encana) holds

regular community meetings regarding the project and it had been met with little community controversy (especially in comparison to projects such as the one that had been proposed for Barendrecht, Netherlands[25]) before 2011. The second location selected was Priddis, Alberta where a University of Calgary CO_2 monitoring project was planned, but was later cancelled. Community members opposed the CO_2 project and it serves as an interesting counterpoint case study to Weyburn. Fairview, Alberta, was selected as a third comparison community for study because it does not have a CCS project planned. This third case community is intended to provide insight into how a community that does not have a carbon injection project perceives CCS and what residents in the area know about CCS. Fairview also was chosen because: 1) the community has had much controversy over energy developments in the area including natural gas extraction, nuclear power, and a hydroelectric project; and 2) I am originally from Fairview and have both contacts and a homestay which decreases the expenses incurred by the project; and 3) there is no proposed or current CCS project in the area. An in-depth discussion of these communities and local energy developments, including CCS, is provided in chapter 6.

Table 5.1. Synopsis of Case Study Locations

	Project Location	**Project Name**	**Date Initiated**	**Date Halted**
Established CCS Project	Weyburn, SK	Weyburn-Midale CO_2 Project	2000	N/A
Planned CCS	Priddis, AB	U of C FGSR	N/A	2011

Project Stage

Completion ↑

[25] The Barendrecht CCS Project was a proposal to store approximately 10 million tonnes of CO_2 over a period of 25 years from Shell's Pernis Oil Refinery in a depleted gas field near the port of Rotterdam, under the town of Barendrecht. Reports from Bellona (2010) indicate that the project was cancelled "due in part to persistent opposition from the local community. This unfortunate outcome shows the extent public reluctance can represent a hurdle to CCS deployment."

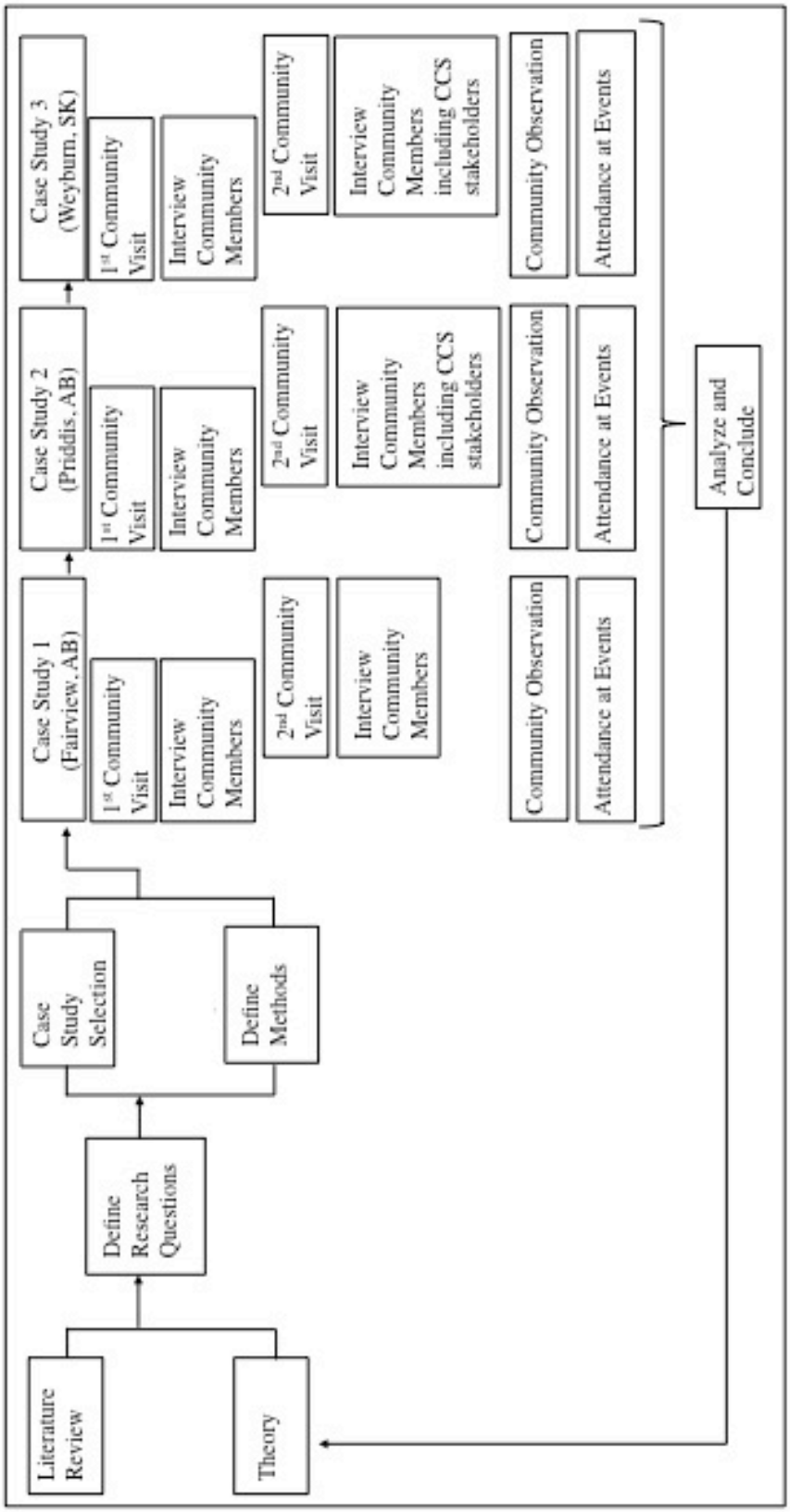
Project but Discontinued				
No CCS Project Currently Planned	Fairview, AB	N/A	N/A	N/A

No Plans

Data Collection

A mixed method approach was used to gather the data in each community. Community members and CCS project stakeholders were interviewed using a semi-structured interview protocol. Questions were modified and added based on observations and interviews. During the interview process I stayed in the communities and attended meetings and gatherings of community members. The following figure (Figure 5.1) illustrates the timeline and design of the research process to better explain the methods used for interviews in each of the three case study sites. Interviews were completed over the course of two visits. The first community visit (a week in duration) was used to introduce myself to members of the community, begin interviews, determine what events and meetings I should attend and recruit participants. All other interviews were completed during a second, longer community visit (three to four weeks in duration). During my community visits I would observe community members by attending events and visiting local residents or stores. I would observe place by walking or driving around the area to get a physical sense of the three locations. I also examined each of the communities' socio-demographic profiles and report them in chapter six. The following section of the chapter describes the process of recruiting, observing networks in each community and interviewing participants.

Figure 5.1. Case Study Research Process and Interviews



Interview Methodology

Face-to-face interviews are an effective method for understanding community and/or individual perspectives towards energy development (Devine-Wright, 2005). This section provides a description of interviews and participants. I also explain how participants were recruited and the geographical boundaries used for participation recruitment. I then discuss the background CCS information provided to the participants, as it was sometimes necessary to provide such descriptions to those who have little or no knowledge of the technology.

Overview of Interviews

Interviews involve the gathering of in-depth data to better understand human behavior and the factors that influence such behavior. The strength of interviewing as a method lies in the ability to explore respondents' subjective interpretations of life events, the personal meaning that they create, and the feelings and cognitions that are involved (Denzin and Lincoln, 1994). Researchers can often acquire a more comprehensive understanding of participant views if respondents are allowed to answer in their 'own voices' through narratives, unconstrained by the limitations of forced-choice answer categories (Banyard and Miller, 1998). Interviews can include general samples of a community or stakeholders with specialized knowledge and experience. This research utilizes participants from both the aforementioned samples to better understand how a community responds to CCS development.

Interviews with Community Members[26] - Interviews with community members are useful when researchers want to understand community patterns more broadly or make preliminary identification of aspects that define a given community or their perspectives. Interviews with community members have provided understanding of developments such as wind turbines (McLaren Loring, 2007) and nuclear power (Pidgeon et al. 2008; Parkhill et al., 2010). In this research I interviewed members of the three case study communities to identify resident perspectives of CCS, how people communicate (e.g. more generally or about CCS and other energy systems), and the underlying social networks of the people who live in the area.

CCS Project Stakeholders - Stakeholder interviews are recognized as a way to tap the views of particular members of a community who have specialized knowledge of an issue (Patton, 1999). Such key informants are often invited based on their experiences, skills and knowledge in the local communities (in this research it was based on their knowledge and experience with CCS projects). They often have access to information and perspectives that researchers do not (Goetz and LeCompte, 1984). Stakeholders are able to provide in-depth comments on the interviewer's questions and clarify emergent views or subsequent findings (Elwyn et al., 2000). Community stakeholder interviews have been used to better understand competing concerns over potential community-based projects such as energy development from wind turbines (see for example Devine-Wright, 2005) or biomass (Upreti, 2004). While one could argue that all community members have a stake in a CCS project, there are some who may be more involved in the

[26] A community member is anyone who lives within the case study area. Additional information on case study borders is located in the participant recruitment section.

approval of or opposition to a project. It is critical to understand the views of those who have had a say in why a project is implemented or opposed (Devine-Wright, 2005).

Priddis project stakeholders included local government officials, individuals who wrote about the project in local media, people who were publicly against the project, and landowners near the proposed project. In Weyburn, specific individuals included those who reported an alleged leak associated with the project, farmers who live on the injection site, and a community relations official for Cenovus. Since there is no CCS project in Fairview, no specific project stakeholders were interviewed in that area.

Beyond the primary semi-structured interview protocol, I tailored additional probing questions based on respondents' answers or particular experiences. For example, those who alleged that there was a CO_2 leak on their property were asked about how they felt the situation was handled, how they thought the risks were communicated and what type of problems they have experienced.

Rationale for Individual and Group Interviews

I originally planned to use group interviews (also called focus groups) to observe interactions between residents about CCS and condense the amount of information that would be collected. However, I soon realized that I needed to use group *and* individual interview combinations. The two main reasons why group interviews could not be the sole data collection method include:

1) Participants were often uncomfortable with discussing controversial or community issues in groups (for more information on this issue see Krueger and Casey, 2009; Morgan, 1996). In small communities, people often know each other and are uncomfortable with saying negative things about their community or work place,

especially when I could not guarantee that participants would not discuss the group interview with others.

2) The smaller population of the rural communities studied make it very difficult to get a group of people together at the same time and place. There is a smaller population to select from in rural areas compared to the larger urban centres. It was also difficult to get a group together during my data collection period (May-November) because of summer events; farmers were busy seeding and harvesting, and many residents were away on summer vacation.

That said, it was also necessary to talk to some groups of people simultaneously (whether it be two people or five). There were some participants who requested to be interviewed with others. For example, Jane and Cameron Kerr, the couple from Weyburn who alleged that CO_2 from the project was leaking and causing harm to their property, wanted to be interviewed together. Interviewing groups was also necessary because of time and budget constraints. Interviews were often lengthy and it took time to get from one interview to another. I also spent 10 to 20 minutes at the beginning and end of each interview establishing rapport and developing relationships.

While researchers often do combine group and individual interviews (Barbour and Kitzinger, 1999) there are some disadvantages to this approach. During group discussions there is social interaction among study participants and concepts and concerns may emerge in focus groups that may not be as likely to occur in one-on-one interview settings. There also is the potential for one participant to influence the opinion of another participant in a group interview. I attempted to mitigate this issue by ensuring that I asked all individuals their thoughts and opinions on each question (rather than only encouraging participants to focus on talking to one-

another as is common in focus groups). To facilitate participant discussion about specific or controversial issues, I would provide my business card (with my address, phone number and email) as advised by Kruger (1994). Participants were encouraged to call me after the interview if they thought of additional responses or if they felt uncomfortable saying something in front of the group.

When determining whether it is beneficial (or possible) to combine the results of group and individual interviews it is necessary to take into account: 1) if the individuals participating in individual interviews are different, in relation to the issue of interest, than those participating in group interviews; 2) if the research goals and questions are similar for both individual and group interviews; and 3) the rationale underpinning the combination of methods (e.g. is it practical or necessary to combine methods) (Lamberta and Loiselle, 2008). A review of the participants and research goals in this study indicate that: 1) there were no major differences among residents participating in the individual and group interviews; 2) the research objectives could be examined using both individual and group interviews and the research questions did not change; and 3) as discussed previously, it was necessary to combine methods in order to collect the data for this dissertation. Therefore it was both beneficial and necessary to combine individual and group interviews in this research study.

Participant Recruitment

A combination of theoretical and snowball sampling was used to select study participants. Theoretical sampling is an approach in which subjects are selected not randomly, but rather on the basis of their knowledge or experience in a particular domain (Lindlof and Taylor 2002). Snowball sampling is a method where participants in the study recommend additional

participants (Biernacki and Waldorf, 1981). This also provided perceived credibility of the research among community members because those living in the area would refer me to others (consequently, I was perceived as less of a stranger). The Internet or phone listings were also used to find initial interview participants. It was important to get a cross-section of respondents in each community with potentially different views about CCS or energy development more generally.[27] Efforts were made to ensure a variety of participants in terms of demographics (age, gender, education), location (rural or urban), and job-type (agriculture, oil industry, government, business, other). Table 5.2 provides a breakdown of the participants' demographics, location and job-type. An in-depth summary of demographic statistics for each community is provided in chapter 6.

Table 5.2. Summary of Participant Demographics, Location and Job-Type

	Priddis	Weyburn	Fairview
Demographics			
Age			
18-29	1	5	5
30-39	3	4	6
40-49	7	8	9
50-59	11	9	10
60-69	10	8	5
70 and over	4	3	6
Unknown*	2	1	3

[27] A cross-section of respondents was ensured by: 1) Maintaining a tally of respondents' demographics and job-type throughout the interview process. If, for example, there were no respondents from the oil industry I would ask participants to identify other residents who worked in the oil industry. 2) I would ask participants to recommend various residents (i.e. not just their close friends). 3) During initial interviews, I recruited from a number of different sources to ensure that participants would be more likely from different social networks (Heckathorn, 2002). 4) Participants were also recruited through a local newspaper advertisement in Fairview and Weyburn (there is no local Priddis newspaper).

Gender[28]			
Male	16	15	20
Female	22	23	24
Education			
No certificate; diploma or degree	2	6	4
High school certificate or equivalent	4	8	10
College; or other non-university certificate or diploma	9	11	14
University certificate or diploma below bachelor level	7	4	4
University certificate; diploma or degree	14	8	10
Unknown	2	1	2
Location**			
Rural	37	16	21
Urban	1	22	23
Job-Type			
Agriculture	3	11	12
Fossil Fuel Industry	6	5	6
Government	1	3	4
Business (Other than Fossil Fuel)	10	7	10
Other	8	12	12

* "Unknown" indicates that the participant did not disclose the requested information.
** Location refers to where the participant lives (not where he or she works).
*** Participants may have had more than one job type (e.g. owned a business and was the mayor of the town). If they had more than one job they were asked which job they spent the majority of their time at.

Although I sought to use similar recruitment methods in each location, the specific context of each community required slight modifications to my methods. For example, participants could be recruited in Fairview through the local newspaper, but there was no local newspaper for the Priddis area[29]. Participants were asked for their opinions regarding the best way to recruit others to interview during the first week of initial interviews in each community. The final methods for recruitment are discussed in Table 5.3.

[28] There were a larger number of female participants in this study. In risk perception studies it is acknowledged that women often perceive hazards as more dangerous than males (Finucane et al., 2000). However, the results of this study demonstrate that there were no major differences between male and female risk perceptions of CCS.
[29] The local newspaper, the Western Wheel, covers the entire M.D. including Okotoks, Black Diamond, Longview, and other towns and hamlets in the area.

Table 5.3. Summary of Recruitment Methods for Communities

Fairview	• Newspaper advertisement in the Fairview Post (See Appendix B) • Newspaper tweets requesting participants (See Appendix B) • Theoretical and snowball sampling
Priddis	• Researchers with the University of Calgary project provided the contact information for CCS project stakeholders • Theoretical and snowball sampling
Weyburn	• Newspaper advertisement in the Weyburn Review (See Appendix C) • Contacts provided during Priddis interviews • Theoretical and snowball sampling

It was critical to define a specific geographic location or identify borders to delineate each case study region. These borders served as a guide to define who was (and was not) interviewed (geographic location is also an important aspect of interactional field theory). The 'Priddis division'[30] of the Municipal District of Foothills was chosen for the Priddis case study region. This area was selected because the proposed University of Calgary carbon storage research project was located in the Priddis division.[31] The Municipal District (M.D.) of Fairview was chosen for the Fairview case study region. The Weyburn case study included two Rural Municipalities (the Rural Municipality of Weyburn and Rural Municipality of Lomond). There are four reasons why two R.M.s were selected for this case study: 1) the carbon injection site is located in the Rural Municipality (R.M.) of Lomond; 2) Weyburn is the area that is most often cited as the location of the carbon injection project (City of Weyburn, 2010); 3) Cenovus and the Petroleum Technology Research Council use the location of Weyburn in their press about CCS (CCS101, 2011); and 4) as discussed in chapter 3, additional effects of CCS projects

[30] A 'division' is a specified section of a Municipal District.
[31] There may have been a few residents who lived on the border of the Priddis division and the Millarville division, as it was difficult to distinguish the exact border.

can include economic and social impacts for local neighboring communities (i.e. R.M.s of Lomond and Weyburn) from nearby projects.

Information Provided During Interviews

Carbon capture and storage is in its infancy and therefore few members of the public have high levels of awareness of the technology, or its risks and benefits. In anticipation that some interview participants may not understand the basics of CCS and to provide greater context, I showed an image and provided a description of CCS to those who were completely unaware of the technology and process. The first question in the CCS section of the semi-structured interview protocol was: "Have you ever heard of carbon capture and storage?"[32] Respondents who had not heard of CCS were provided with the information (see Figure 5.2). The image was pretested during a national online survey to determine if it was clear and people could understand the image (Boyd and Einsiedel, 2011). Two experts – an academic and an industry member – provided input on the description to ensure a balanced depiction of CCS. The following figure (Figure 5.2) includes the illustration and description provided during interviews.

[32] In Weyburn I also asked, "Have you heard of carbon injection?" This was because some participants were unfamiliar with the term "carbon capture and storage" but knew the term "carbon injection." This is discussed further in the results and discussion chapters.

Figure 5.2. Description and Illustration of CCS

Carbon Capture and Storage

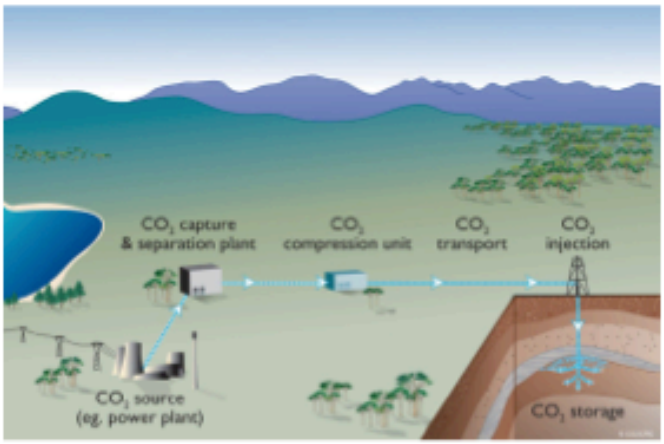


Diagram of Carbon Capture and Storage Technology

Carbon Capture and Storage (CCS) represents a technology that can contribute to decreasing carbon dioxide (CO_2) emissions in the atmosphere. CO_2 emissions can be captured at large industrial sources such as natural gas and coal-fired power plants, oilsands operations, and chemical or manufacturing facilities. This separation process is called CO_2 capture. Once separated, it is compressed and transported to areas where it can be stored permanently in secure, deep underground (geologic) formations. The Canadian government, like many countries in Europe, USA and Australia, has made CCS one of its key strategies to reducing greenhouse gas emissions. The Alberta government has designated $2 billion dollars of support to the technology and industry has also contributed significant finances to enable the development of four large-scale carbon capture and storage projects in Alberta by 2015.* There are still some downfalls associated with the CCS technology, mainly due to the cost of the technology. CCS is currently expensive and therefore not economically viable without significant support from industry and government. There are some risks to CCS development including leakage of CO_2 into the air. But the risks of leakage are low and can be mitigated with proper site selection, measurement, monitoring and verification. Carbon capture and storage can also be used to enhance oil recovery (EOR). For EOR, carbon dioxide is pumped underground to increase pressure and therefore the amount of oil that is extracted from a depleted reservoir. This can be provide economic benefit; however has the downfall of allowing for the continued production and use of fossil fuels, which contribute to greenhouse gas emissions.

* The sentence about government and industry funding to provide support for four large-scale projects was only provided to those residing in Alberta (i.e. Priddis and Fairview).

Interview Questions

Questions that were asked during the interviews were guided by the three primary principles of 'community' (introduced in Chapter 4). Interactional field theorists conceive of community as 1)

created by various social actors who interact frequently across interest lines to solve common problems, 2) rooted in a particular locale that social actors imbue with meaning, and 3) defined by various social networks and interpersonal relationships that are agreed upon and valued by participants (Flint et al., 2010). For this reason initial questions that focused on interactional field included the respondent's perceived membership in the community; attachment to place; the strength of ties within the community; and the overall perceptions of the community. Additional initial themes examined aspects that factor into decision-making and perceptions around energy systems. The following two tables summarize *some* of the topics and provide sample questions to illustrate the categories of questions based on interactional field theory (Table 5.4) and perspectives of energy developments (Table 5.5) addressed. The complete interview protocols for each community are provided in Appendix F (Fairview Protocol), Appendix G (Priddis Protocol), and Appendix H (Weyburn Protocol).

Table 5.4. Questions based on Interactional Field Theory (Chapter 4)

Examples of Questions Based on Interactional Field Theory		
Theoretical Connection	**Theme**	**Sample Questions**
Geographic Location	Membership in locale	• When people ask you where you live, what do you say? Tell me about the area you live in?
Attachment to Place[33]	Place attachment	• What do you like about where you live? What do you not like about where you live? • What do you think about the surrounding land or area?
Interaction	Information networks	• When you want information about something where would you go or who do you talk to?

[33] Attachment to place is rarely understood by one question. It is something that is uncovered through discussion of the location and how they react to developments or disturbances in the area.

	Community organization	• Do you have many interactions with people in this area? • What types of groups or organizations are there in this area? Do you belong to any of them?
Community	Perceptions of community	• Describe the community you live in? • Why do you live here? • What characterizes the people who live here?
	Community agency	• How well do members of your community work together to solve problems? • Can you give me an example of an issue that the community came together to solve? Can you give me an example of a conflict that has split or upset the community?

Table 5.5. Questions based on Perceptions of Energy Systems and CCS Literature (Chapter 3)

Literature Connection and Theme	Sample Questions
General Risks and Benefits of Energy Development	• What are some of the benefits of the development of energy sources in the region (i.e. nuclear, hydro, oil)? • What are some of the risks of the development of energy sources in the region (i.e. nuclear, hydro, oil)?
Risks and Benefits to *Community*	• How have people in this *community* responded to the development of energy sources in the region (i.e. nuclear, hydro, oil, etc.? • How has energy development affected your community wellbeing, if at all?
Knowledge about CCS	• Have you ever heard about carbon capture and storage? If yes, what can you tell me about it?
Perceptions of CCS	• What is your first reaction to hearing about CCS? • Tell me some of your thoughts on CCS?
Risks and Benefits of CCS	• What would be some of the benefits of having CCS in your community? • What would be some of the negative issues of having CCS in your community? • How would your community as a whole react to a CCS development nearby?
Trust in Developer	• What do you think of the companies who are doing the carbon injection (asked only in Weyburn)?

Focusing Event (Alleged Weyburn CO_2 Leak)	• Have you heard of any problems with injecting the carbon? • Do you think it is leaking? Do you feel like it is causing any harm? • How and when did you hear about the alleged CO_2 leak?

Observation and Journal Entries

Observation has been described as "the fundamental base of all research methods" in the social and behavioral sciences (Adler and Adler, 1994). Social scientists are observers of both human activities and of the physical settings where such activities take place (Denzin and Lincoln, 1994). Informal observation was used to examine the relationships and networks among community members and the relationships between people. This is particularly important when examining communities who may be affected by a technological development as the observer can get a better understanding of the perceived risks and benefits without posing questions (e.g. listening to concerns at community events). This may be especially important when researchers are concerned about "social desirability," or the tendency for respondents to provide answers they think researchers want to hear or which help them avoid a socially undesirable image (Adler and Adler, 1994). Researchers examining the collective mobilization of communities commonly utilize observation in their methodological approach to better understand community interactions and concerns (Brandenburg and Carroll, 1995).

During my data collection I attended community events. I was invited to and attended a council meeting (Fairview and Weyburn) or community meeting (Priddis) in each case study area. The mayor (Fairview and Weyburn) or a councillor (Priddis) introduced me at each meeting and described my research to those in attendance. Attendance at other events provided the opportunity to view interactions between people and understand nuances in the community in

question, life in the area, and who may be the (formal or informal) community leaders. All of these observations provided insight for additional or modified interview questions. Appendix D describes the events and gatherings that I attended during the data collection period. As part of my participant observation, I kept a journal recording the research process, questions asked, interactions and reflections on the research process. During the six months of data collection, the sheer number of formal interviews, meetings attended and informal conversations made journal entries a necessity to clearly remember specifics of data collection. I made notes during interviews and event attendance. I then collated these notes and made additional reflections each evening. These entries became particularly important during data analysis as they provided initial themes and reflections on interviews.

Summary of Interviews and Participants

I interviewed a total of 120 respondents (both in group and individual interviews). All interviews were completed face-to-face so I could better gauge whether participants understood questions. Participants were informed of the research goals and objectives and were asked to read and sign a consent form before the interview (see Appendix E). Interviews were conducted using a semi-structured questionnaire. A semi-structured approach was used to allow for additional questions exploring a particular problem or individual experience (Ansay et al., 2004). During the interviews, participants were asked to clarify or expand upon their responses if they brought up topics not covered in the questionnaire. This is one of the benefits of interviews over forced choice surveys. Interviews lasted between 40 minutes to approximately 8 hours over a two-day period. The shorter interviews were often because the participant was brief in their responses or did not elaborate greatly in follow-up questions. The long interviews were most

often with participants who had specific dealings with CCS (i.e. those who were actively involved in opposing or developing sites) or those who elaborated with stories, books or pictures. During the interviews I made preliminary notes, which I then wrote in my research journal. The interviews were transcribed for analysis. The following table (Table 5.6) illustrates the classification of participants in each community involved in the interview process.

Table 5.6. Summary of Participants in Research Project by Community

	Fairview	Priddis	Weyburn	Total
Community Members*				
One-on-one interviews	19	13	25	57
Group interviews with:				
2 people	3 (6 people)	2 (4 people)	2 (4 people)	14
3 people	2 (6 people)	1 (3 people)		9
4 people	2 (8 people)	2 (8 people)		16
5 people	1 (5 people)	1 (5 people)		10
Community Members	36	33	29	98
CCS Project Stakeholders				
Total CCS Project Stakeholder	N/A	5	9	14
Total Number of Participants	**44**	**38**	**38**	**120**

* Table 5.4 demonstrates the number of one-on-one interviews (individual interviews) and group interviews. The group interview column demonstrates the number of people in each group interview. For example, in Fairview there were 3 group interviews with 2 people present (total of 6 people) (highlighted in table to demonstrate example).

Participants were also provided with a short demographic survey to ensure a diversity of different age groups, employment, and gender in the community studied. Participants were asked how long they had lived in the area, their location (rural or urban), age, gender and highest level of education. The number of interviews varied slightly for each community. I interviewed people until a saturation point was found. In qualitative research, a saturation point is achieved when emergent patterns in the data stabilize and no novel information is gained from additional

respondents (Glaser and Strauss, 1999). One hundred and twenty-two people were invited to take part in an interview and in total 120 agreed to be participants in the study.

Data Analysis

Data analysis consisted of analytic induction and thematic analysis guided by interactional field theory. Analytic induction involves identifying patterns through initial observations or notes and refinement through the continual testing against any new observations. This process is referred to as 'progressive falsification' (Strauss and Corbin, 1990). Thematic analysis is a complementary coding strategy as it allows for themes, in this case guided by the interactional field theory framework, to emerge through the reading and interpretation of the data (Boyatzis, 1998). These themes then become the categories for analysis (Rice and Ezzy, 1999). This approach is commonly used in qualitative research to analyse and understand themes in interviews (Aronson, 1994).

Both deductive and inductive approaches were utilized to carry out the processes of analytic induction and thematic analysis described above. A deductive approach utilizes existing research questions and theories to guide the elaboration of themes (Corbin and Strauss, 2008). In the case of this analysis, I used existing insight from studies using interactional field theory and a literature review of perceptions of energy technologies and CCS to consider initial themes that were verified by the process of "progressive falsification" described above. The major categories were based on the three primary tenants of community as discussed in the previous methods section about *interview questions*.

The deductive approach was complemented with an inductive analysis. This allowed for themes to emerge from the data collected to better explain the interactional field theory

framework (Corbin and Strauss, 2008). An inductive approach is particularly useful in community research as there are phenomenon and important issues not known to the researcher that will emerge during data collection (LeCompte and Schensul, 2010).

All data, including interviews and other written data, were imported into the qualitative data analysis software NVivo to be coded and analysed. The following steps demonstrates the process of coding used:

1. All interviews and written texts (including follow-up emails or letters) were read before coding to get an impression of the interview and conception of possible themes.
2. A codebook was developed in NVivo by coding several interviews until no new codes were discovered. These categories were reflective of observed patterns in the data. This codebook was used for each community, but the process was reiterated for each community, as each case study had different characteristics of energy development and community perspectives.
3. Each interview was coded for themes and sub-themes. Common themes were analysed throughout the three case studies, yet unique themes and categories existed in each case. This is a process dubbed as the 'discovery' stage. Themes will be further discussed in the results chapter. NVivo affords the ability to highlight phrases in order to examine text and remove codes that were not similar to others in the theme. Whenever possible, a quantitative count was used to examine *how many* participants responded in a certain way. For example how many people in Priddis had heard about the carbon injection project or how many people in Weyburn thought that there was a CO_2 leak in the injection area. I coded all text relevant to community, place and energy development. Aspects where participants went on a tangent unrelated to this study were not coded.

4. Observed abnormalities or apparent contradictions in the theme patterns identified in proceeding steps were presented to peers. Regular peer debriefings took place with social researchers who were experts in public perceptions of CCS research as well as researchers familiar with interactional field theory. The peer debriefings served to verify the integrity of research methods and the analysis and interpretations of data collected for this dissertation (a form of inter-coder reliability). Themes were also validated by comparing emergent results to other literature and research on community and energy development (Aronson, 1994).
5. The most representative quotations of themes were selected through multiple stages of increasingly restrictive coding. The final themes and quotations are presented for each case study in chapter 7 and discussed further in chapter 8.

Chapter Summary

The methodology selected for this dissertation includes case studies and mixed methods, including individual and group interviews, attendance at community events and participant observation to examine how locally affected communities perceive CCS. The studies were tailored to community characteristics yet structured so that lessons could be drawn from each of the locales. Participants from three rural Canadian communities with different experiences regarding CCS were selected as part of the research. Communities chosen for study are located in an area with either: 1) an established CCS project; 2) a CCS project that was planned but cancelled due to local opposition; and 3) a community with no plans for a CCS project.

Interviews were completed with community members *and* CCS project stakeholders who lived in the area. This provided an understanding of the general views of those who lived in the

area and those who were particularly active in the approval or opposition of a project. Participants were recruited through both theoretical and snowball sampling; ensuring that a cross-section of community members were interviewed (based on demographics, job-type and location). Data analysis included analytic and thematic analysis to identify themes that were relevant to the research questions and interactional field theory to better understand how all three communities perceive CCS and other nearby energy developments.

The following chapter (Chapter 6) provides an in-depth description of the case-study communities and a background of the local population and current economic conditions. I also provide a discussion of energy developments in each of the three areas and a description of the proposed University of Calgary research project in Priddis and the Weyburn-Midale CO_2 Project in Weyburn.

CHAPTER SIX: COMMUNITY PROFILES, HISTORY OF ENERGY DEVELOPMENTS AND CCS PROJECTS

Introduction

Community history, local industry, and economic conditions provide an important context for understanding local residents' risk perceptions of developments (Kasperson et al., 1988). In this chapter, I describe the local conditions for each case study area included in this dissertation. This is the context in which these carbon capture and storage or other energy projects are located. For each case study location, I provide an overview of the community, including demographics of local populations and a discussion of the local economy. I also describe the history of energy developments in each area, with a focus on fossil fuel extraction industries. This includes the Weyburn-Midale CO_2 Project and an overview of the proposed University of Calgary Geoscience Field Research Station in Priddis, including a description of the events that led up to its cancellation. A discussion of recent allegations about a CO_2 leak at the Weyburn-Midale CO_2 Project also is included in this section. Case study descriptions are presented in the following order: 1) Priddis, 2) Weyburn and Goodwater, and 3) Fairview.

Priddis, Alberta

Priddis is a small southern Alberta hamlet situated in the Municipal District of Foothills No. 31 (see Images 6.1). The community is located on the eastern slopes of the Rocky Mountains 18 km west of Calgary on Highway 22X. Other nearby population centers in the municipal district include the Towns of Okotoks, High River, and Black Diamond; the Village of Longview; and the Hamlets of Aldersyde, Blackie, Cayley, De Winton, Hartell, Millarville, Naptha, and Priddis

Greens. The Municipal District (M.D.) of Foothills No. 31 has 7 divisions. Priddis is located in Division 4 of the M.D.[34]

Images 6.1. Entering the Hamlet of Priddis

The sign on the right indicates hamlet limits. It reads: "Entering Hamlet of Priddis"

Many residents live in the outskirts of Priddis on acreages or larger parcels of land. The topography of the Priddis area consists of rolling hills and is primarily described as 'ranch country' (Priddis, 2012). The area is an increasingly popular place for commuters to live because of its proximity to the City of Calgary (Priddis, 2012).

Community Overview and Present Local Economy

The Municipal District of Foothills had a population of 19,736 in 2006.[35] The population has increased 18.9% since 2000. The Priddis area had a 2006 population of 964 residents, with 383 occupying private dwellings and 335 census families. There was an average of 2.6 people in each family and the average number of children at home was 0.7.

As illustrated in Table 6.1, the education level for Priddis residents is higher than the provincial average. For example, only 15% of residents have no educational certificate (including a high school certificate) compared to 23% of Albertans. Priddis-area residents also have completed more post-secondary education than other Albertans. Thirty-two percent of Priddis residents have completed education above a university degree, compared to only 17% of

[34] See Images 5.1 in previous chapter for a map of Canada illustrating the locations of the three communities.
[35] All demographic information in this chapter was obtained from Statistics Canada.

the provincial population. Approximately 49% of Priddis area residents are 50 and older, while only 28% of the provincial population is 50 and older.

Table 6.1. Gender, Age and Education Demographics for Priddis, M.D. of Foothills and Province of Alberta

	Priddis		M.D. of Foothills		Province of Alberta*	
Total Population	964		19,736		3,290,350	
Gender (Male)	475	49%	9,945	50%	1,646,800	50%
Age Characteristics						
0-9	70	7%	2,075	11%	406,705	12%
10-19	125	13%	3,140	16%	462,705	14%
20-29	70	7%	1,595	8%	491,905	15%
30-39	70	7%	2,020	10%	472,155	14%
40-49	160	17%	3,990	20%	543,025	17%
50-59	235	24%	3,740	19%	426,730	13%
60-69	165	17%	2,015	10%	236,115	7%
70-79	70	7%	900	5%	158,390	5%
80 and over	5	1%	265	1%	92,610	3%
Median Age of Population**			43.1		36.0	
Education Attainment (age 15 and over)***						
No certificate; diploma or degree	125	15%	3,015	19%	614,865	23%
High school certificate or equivalent	210	25%	4,685	29%	688,140	26%
Apprenticeship or trades certificate or diploma	100	12%	1,775	11%	285,815	11%
College; CEGEP or other non-university certificate or diploma	110	13%	3,070	19%	472,210	18%
University certificate or diploma below the bachelor level	75	9%	635	4%	105,680	4%
University certificate; diploma or degree	270	32%	3,020	19%	458,425	17%

* Statistics for M.D. Foothills and Province of Alberta displayed to provide comparison.
**The dissemination area for Priddis does not provide a median age for population.
*** Total population 15 years and over: Priddis = 4,895; M.D. of Foothills = 16,195; Province of Alberta = 2,625,145.

The majority of people who live in the Priddis area are at least third-generation residents. There were 560 residents (66.7%) who claimed they were at least third-generation residents of Priddis. Twenty-one percent (n=175) claimed they were second-generation residents and 13.1% (n=110) claimed they were first-generation residents.

Income levels in the Priddis area are high when compared to the rest of Alberta. The 2005 average family income in Priddis was $119,328; almost double the provincial average of $63,988. The number of residents who work in 'management positions' is almost triple the Alberta average and only 2% percent of Priddis residents work in 'the trades,' compared to 18% of Albertans (see Table 6.2). The unemployment rate in Priddis is 1.9%.

Table 6.2. Residents' Occupation and Industry for Priddis, M.D. of Foothills and Province of Alberta

	Priddis		M.D. of Foothills		Province of Alberta	
Occupation*						
Management occupations	145	27%	2,085	17%	187,240	10%
Business; finance and administration occupations	120	22%	2,250	18%	340,430	18%
Natural and applied sciences and related occupations	65	12%	930	7%	144,240	7%
Health occupations	35	7%	440	4%	103,620	5%
Occupations in social science; education; government service and religion	30	6%	595	5%	136,610	7%
Occupations in art; culture; recreation and sport	25	5%	350	3%	45,160	2%
Sales and service occupations	70	13%	2,045	16%	438,105	23%
Trades; transport and equipment operators and related occupations	10	2%	1,730	14%	350,360	18%
Occupations unique to primary industry	35	7%	1,790	14%	117,500	6%
Occupations unique to processing; manufacturing and utilities	0	0%	205	2%	65,365	3%

Industry						
Agriculture and other resource-based industries	70	13%	2,405	19%	228,520	12%
Construction	10	2%	1,520	12%	169,420	9%
Manufacturing	20	4%	620	5%	138,365	7%
Wholesale trade	10	2%	545	4%	85515	4%
Retail trade	20	4%	985	8%	206,655	11%
Finance and real estate	60	11%	735	6%	97,465	5%
Health care and social services	45	8%	595	5%	175,200	9%
Educational services	30	6%	630	5%	120,460	6%
Business services	105	20%	2,445	20%	354,265	18%
Other services	115	21%	1,940	16%	352,760	18%

* Total experienced labour force 15 years and over: Priddis = 535; M.D. of Foothills = 12,420; Province of Alberta = 1,928,635.

History of Industry and Developments

There have been relatively few industrial or energy developments in Priddis. Industrial, residential or recreational developments are often discouraged in the area and there are a number of initiatives and groups that focus on the preservation of the land in a 'natural state.' There also are many conservation initiatives and environmental conservation organizations active in the Priddis area, including the *Cross Conservation Area, Foothills Land Trust, Nature Conservancy of Canada, Western Sky Land Trust* and the *Southern Alberta Land Trust Society*. These initiatives primarily focus on the establishment of conservation easements that create a legally enforceable land preservation agreement between a landowner, government agency or qualified land protection organization. Conservation easements often restrict real estate development and commercial or industrial uses to a mutually agreed upon level. Development in the Priddis area has been a concern of residents for many years, as demonstrated by the story behind Ann and Sandy Cross donating the land for the *Cross Conservancy*:

> As they settled into life on Rothney Farm together, they watched the expanding City of Calgary approach, and new acreages divide the farmland around them. Concerned about

> what the future held for the land, they decided to act. In 1987, Ann and Sandy donated nearly 2,000 acres of their land to the Province of Alberta. At the time it was the largest private land donation in Canadian history. Sandy wanted the land to be preserved the way it was for future generations to enjoy. (Cross Conservation, 2012)

Praxis Research administered a 2007 survey to 344 residents in the Priddis area to better understand development concerns (Holroyd, 2008). The survey results indicated that more than 85% of respondents were 'very concerned' about diminished water quality in local wells, springs and aquifers. There were 58% respondents who were 'very concerned' with the reduction in wildlife numbers due to land fragmentation and loss of habitat and 57% of residents were 'very concerned' about the loss of visual scenery due to developments (Holroyd, 2008). The same survey asked residents what they could 'afford to lose' over the next few decades, in either a visual or production sense, to protect the water supply and setting. The suggestions as to what could be lost were attributed to factors that included "oil and gas development, recreational use of the ecosystem (specifically OHV [Off Highway Vehicle] use), and urban sprawl, including acreages (Holroyd, 2008, p.92)."

Few oil and gas extraction developments have taken place in the Priddis area. There have been some negative experiences with drilling in the area, including the exploration of a natural gas well that contaminated residents' drinking water. The Court of Queen's Bench of Alberta found a gas drilling company (Impact Energy Inc.) liable in 2009 for contaminating a water well on the Blatz property. The Blatzs are multi-generational residents of the Priddis area. The Blatzs had to drill a new water well as a result of the contamination that resulted in health problems such as diarrhea, mouth sores, and bladder infections. The court ordered the gas drilling company to pay for the construction of the new well ($30,000). A Blatz family member was awarded $4,000 for lost wages due to time spent dealing with the contamination and seven other

family members were paid $1,000 for the health problems they suffered (Court of Queen's Bench of Alberta, 2009).

Proposed University of Calgary Geoscience Field Research Station

During the fall of 2010, the University of Calgary planned to establish a field research and training center on university land, nine kilometers southeast of Priddis. The goal of the project was to conduct research on technology used for the measurement, monitoring and verification of carbon storage and to provide training for geoscience and engineering disciplines (Lawton, 2010). The site was to include two 500-meter depth wells spaced about 50 meters apart. One of the wells would act as an observation well and the other would be used for periodic injection of small volumes of CO_2. The project was planned to inject approximately 600 tonnes of CO_2/year (Lawton, 2012).

The Rothney Astrophysical Observatory (RAO), managed by the University of Calgary, was adjacent to the proposed carbon storage research and training site. The RAO has very strong and positive connections with the community. They host school trips and open houses for the University of Calgary. The RAO also is involved in the community through the 'dark night initiative' that aids the M.D. of Foothills in becoming more aware of the night environment and minimizing the impacts of lighting yards, streets, and commercial and industrial activities (M.D. of Foothills No. 31, 2012). Early in the proposal of the carbon storage research site, proponents recognized that it would be important to build upon the relationship that the community has with the RAO and not to damage existing relationships with the new project.

A major concern was any impact of the project on the quantity and quality of water in the area (Holroyd, 2008). The Paskapoo Aquifer was beneath the proposed research site. It is one of the most extensively used aquifer formations in west central Alberta (NRCan, 2012).

Opposition to and Cancellation of the Geoscience Field Research Station

The University of Calgary held multiple meetings with community members and those managing the Rothney Astrophysical Observatory about the carbon storage research site. Professor Don Lawton (the lead of the project) discussed the project with Terry Waddick (the councilor for the Priddis area) during the summer of 2010. Professor Lawton also met with councilor Suzanne Oel after she replaced councilor Waddick. These initial meetings were generally seen as positive, although both councilors discussed local community concerns about developments and water quality and quantity. Professor Lawton met with the M.D. of Foothills Council in High River (attended by approximately 15 people) in early February. Residents voiced concerns and asked questions. After the community meeting, support for the carbon storage project appeared to wane.

The Cross Family Speaks Out

Sandy Cross donated the quarter section (160 acres) of land to the University of Calgary in 1971 and was a major contributor for the large telescope at the observatory. He and his wife, Ann, had also donated 2,000 acres (the Ann and Sandy Cross Conservation Area) just south of Calgary, adjacent to the University of Calgary quarter section. The Cross Conservation area is dedicated to "protecting habitat and providing space for native species of wildlife" and "offering conservation education programs" (Cross Conservation, 2012). Sandy Cross was a prominent

community member and was the son of A.E. Cross (one of the Calgary Stampede's "Big Four"[36]) and Helen Rothney MacLeod (a prominent resident of the Calgary area).

Marshall Abbott, the stepson of Sandy Cross, voiced his opposition to the location of the proposed project in the local newspaper (see Images 6.2). Abbott stated that his stepfather would be "rolling in his grave" if he knew of the University's intentions for the land:

> "This provides a footprint and dangerous precedent," Abbott said. "Once there is one kind of industrial usage, what's going to stop that from being repeated with other research efforts and ultimately industrial development?"… "An industrial footprint would go against the grain of what his intentions for the land to be," Abbott said. "Talking to my mom (90-year-old Ann Cross), I know she is appalled with what the U of C has done here." (Campbell, February 16, 2011)

Images 6.2. Western Wheel Article on Cross Family Concern About Proposed CO_2 Storage Project

Marshall Abbott was not necessarily against the project *idea*, just the *location* of the project. In the article, he states a preference for the project to be conducted "in an area already with a large amount of industry" (Campbell, February 16, 2012).

Local Media Reporting and Project Cancellation

There were a number of negative news reports about the proposed University of Calgary carbon storage project in the local newspaper, the Western Wheel. The President of the *Priddis and*

[36] The "Big Four" refers to four of the pioneer ranchers in the Calgary region who together founded the Calgary Stampede (Cross Conservation, 2012).

Millarville Residents Association (PMRA) wrote a letter to the editor stating some of the possible ecological risks to "the community and its people living in the area" (Western Wheel, February 2, 2011). She stated that Sandy Cross would not have wished his land to be used for this type of project:

> As an indication of his strong feeling to protect nature and the land, Mr. Cross also gave land now known as the Ann and Sandy Cross Conservation area, protecting native wildlife and grasses. This area is a centre of learning to thousands of students and one of the sanctuaries for herds of elk and other wildlife. Sadly, those attendees at the presentation [at the M.D. of Foothills meeting] only heard about the academic and technical benefits to the university on a project made possible through land given to them by a rancher. Mr. Cross felt the importance of protecting the community and the land on which it currently thrives. (Dover, February 2, 2011)

An additional community meeting to discuss the carbon storage research project was scheduled for March 15, yet was never realized. A private meeting was organized to debate the location of the carbon storage research project. The meeting was held at the University of Calgary with faculty, administration and community members, including representation from the Cross family. The Geoscience Field Research Station project in Priddis was ultimately cancelled. Professor Don Lawton stated in the Western Wheel (March 30, 2012):

> We engaged in consultation and discussion with many stakeholders in the area, including members of the Cross family, which donated the land to the university back in 1972. Much of the feedback we received was that the proposed research involves a footprint that is considered to be inconsistent with the goals of the original donation of the land to the university. The proximity of the site to the Cross Conservancy land and residents' concerns about possible impact on the wildlife corridor and ecological habitat were also important factors in the decision. We respect these sentiments. So in the best interests of the community and the university, we have decided to look elsewhere for a site to pursue this important research and education initiative.

The University of Calgary is attempting to find another location for the carbon storage research site.

Weyburn and Goodwater, Saskatchewan

The communities of Weyburn and Goodwater are located in southeastern Saskatchewan (see Images 6.3). Weyburn is located 116 km southeast of the City of Regina and 75 km north of the American border. Goodwater is a smaller hamlet located 41 km southeast of Weyburn. Weyburn is the economic and business center for the region and provides goods and services to nearby hamlets and towns. Goodwater is situated in the Rural Municipality (R.M.) of Lomond and Weyburn is located in the R.M. of Weyburn. The area is comprised mostly of flat farmland and there is little variation in topography.

Images 6.3. Entering the City of Weyburn and the Hamlet of Goodwater

Left: One of the welcome signs for the City of Weyburn. It reads: "Working together for a healthy community." **Right:** Sign indicating Goodwater hamlet limits. It reads: "Welcome to Goodwater."

Community Overview and Present Local Economy

The case study of Weyburn and Goodwater included the City of Weyburn, Rural Municipality of Weyburn and Rural Municipality of Lomond. The 2006 population of this area was 10,622. The City of Weyburn had 4,045 private dwellings in 2006 and 2,605 families with an average of 2.9 people in each family. The R.M. of Weyburn had 320 private dwellings, 255 families and an

average of 3.1 people in each family. The R.M. of Lomond in 2006 had 115 private dwellings and 95 families with an average of 2.9 people in each family unit.

The education level of residents in the City of Weyburn mirrors provincial averages for Saskatchewan (see Table 6.3). Residents of the surrounding rural municipalities have a lower education attainment level when compared to the province. Six percent of residents in the R.M. of Weyburn have completed a university degree and no residents[37] living in the R.M. of Lomond have a university degree. Meanwhile, approximately17% of Saskatchewan residents have completed a university degree. Forty-eight percent of residents in the R.M. of Lomond ended their formal education at a high school certificate.

Table 6.3. Gender, Age and Education Demographics for City of Weyburn, R.M. of Weyburn, R.M. of Lomond and Province of Saskatchewan

	City of Weyburn		R.M. of Weyburn		R.M. of Lomond		Province of Saskatchewan*	
Total Population	9,433		888		301		968,157	
Gender (Male)	4,510	48%	465	52%	170	56%	475,240	49%
Age Characteristics								
0-9	1,080	11%	115	13%	30	10%	118,565	12%
10-19	1,270	13%	150	17%	40	13%	144,030	15%
20-29	1,100	12%	100	11%	25	8%	125,490	13%
30-39	1,040	11%	105	12%	30	10%	111,490	12%
40-49	1,330	14%	155	17%	50	17%	147,105	15%
50-59	1,130	12%	125	14%	60	20%	128,460	13%
60-69	830	9%	85	10%	30	10%	80,820	8%
70-79	860	9%	55	6%	15	5%	64,285	7%
80 and over	785	8%	15	2%	10	3%	47,920	5%
Median Age of Population	42.0		39.1		44.1		39.0	
Education Attainment (age 15 and over)**								
No certificate; diploma or degree	2,295	31%	210	29%	50	20%	231,730	30%
High school certificate or	1,980	27%	220	30%	120	48%	205,495	27%

[37] Due to the fact Statistics Canada randomly rounds the demographic figures there could be a few residents with a university degree, but Statistics Canada reports that there are zero.

equivalent								
Apprenticeship or trades certificate or diploma	920	12%	120	16%	45	18%	86,310	11%
College; or other non-university certificate or diploma	1,225	17%	90	12%	20	8%	111,770	15%
University certificate or diploma below the bachelor level	285	4%	40	5%	15	6%	32,180	14%
University certificate; diploma or degree	675	9%	45	6%	0	0%	98,755	13%

* Province of Saskatchewan statistics displayed to provide comparison.
**Total population 15 and over: City of Weyburn = 7,385; R.M. of Weyburn; R.M. of Lomond = 250; Province of Saskatchewan = 766,235.

Most of the people in the Weyburn and Goodwater area are at least third-generation residents. In the City of Weyburn, 75.1% (n=5,545) of people identified as at least third-generation residents, 19.6% (n=1,450) identified as second-generation residents and 5.2% (n=385) identified as first-generation residents. These numbers are similar in the R.M. of Weyburn. Eighty-two percent (n=605) of people identified as at least third-generation residents, 15.1% (n=110) claimed to be second-generation residents and only 1.4% (n=10) first-generation residents. In the R.M. of Lomond, 84.0% (n=210) identified as at least third-generation residents, 10.0% (n=15) identified as second-generation residents and 4.0 % (n=10) identified as first-generation residents.

The primary industries in Weyburn include agriculture and the oil industry. In addition to the area's significant oil resources, the area also has the country's largest privately owned inland grain terminal. Many residents in the rural municipalities work in 'occupations unique to primary industry' (e.g., the oil industry or farming) including 38% in the R.M. of Lomond and 26% in the R.M. of Weyburn. These proportions are high when compared to the provincial average of 13% employed in 'occupations unique to primary industry' (see Table 6.4). Only 10% of those living *within* the City of Weyburn work in 'occupations unique to primary

industry.' Approximately 41% of residents in the R.M. of Lomond and 35% of residents in the R.M. of Weyburn worked in 'agriculture and other resource-based industries' compared to the provincial average of 16%.

Table 6.4. Residents Occupation and Industry for City of Weyburn, R.M. of Weyburn, R.M. of Lomond and Province of Saskatchewan

	City of Weyburn		R.M. of Weyburn		R.M. of Lomond		Province of Saskatchewan	
Occupation*								
Management occupations	395	8%	55	10%	0	0%	41,595	8%
Business; finance and administration occupations	720	15%	80	14%	20	10%	80,525	16%
Natural and applied sciences and related occupations	165	3%	15	3%	0	0%	21,765	4%
Health occupations	390	8%	40	7%	20	10%	32,205	6%
Occupations in social science; education; government service and religion	400	8%	35	6%	0	0%	42,840	8%
Occupations in art; culture; recreation and sport	100	2%	15	3%	0	0%	10,960	2%
Sales and service occupations	1,320	27%	100	18%	40	20%	120,600	23%
Trades; transport and equipment operators and related occupations	690	14%	60	11%	15	8%	83,245	16%
Occupations unique to primary industry	475	10%	145	26%	75	38%	67,660	13%
Occupations unique to processing; manufacturing and utilities	250	5%	10	2%	10	5%	16,075	3%
Industry								
Agriculture and other resource-based industries	780	16%	195	35%	80	41%	84,305	16%
Construction	280	6%	35	6%	0	0%	29,940	6%
Manufacturing	245	5%	25	4%	10	5%	29,865	6%
Wholesale trade	175	4%	15	3%	10	5%	19,100	4%
Retail trade	695	14%	60	11%	15	8%	56,730	11%
Finance and real estate	180	4%	10	2%	0	0%	25,280	5%
Health care and social services	715	15%	60	11%	40	21%	58,405	11%
Educational services	340	7%	35	6%	0	0%	40,315	8%
Business services	595	12%	45	8%	20	10%	70,545	14%
Other services	885	18%	80	14%	15	8%	102,990	20%

* Total experienced labour force 15 years and over: City of Weyburn = 4,895; R.M. of Weyburn = 555;

R.M. of Lomond = 200; Province of Saskatchewan = 517,475.

There is a relatively low unemployment rate in the rural municipalities compared to the rest of Saskatchewan. The unemployment rate is 1.8% in the R.M. of Weyburn and average family income is $74,736. The unemployment rate in the R.M. of Lomond is 0%, but average family income, $49,893, is lower than in the R.M. of Weyburn. The City of Weyburn has an unemployment rate of 5%, which is closer to the provincial average of 5.6%. Weyburn also has a slightly higher than average family income ($64,165) when compared to the surrounding rural areas and is above the provincial average of $58,563.

History of Oil Industry

There is a long and extensive history of oil extraction in the Weyburn and Goodwater area. These communities are located within the Bakken formation, which provides a large amount of oil for both Canada and the United States. The Bakken formation is an area that occupies approximately 520,000 km^2 and underlies parts of Montana, North Dakota, Saskatchewan and Manitoba. The Weyburn area has become an established oilfield service center due to the large oil reserves underlying southern Saskatchewan. More than 600 wells operate in the immediate area (City of Weyburn, 2011).

The Central-Del Rio Company drilled the first oil well in the Weyburn area[38] during the fall of 1954 (Weyburn R.M. #67, 1986). The same company then drilled wells north and west of the discovery well and did not find additional oil resources. They moved to the Goodwater area

[38] The legal land description of the discovery well was NW-6-7-13-W2 (i.e. the North West quarter of Section 6, Township 7, Range 13, West of the second meridian).

where the majority of the wells are located. The primary oil companies in the area have evolved through many mergers and divisions – from Central-Del Rio to PanCanadian, then Encana and most recently, Cenovus. The history of these changes begins with the merger of Central-Del Rio with Canadian Pacific Oil to form PanCanadian. PanCanadian then merged with Alberta Energy Company to form Encana. More recently Encana divided into two companies: Encana, which is primarily focused on gas exploration and Cenovus, which focuses on oil extraction. Of particular importance to this research is the acknowledgement that "the oil companies may have changed but the employees have not" (Walkeden, 2012).

Cenovus operates the Weyburn field and has a 62% ownership stake. The company currently employs about 80 people in the Weyburn area (Walkeden, 2012) while the Apache oil company employs approximately 28 in the Midale area (Apache, 2011). Other oil companies in the area also employ locals.

The Weyburn oil field is made up of three municipalities: 1) R.M. of Weyburn No. 67; 2) R.M. of Cymri No. 36; and 3) R.M. of Lomond No. 37. The majority of the producing wells are located in the R.M.s of Lomond and Cymri. Much of the CO_2 injection project is located in the R.M. of Lomond (which contains Goodwater) (Weyburn R.M. #67, 1986). The amount of oil recovered through primary and waterflood recovery methods has decreased since initial use of these methods (Cenovus, 2012). Cenovus announced a plan in 1998 to implement a large-scale enhanced oil recovery project using CO_2 from a coal gasification plant in North Dakota (PTRC, 2012). Later in the year, they began pipeline construction. The following section provides an overview of the carbon injection project in the Weyburn and Midale fields.

Weyburn-Midale Enhanced Oil Recovery and Carbon Capture and Storage Project

The Weyburn-Midale CO_2 Project has played an important role in the development of CCS, as it is one of the earliest and largest demonstration sites in the world (Cenovus, 2012). The project sparked early interest (1998) from the International Energy Agency as an opportunity to study and better understand subsurface CO_2 injection, migration and monitoring. The Saskatchewan Ministry of Energy and Mines (now Saskatchewan Ministry of Energy and Resources), the federal Department of Natural Resources, and PanCandian (now Cenovus) initiated CO_2 injection in 2000 at the Weyburn Unit. The Petroleum Technology Research Center (PTRC) manages the research project and more than 30 international research organizations have applied scientific procedures and techniques to assess the integrity of the geological storage system, monitor CO_2 in the subsurface and test for evidence of anthropogenic CO_2 at the surface (PTRC, 2012). Funding for the research came from both private and public sources and is supported by both Canadian and US governments. The *research project* runs parallel to the EOR operation operated by Cenovus.

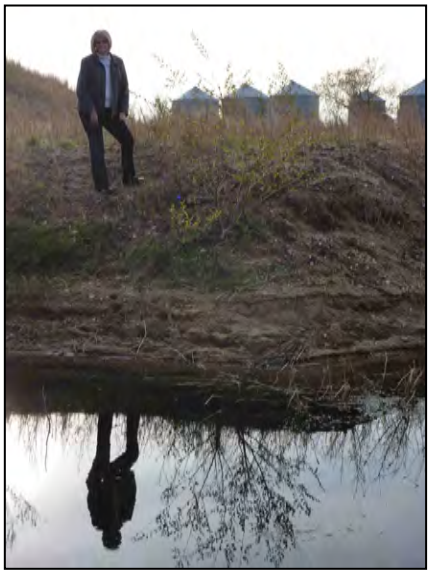
Carbon dioxide from the project is transported from a coal gasification plant in Beulah, North Dakota. The CO_2 travels 320 km by pipeline across the Canadian-US border. In 2000, Cenovus began injecting 5,000 tonnes/day of 95% pure CO_2. Apache Canada joined the project in 2005 and began injecting approximately 1,300 tonnes/day of CO_2 for EOR at the adjacent Midale field. By 2006, Cenovus was injecting 6,500 tonnes/day and Apache was injecting 2,000 tonnes/day. Weyburn is currently producing 27,000 gross barrels of oil per day and projects approximately 26 million tonnes of CO_2 to be stored in the area (Cenovus, 2012).

In 2011, a CO_2 leak was claimed to have occurred at a farm near Goodwater. While not central to the primary focus of this dissertation, it is briefly recounted here as the incident provides additional insights into understanding this region and area residents' views on CCS.[39]

Alleged Leak at Weyburn-Midale CO_2 Project

The first public allegation of a leak from a CO_2 injection project was made with regards to the Weyburn-Midale CO_2 Project. Jane and Cameron Kerr, long-time residents of the Goodwater area, alleged that CO_2 from the Weyburn Project was leaking onto their farm (see Images 6.4).

Images 6.4. Location of the Alleged CO_2 Leak from the Weyburn CO_2 Project



Jane Kerr and the gravel pit (now a dugout) at the Kerr farm where the alleged CO_2 leak from the Weyburn CO_2 Project occurred.

The Kerrs indicated that there was CO_2 degassing, animal deaths and water issues beginning in 2003 stemming from a gravel pit they excavated behind their residence (Kerr, 2011). The Kerrs and their lawyer held a press conference in 2011 outlining results from tests analyzed by Petro-Find (consultants Kerrs hired to test their property for anthropogenic CO_2). After the press conference, media outlets from Canada and other countries reported about possible leaks on the Kerr property (Boyd et al., 2013).

After the public announcement of the alleged leak, a number of organizations, including Cenovus, International Performance Assessment Centre for Geological Storage of

[39] This case has been more fully described in Boyd et al.,2013. Appendix A provides a time line of the history of testing on the Kerr farm, the press release regarding allegations of a leak and the resulting media reports and final reports.

CO_2 (IPAC-CO2), and PTRC reported that they would commission site assessments to test for anthropogenic CO_2. Testing was delayed until August 2011 due to high water levels. Cenovus and IPAC-CO2 released reports in late 2011 stating that there was no anthropogenic CO_2 present at the Kerr farm. An additional report by the PTRC and the British Geological Survey also found similar results but was not publicly released (Sacuta, 2012).

Fairview, Alberta

Fairview is a small town in northwestern Alberta situated in the Peace Country (see Images 6.5). It is located approximately 561 km north of Edmonton. Other large population centers include Grande Prairie 115 km to the south and Peace River 82 km to the northeast. Main access to the community of Fairview is from Highway 2 and it is located near Historic Fort Dunvegan (a provincial park) on the Peace River. The outlying areas include farmland, boreal forest and wetlands.

Images 6.5. Entering the Town of Fairview

One of the welcome signs for the M.D. of Fairview.

Community Overview and Present Local Economy

The Town of Fairview had a population of 3,297 in 2006 and the Municipal District had 1,432 residents. The population of the Town of Fairview grew 4.5% between 2001 and 2006, while the Municipal District had a 20.5% decrease in population between 2001 and 2006. There were a total of 1,389 private dwellings and 880 families in 2006 in the Town of Fairview. There were far fewer private dwellings (n=571) in the Municipal District. A total of 395 families lived in the Municipal District.

The majority of Fairview residents have lived in the area for three or more generations. In the Town of Fairview, 68.4% (n=1,740) identified as third-generation residents of Fairview, 25.7% (n=655) identified as second-generation residents and 6.1% (n=155) identified as first-generation residents. These numbers are similar in the Municipal District of Fairview. Approximately 71% percent (n=775) identified as third-generation residents, 25.2% (n=275) identified as second-generation residents and 3.7% (n=40) identified as first-generation residents. The breakdown of age, gender, and education attainment is provided below in Table 6.5.

Table 6.5. Gender, Age and Education Demographics for the Town of Fairview, M.D. of Fairview and Province of Alberta

	Town of Fairview		M.D. of Fairview		Province of Alberta	
Total Population	3,297		1,432		3,290,350	
Gender (Male)	1,595	48%	745	52%	1,646,800	50%
Age Characteristics						
0-9	455	14%	170	12%	406,705	12%
10-19	465	14%	255	18%	462,705	14%
20-29	410	12%	110	8%	491,905	15%
30-39	410	12%	180	13%	472,155	14%
40-49	440	13%	270	19%	543,025	17%
50-59	385	12%	220	15%	426,730	13%
60-69	265	8%	125	9%	236,115	7%
70-79	280	8%	80	6%	158,390	5%

80 and over	190	6%	30	2%	92,610	3%
Median Age of Population	37.8		40.1		36.0	
Education Attainment (age 15 and over)**						
No certificate; diploma or degree	900	35%	380	35%	614,865	23%
High school certificate or equivalent	560	22%	165	15%	688,140	26%
Apprenticeship or trades certificate or diploma	390	15%	185	17%	285,815	11%
College; CEGEP or other non-university certificate or diploma	410	16%	265	24%	472,210	18%
University certificate or diploma below the bachelor level	95	4%	15	1%	105,680	4%
University certificate; diploma or degree	185	7%	75	7%	458,425	17%

* Province of Alberta statistics added to provide comparison.
**Total population 15 and over: Town of Fairview = 2,545; M.D. of Fairview = 1,090; Province of Alberta 2,625,145.

There are lower levels of education attainment in Fairview when compared to the rest of the Alberta population. For instance a smaller proportion of the Fairview population has completed a 'certificate, diploma or degree' when compared to the rest of the province. Approximately 35% of residents in both the M.D. and Town of Fairview had not completed any certificate, diploma or degree while 23% of Albertans had. The Fairview area also contains a smaller proportion of people who have completed a University Certificate (7% in both the M.D. and Town of Fairview compared to 17% of Albertans).

Major industries in the Fairview area include gas extraction[40] (primarily managed by Devon) and agriculture. Many local residents work in 'agriculture and resource-based industries' (see Table 6.6). Approximately 21% of residents in the Town of Fairview and 40% of residents in the municipality work in 'agriculture and resource-based industries' compared to

[40] There is oil extraction in the M.D.; however, oil extraction accounts for only 5-10% of fossil fuel extraction in the area (McIntyre, 2013).

12% of the Albertan population. Other major employers in the area include the Grande Prairie Regional College (Fairview Campus) and the Woodmere tree nursery.

Table 6.6. Residents Occupation and Industry for the Town of Fairview, M.D. of Fairview and Province of Alberta

	Town of Fairview		M.D. of Fairview		Province of Alberta	
Occupation*						
Management occupations	135	8%	40	5%	187,240	10%
Business; finance and administration occupations	255	14%	135	17%	340,430	18%
Natural and applied sciences and related occupations	70	4%	20	2%	144,240	7%
Health occupations	85	5%	45	6%	103,620	5%
Occupations in social science; education; government service and religion	125	7%	40	5%	136,610	7%
Occupations in art; culture; recreation and sport	15	1%	10	1%	45,160	2%
Sales and service occupations	455	25%	115	14%	438,105	23%
Trades; transport and equipment operators and related occupations	430	24%	150	19%	350,360	18%
Occupations unique to primary industry	130	7%	250	31%	117,500	6%
Occupations unique to processing; manufacturing and utilities	70	4%	0	0%	65,365	3%
Industry						
Agriculture and resource-based industries	375	21%	325	40%	228,520	12%
Construction	170	10%	35	4%	169,420	9%
Manufacturing	50	3%	25	3%	138,365	7%
Wholesale trade	70	4%	20	2%	85,515	4%
Retail trade	180	10%	60	7%	206,655	11%
Finance and real estate	95	5%	50	6%	97,465	5%
Health care and social services	150	8%	60	7%	175,200	9%
Educational services	175	10%	60	7%	120,460	6%
Business services	215	12%	95	12%	354,265	18%
Other services	300	17%	75	9%	352,760	18%

* Total experienced labour force 15 years and over for town of Fairview = 1,785; M.D. of Fairview = 810; Province of Alberta = 1,928,635

The unemployment rate for the Town of Fairview was 6.1%, which was slightly higher than the provincial average of 4.3%. The unemployment rate for the Municipal District was slightly lower at 3.1%. The average family income in the Town of Fairview was $76,081 which is slightly higher than the provincial average. The average family income for the M.D. of Fairview was $61,163.

History of Gas Extraction Industry and Other Energy Developments in the Area

Fairview has many resources for energy development, including large natural gas reserves and a river suitable for the construction of hydroelectric projects. Large natural gas fields below Fairview provide employment opportunities for many in the area. Hydroelectric projects have been discussed in the area for some time. The town website states, "In addition to the potential for recreational opportunities afforded by the Peace River, future hydroelectric power generation stands to create further economic development" (Town of Fairview, 2012). The Fairview community also was involved in the North Peace nuclear power debate concerning the proposal to build a power plant 50 km northeast of Fairview. Discussions about CCS and these energy systems provide insights into how locally affected people make decisions about energy developments in their area.

Natural Gas Extraction

J.C. Anderson[41] discovered the Dunvegan natural gas field on September 19, 1970. It is reported that the "vast Dunvegan field was one of the largest findings in Alberta gas history" (Canadian

[41] J.C. Anderson currently lives in the Priddis-Millarville area where he owns almost 3,000 acres of land.

Petroleum, 2010). The Dunvegan field has produced more than 1 trillion cubic feet of gas and is expected to remain productive for years to come (University of Texas, 2010). It was managed and operated by Anderson Exploration before Devon acquired the company in 2001. There are approximately 250 existing wells in the Fairview area (Devon, 2012). The company employs approximately 115 people in the district and 45 people in the Dunvegan field.

Other Proposed Energy Projects

Dunvegan Hydroelectric Project Proposal - TransAlta (through its wholly owned subsidiaries, Canadian Hydro Developers, Inc. and Glacier power Ltd.) has proposed to build a hydroelectric project across the Peace River. The project would be located upstream of the bridge crossing at Dunvegan in the M.D. of Fairview (26 km south of the town of Fairview). The proposed project would generate approximately 600,000 MWh of electricity per year. Construction was planned to last three-to- four years and would generate approximately 500 person-years of employment. The proposal of a project at Dunvegan is not new to Fairview residents. In the mid-1980s the area was studied as a possible site for a 'Dunvegan Dam and Reservoir.' Glacier Power held a public open house in Fairview on August 22, 1999, regarding a proposed hydroelectric project on the Peace River. Canadian Hydro received formal project approval from the Natural Resources Conservation Board and Alberta Utilities Commission on May 7, 2009 to construct and operate a Hydro Facility and Power Plant (Canadian Environmental Assessment Agency, 2009). More recently, TransAlta reported that they are undertaking further investigations and monitoring of the area before they can build a hydroelectric project at the Dunvegan site (TransAlta, December 6, 2011).

Bruce Power Nuclear Power Plant Proposal - Cardinal Lake (approximately 50 km from Fairview) was announced in 2007 as one of the locations considered for a nuclear power plant. If approved, the four reactors would have been functioning as early as 2017 and producing up to 4,000 megawatts of power per year. Bruce Power (previously Energy Alberta Corporation) announced in 2008 that the company had taken the first steps toward building the power plant by filing an application with the Canadian Nuclear Safety Commission. However, Bruce Power announced an alternate site for the plant in 2008 located 30 km north of Peace River at the Whitemud site. A few months later Bruce Power withdrew its application to construct a nuclear power plant at Cardinal Lake. In December 2011 Bruce Power decided to completely cancel the project at all proposed locations in the Peace Region. Residents in the region were divided about the proposed nuclear power plant. Some residents who supported the plant created groups such as the "Committee for Sustainable Regional Socio-Economic Development." Other local people and groups greatly opposed the nuclear proposal, such as the group entitled "Earth Alternatives." The Town of Fairview hosted several information sessions and meetings with Bruce Power (previously Energy Alberta Corporation) and the Canadian Nuclear Association.

Chapter Summary

Each of the three communities discussed in this chapter have local cultures and histories that influence community views on energy system developments. The Priddis area has few industrial or fossil fuel extraction developments. Residents also have a very high average family income, high levels of education attainment, low unemployment rates and many work in managerial positions. Community members focus on land conservation and do not rely on local natural resources for economic sustainability. There are a number of prominent community members in

the area, such as the Cross family, who have lengthy associations with environmental conservation and who played a prominent role in community discussions around the proposed CCS project. In addition, there is a history of concerns about water quality in the region. These factors contributed to the rejection of proposed University of Calgary research project in the Priddis area.

In contrast, the majority of Weyburn and Goodwater residents work in primary resource industries such as oil extraction and agriculture. Education levels and family income are on par or lower than the rest of Saskatchewan and residents rely on local natural resources for economic and community stability. The long and extensive history of oil development in the Weyburn and Goodwater area contributed to the development of an enhanced oil recovery project in the area. As conventional oil extraction methods began to fail, EOR helped extend oil extraction and increase community and economic stability in the area. This project would become one of the first large-scale carbon injection and storage demonstration projects in the world.

Fairview resembles Weyburn in that the major industries in the area include agriculture and natural gas extraction. This rural area is decreasing in population and has seen a decline in major industries such as forestry. There is no CCS project proposed for the Fairview area; however, there has been a long history of natural gas extraction and energy development proposals in the region. Residents are familiar with the natural gas industry and the fossil fuel industry employs many in the area. The demographic characteristics, local economy and reliance on primary resources in this community sets the stage for support of energy developments and other projects that can provide economic and community sustainability.

CHAPTER SEVEN: COMMUNITY PERSPECTIVES OF CCS PROJECTS

Introduction

Public views on any controversial technology can factor into its successful introduction or implementation. Locally affected residents' perceptions of CCS are particularly critical to the successful deployment of controversial energy technologies, including carbon injection projects. This chapter examines: 1) community members' awareness of CCS; 2) residents' overall assessment of a CCS development in their area; and 3) factors that contribute to the community's assessment of CCS in the three case studies selected for this research. More specifically, I outline how various factors within the community contributed to the opposition to or support for a CCS project or energy development. In this chapter I endeavor to identify and elucidate the socio-cultural contexts influencing perspectives and decision-making in each community as these factors are critical to evaluating locally affected residents' views of CCS developments.

The results presented here include three case studies of how communities perceived energy developments or proposals in their region. This includes a community that already has a CCS project in place and a community that had a planned CCS project which was halted. Communities in the Weyburn and Goodwater area supported the large-scale EOR project. The Priddis community actively opposed the proposed carbon injection research project. The third case study, Fairview, did not have a proposed CO_2 storage and monitoring project. Insights from Fairview can offer lessons about risk perceptions, particularly because the community has had much experience with several other energy development proposals (including natural gas extraction, nuclear and hydroelectric projects). This case community can also provide valuable insights into residents' awareness of and views towards a potential CCS project in the region.

The results of these case studies include community observations and both the one-on-one and small group interviews. Insights from all data collection strategies are included here to provide a holistic understanding of community members' views as there was little difference in the responses between the two methods used. The first section of this chapter discusses the framework developed to understand local risk perceptions. I then use this framework to compare results from the three cases and discuss how local characteristics influenced support for or opposition to CCS development.

Examining Local Risk Perceptions Through the Lens of Place and Community

This study utilizes the lens of interactional field theory to examine how locally affected communities perceived a CCS development in their locality. Emergent elements affecting community perception of CCS development are organized broadly into three conceptual categories adapted from Wilkinson's conceptualization of community as an interactional field (see Flint, 2009): 1) demographic and community characteristics; 2) place-based knowledge and experience; and 3) interactions and relationships among residents. In the following paragraphs, I briefly describe these broad conceptual categories and describe why these categories help organize the results for this study.

Demographic and community sustainability characteristics – This category largely includes quantifiable characteristics that describe and aggregate attribute data about residents in a community. It includes such factors as community growth or in-migration. It can also include indicators such as how many generations have lived in the area. This is important as research demonstrates that residents who have parents or grandparents may feel more strongly attached to the place in which they reside. Other factors include the proportion of residents employed in

different sectors of the local economy, dependency on local industry and vibrancy of the economy.

Place-based knowledge and experience – This category describes attributes of residents that are not as easily quantified such as "sense of place" or "place attachment" as defined previously in this chapter. These characteristics can include appreciation of the local environment or perceived quality of living as a function of the physical landscape that is part of the community. The knowledge aspect can include long-term observations about or experience with the management of or modification to local ecosystems. It can include connections to the land, particularly from those in occupations that involve working with or taking care of the land (i.e. land managers, farmers, ranchers, trappers).

Interactions and relationships among residents – This category includes communication and interactions between local organizations, community groups and individuals. Interaction characteristics may include the importance of and frequency of interrelationships between residents in a locality and whether these relationships contribute to a broader affinity for the social system (i.e. community) that they identify with. Expressions of this category may include past instances of community mobilization (in this case I especially examine cases of past mobilization on development issues). This category also can include information about local leaders (or champions) in the area and how they respond to and communicate about proposed or current developments.

Each case study section presented below begins with a discussion of community awareness for CCS and overall support for or opposition to the technology. The three categories discussed above are then used to organize and examine interrelationships between specific

community and place characteristics in Priddis, Weyburn and Fairview that contributed to support for or opposition to CCS.

Case Study: Priddis, Alberta

Awareness of Carbon Capture and Storage

The Priddis area was to host a small carbon storage research project (see Images 7.1). The project ultimately was cancelled in early 2011 due to local opposition. Thirty-eight residents were interviewed in the Priddis area from July 15 to September 8, 2011. Participants were asked two questions to better understand residents' awareness of CCS: 1) have you heard of carbon capture and storage; and 2) have you heard about the University of Calgary project that was proposed for the region? All but three of the interview participants included in this study had heard of CCS and could provide a basic description of carbon capture and geological storage. Only four participants were unaware of the proposed University of Calgary carbon storage project. While most residents were able to provide a basic understanding of CCS, there was some confusion about the relationship between CCS and hydraulic fracturing.[42] Four participants stated that they thought CCS was similar to hydraulic fracturing projects. All four who thought carbon injection was similar to hydraulic fracturing had very negative perspectives of CCS.

[42] Hydraulic fracturing is also commonly known as 'fracing,' 'fraccing' or 'fracking.' Hydraulic fracturing produces

Images 7.1. Location of the Proposed CO_2 Injection Research Project near Priddis

Left: The Rothney Astrophysical Observatory. **Right:** The view from the University of Calgary land.

Community Perspectives of CCS

There were two general reactions to the proposed carbon storage project in Priddis: 1) ambivalence, or 2) opposition. The majority of respondents – 30 out of 34 who were aware of the proposal – were opposed to the proposed research project. There were no participants who stated that they were in favor of the carbon storage project *in the proposed location*.

Many community members interviewed stated that they had not vocalized their opposition to the project because of an upcoming community meeting that was never held. A resident who worked in the service industry stated:

> We sort of expected right from the very beginning [that there would be opposition] and there was supposed to be an open house that never came to fruition and had that happened, yeah I'm pretty sure there'd a been a lot of people there but because it didn't happen there was no ground swell (PR30)[43].

[43] All interview files were assigned a code and names were removed to provide participant anonymity. All direct interview quotes in this dissertation are labeled for ease of reference. Codes include a two letter location and participant number. Two letter location codes include: PR=Priddis, WG=Weyburn and Goodwater, FV=Fairview. For example, PR30 is a quote from participant number 30 in Priddis.

Many residents indicated that they would have attended the meeting had it been held. One retired resident suggested, "it would have been a royal bloody fight (PR07)." The majority of the residents interviewed stated that they thought the project should not be located in a populated area. For instance one resident said: "why wouldn't they do that in a more sparsely populated area? You know, it didn't make sense to have it here (PR11)." There were primarily negative perceptions associated with the proposed carbon storage project. The benefits and disadvantages perceived by residents in the Priddis area are illustrated in Table 7.1 to provide a snapshot of the general risk perceptions. They are discussed in depth in the following section.

Table 7.1 Priddis Residents' Perspectives of Positive and Negative CCS Attributes in the Community

CCS in The Community	
Positive	Negative
Increased use of University of Calgary land	Increased traffic
	Increased noise
	Threat to drinking water
	Possible earthquakes
	Threat to nearby conservation area
	Threat to wildlife
	Possible leaks (ground and water)
	Possible industry growth and development

While most residents were opposed to the proposal, four were ambivalent about the carbon injection project. As one retired resident explained: "The reason for me being ambivalent is that there is a lot of people who derive a very satisfactory living from the oil and gas industry

here (PR20)." Two residents explicitly stated that they were ambivalent *until* the Cross family[44] spoke out against the project.

An Examination of Factors Influencing the Perspectives of CCS

Interactions and Relationships Among Residents

Community identity and relationships

One of the most common themes in the Priddis interviews was the importance of "community." Most residents discussed their connections to people and relationships in Priddis and the greater Foothills area. Thirty-four of 38 residents indicated that the interrelationships between people in the area were important to them and a reason for living in the area. A resident who worked in construction discussed this in one of the interviews:

> I don't just have a family at my core of who I am, I have a community and it's a connectedness that you don't just get by sharing an address. You have to share a connection, a personal type connection or an ethical connection or a cooperative connection. The larger group can all have the same address but if you connect, then you're part of the community. When a crisis hits, they're [the community] there, they will step up to the plate…you have to recognize that there is the core and then there is the fringe that supports the core…yep, that's how I see my community (PR35).

Many interviewees indicated that they felt a strong attachment to others living in the area, and expressed a desire to protect the sense of community and reduce conflict among individuals. This protection of community was indicated by 12 people as a reason why residents may not support developments that could cause disputes between people in the area (see Images 7.2).

---

[44] As discussed in the previous chapter the Cross family were some of the first ranchers in Priddis, donated land to the University of Calgary and are influential residents of the Calgary region.

Images 7.2. Events Attended in the Priddis Area

Left: Millarville Farmer's Market. **Center:** The Priddis Fall Super in the Priddis Community Hall. **Right:** Local rodeo competition.

Communication networks

There are strong informal and formal communication networks within the community and the greater Foothills region. Many Priddis residents indicated that they obtain much of their information through formal communication networks such as the Internet, TV, and newspapers, among other mass media. However, informal communication networks such as interpersonal communication (e.g. neighbor-to-neighbor communication) was considered by three-quarters of respondents (n=28) as an important means to get information about the community. Informal communication networks were critical to the rejection of the carbon injection proposal site because community members spread information about the potential drawbacks and consequences of the proposal through these channels. These included both word of mouth and letters written among residents (including letters written to the local newspaper and municipal government). Half of the interviewees (n=12) who knew about the project indicated that they heard about the university proposal from another community member. When discussing CCS, one service industry resident stated:

> I know he [Dr. Lawton] had gone around and was talking to people and they all [the community] know what's going on. They all talk amongst themselves, it's a very close knit community…I just have to say one thing, like we're having a BBQ this night and then all sorts of people show up because its just this network communication that exists (PR15).

I observed firsthand the strong communication networks in the Priddis community. A few participants knew whom I was interviewing next even though I had not told anyone.

Community members also cited the importance of social media as a means to mobilize the community. Ten interviewees cited social media as a method to disseminate information and to mobilize the community. For example, some residents have used Facebook to mobilize community members to support local functions. As one retired resident explained:

> There was a crisis because the board running the Millarville Agricultural Society decided that they were going to cancel the fair. Well, within days you have like a thousand people who are supporting the fair…This was probably the first time that a real, electronic blitz became part of any negotiation in the community and it was resoundingly successful (PR20).

Presence of local champions

Respondents made it clear that one of the most important reasons for the rejection of the carbon injection research project was the presence and voice of the Cross family (see Images 7.3). The Cross family opposition to the project was outlined in chapter 6. Three quarters of the interviewees (n=28) spoke of the Cross family [particularly Sandy Cross, the man who donated the Anne and Sandy Cross Conservation Area]:

> Cross is a powerful guy. You know who the Cross family is don't you? One of the big four…in the brewery – huge, big man in the Ranchman's Club, big guy in the Stampede, powerful person, alderman for many years, formidable personality, money, elite, married into Colonel Macleod's family, books written about him. This is Calgary elite, this is Calgary aristocracy, that's who you're talking about. The Calgary aristocracy, not just Calgary money, Calgary aristocracy (PR36).

Other Priddis residents emerged as local leaders who were willing to spend time and effort to ensure that the carbon injection research project did not proceed. For example, members of these influential families wrote letters to the editor and talked to the university administration about the opposition of the project in the area. Residents within the area were particularly aware that the

Abbots (Marshall Abbot is Sandy Cross's son-in-law) were influential in the cancellation of the carbon injection proposal, "Obviously, once the Abbotts spoke out…which you don't see very often of people of their level of prominence. They tend to keep a low profile, but I think that was when momentum may have changed (PR06)." More than a quarter of interviewees (n=11) indicated that they became more actively opposed to the proposal because these influential people were against the project.

Images 7.3. Ann and Sandy Cross Conservation Area

Left: A building located on the Cross Conservation area. **Right:** The Cross cabin where Sandy Cross lived before he married Ann and moved to a nearby location. The Cross family donated 4,800 acres for educational programs, to protect habitat for native species of plants and wildlife (Cross Conservation, 2012).

Community Networks

Priddis residents have utilized community networks to collectively mobilize regarding issues such as environmental protection, subdivisions or other developments. One resident in the service industry stated, "in the Millarville, Priddis area….they'll really band together to get stuff accomplished (PR27)." Another participant from the oil industry stated, "it's nice to see people with that kind of heart and determination and I'll tell you when the Millarville-Priddis group

decide something, they can move mountains when they all get together, there's no question about it (PR26)."

Almost all of the interviewees (n=35) commented on the ability of community members to come together and use local networks for or against a project. A number of residents provided examples of when Priddis residents had mobilized in the past. The majority of examples were efforts to reject subdivision proposals. A typical example included stories of people who wanted to subdivide their land:

> It just became a huge issue in the M.D. and the people that had been there for three, four generations were totally opposed to seeing this area developed…the total community just rose up against it and once they did that, they just band together strong and the M.D. finally had to say no we're just not going to let it happen (PR30).

The mobilization of Priddis residents has included the formation or utilization of community organizations (discussed further below). For instance one resident recounted that *The Priddis Millarville Residents Association* was formed because one "of the prime concerns was developments, and the pressure it's likely to bring (PR12)." These findings reflect classic notions that when a community that exhibits strong ties to place feels threatened, they will often band together for collective action (Fritz, 1961).

Demographic and Community Sustainability Characteristics

Access to financial resources

The average family income in the M.D. of Priddis is almost double the Alberta average (Statistics Canada, 2006). Residents indicated that the potential for increased jobs or visitors to

the area as a result of the CCS project[45] were not seen as an incentive for the community because there was not a demand for the influx of resources from the proposed project. Many people who live in the area have significant financial resources and residents suggested that many in the area do not concern themselves with economics/environmental tradeoffs (e.g. tradeoffs between increasing income for the use and possible degradation of land) (see Images 7.4). As one resident described:

> These guys they band together and there is some of the most beautiful land in the world just west of here and there's big tracts that will never be developed because they got the money, the money doesn't lure them, somebody comes in and say we'll give you $250,000 a quarter or we'll give you $1,000,000 a quarter -- sell us this land…not going to happen (PR22).

Images 7.4. Priddis Land Value and Proximity to Calgary

Left: The land in the Priddis area is highly valued. **Right**: A view of the City of Calgary from the Priddis area.

A respondent suggested that people want to live in the Priddis area *because* there are few industrial developments in the area, "there are those who have spent two to three million dollars to have a home to be a part of this rural atmosphere and that's what they paid for (PR08)." Hence

[45] Due to the nature of the project (a University research project) it was unlikely there would be local job creation.

the potential increase in visitors or services associated with the CCS project were not perceived as benefits; rather, they were seen as a negative impact on their existing community.

Multi-generational residents

Ownership of land in the Priddis M.D. often extends for many generations – 67% of residents in Priddis are third or more generation residents. Members of these families are often seen as local leaders or trendsetters due to their connections in the community and their influence (see section above on local champions). For example, descendants of the Cross family and the McEwan family have lived in the community for many years and are well respected. One in four interviewees (n=12) expressed a desire to respect the wishes of Sandy Cross about the land he donated to the University of Calgary (i.e. residents stated that he would not have wanted a CCS project on the land). As one resident explained:

> Sandy Cross donated all that land and he'd be just spinning in his grave and so all of his descendants are saying no you can't do that...That's not the intention, he went to a lot of effort and everything to make sure that this land was going to be protected for a lot of years after he was dead and gone (PR20).

Ten respondents indicated that their own family members (not necessarily prominent members of the area) had lived in the area for many generations and that this motivated a current desire to protect the land against risks and developments such as the carbon storage project. Residents wanted to preserve the unique and undeveloped nature of the area that those families had begun:

> It's the way that I was brought up, it's [the land] is meant to be kept raw and natural, a lot of people that live out here now feel very strongly in the same way…I think I'm more that way because that's how my Dad thought so I've been engrained or I've be taught to you know, you just keep it that way (PR12).

Desire for population growth and economic sustainability

There were no participants who stated that they wanted community growth or that they needed economic growth to sustain their community. Population growth due to the project was not discussed because of the nature of the University research project – it was unlikely that there would be population growth associated with the project. The project would have likely been viewed even more negatively if there had been population growth. As discussed in the section on community relationships, residents in the Priddis area have fought against subdivisions and population growth in the area. A retired resident stated, "people around here do not want growth, ironically even the new people don't want anybody else coming in, they want to be the last ones to move into the community (PR29)."

Place-Based Knowledge and Experience

Local peoples experience with development

Priddis is an area where developments are rarely welcomed. Both housing and industrial developments have been and continue to be a major source of controversy in the area. A quarter of the interviewees (n=11) stated that the CCS project was perceived as "industrial" activity. This "industrial" activity was seen as having the potential to change the character of the local area, which residents appreciate in its current state. For example, "it's an area where these families have hung onto the property in large blocks to protect its aesthetic value and then to have industrial activity happening virtually in your backyard… I think that was something that upset people (PR10)." Other interviewees thought the CCS project would lead (i.e. open the door) to more industrial activity in the area if they agreed to this project. They felt that other projects would follow:

> It was viewed in part as almost an industrial activity and this is a bedroom community and there isn't really any indigenous industry here other than the pipelines which you can't see and I think…okay what are [we] walking into? Are we going to start to look like Aldersyde[46] or some place where there's a fair bit of oil and gas activity going on? I've moved out from the city to get away from this so I don't want it here (PR25).

Residents of Priddis have little experience with oil and gas or other energy developments in the community. However there was one natural gas well that had caused much concern for those who live in the area and this negativity has affected perceptions of further developments (discussed previously in chapter 6). The natural gas well allegedly contaminated an aquifer and resulted in a lawsuit. Nine interviewees indicated that the drilling and injection of CO_2 could contaminate the aquifer like the natural gas well had. As one retired resident stated:

> I don't know anybody around here if they were approached that would allow a well, there may be exceptions, but I don't know any personal contacts that would say oh yeah go ahead you can drill on my back forty. I just don't think it's going to happen, because everybody out here knows [name] experience [referring to the water well contamination] (PR13).

Respondents also indicated they did not trust companies that would drill for oil or gas (or inject CO_2) in the area because of the negative experiences surrounding the existing oil well in the municipal district.

Place attachment

Residents' relationship with and attachment to their locality was one of the most important factors in the community response and perceptions of the carbon storage project. Most interviewees (n=34) commented on the "picturesque" landscape of the area and often described it as "God's Country." Three in four interviewees (n=28) indicated that one of the reasons they

[46] Aldersyde is a community near Priddis also in the M.D. of Foothills #31.

lived in the Priddis area was because of the natural state of the land. As such many people were opposed to projects, such as the CCS project, which were perceived as disrupting that natural state. Priddis is a bedroom community for Calgary and residents reported that they live in the M.D. of Priddis because of the lifestyle and area. A resident in the service industry described:

> I know hundreds of people here that work in downtown Calgary and you know, the hell they go through to get there every day is more than I would want to do but they do it because of the quality of life when they're home (PR07).

Local independence and pride

Residents suggested that the history of the Priddis area and the pride residents have for the area contributes to the perceptions of developments such as the CCS project. As one resident said, "there's a very strong rural center around here and very strong proud people… (PR01)" Residents had pride in their traditions such as the *Priddis Millarville Fair*. If these traditions were viewed as being threatened it is likely to evoke a community response and be a cause for conflict or opposition. For instance at one point in time some organizers of the annual Priddis Millarville Fair attempted to cancel the event. A participant stated:

> Everyone was up in arms, how dare they cancel our fair, it was quite a to-do and in fact the fellow that was on the Board…he is a real-estate person…I'm surprised that he did that because he has history here too…I don't think he sold a piece of land or listed another piece of land since he did that…everyone was upset with him! I think people are strongly community minded here and don't mess with our traditions (PR24)!

Of particular significance was pride in the land and areas of special importance such as the local *Anne and Sandy Cross Conservation Area*. Residents commented that the conservation area should be protected and 12 mentioned they were especially troubled that the University wanted to develop it for reasons that were 'contrary to Sandy Cross's wishes' (i.e. implement a carbon storage project).

Concern over ecological and health issues

There were two *major* concerns surrounding a CCS in the Priddis area: 1) concern about the groundwater, and 2) the effect on local wildlife. The safety and sustainability of the communities' water is a major issue and is a concern for many in the area (see Images 7.5). This community has had a history of water issues, especially with subsurface wells that have dried up. Residents are particularly concerned about the quantity and quality of water in the area (Holroyd, 2008) and do not want anything in the area that could potentially cause harm to their water sources. The majority of participants (n=31) indicated that water was a major concern in the area, and 15 stated that they were concerned that the proposed project would threaten the groundwater. For instance one retired resident explained:

> I think the main concern [of the CCS project] was potential impacts on groundwater… There's one issue that always looms large over everything - that is water. Specifically ground water and that was one of the big concerns that people had was about the aquifer in the area…there doesn't seem to be a whole lot of hard data on just how much water is in the Foothills…I knew that for residents out in the area that is going to be a big issue (PR32).

Others discussed the problem of CCS leaks in general (not necessarily tying it to water): "there's no proof of what it's going to do down below and I know the Professor assured that it would be done safely, but it's in its early stages…look at what's happened there with methane gas." Fifteen were concerned about leakage, for example:

> It can cause damage…and CO_2 is a dangerous gas when it releases to the surface and it has been known to kill all kind of biological plants and animals and there have been cases where humans have been killed by accidental release of CO_2 from ground storage (PR35).

More than half of the interviewees (n=25) indicated how important it was to have wildlife in the area and near their homes (see Images 7.6). Uncertainty surrounding the impact of the CCS project on local wildlife and a perception that the project may harm local wildlife were seen

as a potential detriment to the community. One resident discussed the importance of the University of Calgary land for the migratory paths of animals in the area:

> There is a resident elk herd right now of about 300, there's beavers all up and down Pine Creek… there's whitetail, mules, I've seen lynx, bobcat, everything you can imagine out there. So it's a pretty special spot and the community recognizes that. There is a wildlife corridor and there's currently an elk herd moving around, they hang out on the conservation and one of their main migratory pathways is right through here and they come through this little gap [referring to the University of Calgary land] (PR22).

Images 7.6. A Herd of Elk in the Priddis Area

Elk are common in the Priddis area. Residents were concerned about how the CO_2 storage project would affect local wildlife.

Linked to the concern about animals was apprehension that the project would affect the conservation area. One in four interviewees (n=10) mentioned their concern about the impact of the project on the conservation area. A rancher in the area said, "anything that taps into the watershed would affect the conservation area (PR31)." Another indicated that "its is just so close to the conservation and to the head waters of Pine Creek which is responsible for a bunch of biodiversity in the area, it just was the wrong place (PR35)."

Fewer (n=4) residents mentioned their concern about how CO_2 storage might affect the stability of the area and the possibility of an increase in earthquakes. As a retired resident stated: "Because you certainly understand when you think about all the stuff that's down there why we have earthquakes and all that. We don't have much of that here, but we could (PR19)."

The increases of traffic and noise that would accompany a CCS project concerned five residents. A resident was worried that there "would be increased traffic and increased noise…and trucks would be coming in (PR05)." Another resident suggested, "anything that brings increased activity must be viewed with skepticism (PR06)."

Concerns about focusing events (in this case the alleged CO_2 leak at the Weyburn-Midale CO_2 Project)

Results suggest that the alleged leak at the Weyburn-Midale CO_2 Project was particularly influential regarding negative perspectives of carbon injection in Priddis as the announcement of the alleged leak coincided with the announcement of the university research project. A resident stated that he "remembered that a couple of people did bring that [the alleged leak] up as a concern because it was roughly the similar time (PR19)." Another stated, "Yea, then there was some bad timing like there's that one incident in Saskatchewan (PR21)."

Three in four interviewees (n=28) recalled the allegations of a leak at the Weyburn-Midale CO_2 Project during the interviews. However, it remains unclear if the allegation of a CO_2 leak at the Weyburn-Midale CO_2 Project was a major factor in opposition to the CCS project (e.g. if the project would have gone ahead if there were not allegations of a leak). Almost a third of interviewees (n=12) commented that the alleged Weyburn leak was a major concern, others suggested that it did not affect their opinion of CCS. There were four residents who had not heard of the alleged leak and they were still vehemently opposed to the carbon injection project. While some residents in Priddis had heard about the alleged Weyburn leak, there were residents who did not believe CO_2 leaks would necessarily be a problem in the Priddis area. For instance, one resident suggested that people used the leak as a point in their argument against the

CCS project, even if they didn't necessarily think there was a leak in Weyburn or that it would leak in Priddis: "we used it [for our argument], but there wasn't a similarity…you can't say okay cause they had leakage we're definitely going to have leakage. We didn't know that, but yes the timing from our point of view was perfect (PR20)." While there was concern about ecological and health issues that could result from a possible leak, some residents used the allegations as part of their arsenal of arguments against CCS, even if they did not believe there was a concern.

Case Study: Weyburn and Goodwater, Saskatchewan

Awareness of Carbon Capture and Storage

The second case study presented is the Weyburn/Goodwater area. The Weyburn/Goodwater area hosts one of the world's largest enhanced oil recovery (EOR) with CCS demonstration project (see Images 7.7). Interviewing participants from this area can provide reasons why this project has been successfully integrated into the community.

Images 7.7. CO_2 Injection in the Weyburn Field

Thirty-eight residents from the Weyburn/Goodwater area were asked two questions about their awareness of CCS and the Weyburn EOR project: 1) have you heard of carbon capture and storage; and 2) have you heard of the carbon capture and storage (or carbon injection) project in the area (see Images 7.8). For the latter question, participants were asked using the phrase 'carbon capture and storage,' and if they did not understand I would ask again using the phrase 'carbon injection project.' The majority (n=32) of participants interviewed in Weyburn/Goodwater had heard of CCS (or carbon injection) and could describe that it was injecting CO_2 underground. Six respondents had not heard of the Weyburn-Midale CO_2 Project. Four of these six respondents had lived in the area less than three years and did not work in the oil industry. Most residents interviewed understood that the Weyburn-Midale CO_2 Project is a 'carbon injection' project and could explain that it was prolonging oil recovery and production in the area. None of the respondents interviewed described the Weyburn project as a form of carbon mitigation (i.e. the purpose was to remove CO_2 from the atmosphere).

Images 7.8. CO_2 Education in the City of Weyburn

Left: Videos and information about the Weyburn CO_2 Project are displayed in a room at the Weyburn City Hall building. Information is provided about Apache, Cenovus, IEA GHG, enhanced oil recovery, the number of people employed by oil companies, the amount of CO_2 stored from the project, etc.
Right: International papers that discuss the Weyburn-Midale CO_2 project are displayed for the public.

Community Perspectives of CCS

Among the 38 residents interviewed, almost all (n=36) respondents from the Weyburn and Goodwater area indicated that oil (and therefore EOR) was a positive asset to the community. However, they did not necessarily distinguish between the oil industry and CCS, meaning they had high support for CCS because they also supported the oil industry. This positive reaction to CCS was primarily due to the fact that the Weyburn-Midale CO_2 Project is an enhanced oil recovery project and increases (prolongs) oil production in the area. Residents within the *city* of Weyburn were especially positive about CCS development (i.e. they were more likely not to state that there were any risks or negatives of the project). This may be because they were further from any possible health consequences of CCS and were more likely to benefit from the results of increased oil production and growth. As a local government member expressed:

> I've never really heard…gee I don't want to be in that area because it's CO_2 storage, I just don't trust it, I don't believe in it. I've never heard any of those kinds of comments. I'm not aware of anything that has been negatively impacted. I'm not necessarily involved with the R.M. [rural municipality] around Weyburn or other rural municipality districts…but I've never heard of that (WG03).

Participants in the Weyburn/Goodwater area perceived the Weyburn-Midale CO_2 Project as much more positive than the preceding Priddis case study. Table 7.2 outlines respondent's perspectives of CCS in the Weyburn and Goodwater area. The perspectives outlined here are discussed further in the following section.

Table 7.2 Weyburn and Goodwater Residents' Perspectives of Positive and Negative CCS Attributes in the Community

CCS in The Community	
Positive	Negative
Increase jobs	Increase traffic
Increase oil production (EOR)	Possible earthquakes
Positive perceptions of the area	Possible leaks (health and safety issues)
International fame and recognition	
City growth	
More money for rural municipalities	
Benefits for local industry	
Growth of surrounding communities	
Additional income source for landowners	

The only participants interviewed who stated they were very against the Weyburn-Midale CO_2 Project were those who alleged that there was a CO_2 leak on their farm. Those who lived in the rural areas were on average more concerned about the overall project than those in the urban populations. While most participants did state that they doubted that there were CO_2 problems, four acknowledged that there were some concerns such as rusty granaries, or other chemicals that were associated with the oil industry (including the injection of CO_2). However there was an acknowledgement amongst almost all (n=36) rural and urban participants in Goodwater and Weyburn that EOR was beneficial to the local communities and region. A local resident the service industry stated:

> It's just going to be more pump jacks you know. They realize that it is just another way of extending the life of this field because…the success of this operation really links back to the success of their farming operation so a lot of them really want there to be that steady pace of development and with increasing technology comes that steady pace so nobody wants to see this field shut in. They know that as long as this field is kept busy then it's going to support them which is going to support the ag [agriculture] industry and going to support the City of Weyburn (WG17).

An Examination of Factors Influencing the Perceptions of CCS

The carbon injection project near Weyburn has successfully operated for a decade with little public opposition. The following section will describe the factors that respondents indicated as contributing to public support for the Weyburn-Midale CO_2 Project. These factors are organized using the three factors discussed as important in the interactional approach for community (demographics and community sustainability characteristics; place-based knowledge and experience; interactions and relationships among community). Results demonstrate that participants perceive the carbon injection project, Cenovus and other oil field operators as part of the community. This makes community members unlikely to oppose the carbon injection project because they view the company and its operations as vital to community sustainability.

Interactions and Relationships Among Residents

Community identity and relationships

Community members in Weyburn and Goodwater described strong bonds between neighbors and how individuals watched out for each other's interests (see Images 7.9). Through these descriptions the importance of neighbors and the community became clear: "in our community you have the strong family bond, but then the extended family of your neighbors (WG07)." The majority of interviewees (n=30) indicated that their neighbors or others in the community worked in the oil industry – many indicated that it was important to support community members by also supporting the oil companies they worked for. Residents often mentioned that the oil company is *part* of the community and that the "community couldn't function without Cenovus in the area (WG34)."

Images 7.9. Events in the Weyburn Area

Left: Weyburn Multi-Cultural Days celebration. **Center:** Weyburn and District 'Communithon,' where residents raise money for United Way. **Right:** Weyburn Farmer's Market.

Communication networks

Strong formal and informal communication networks were described as existing among community members in Weyburn and Goodwater. These included communication in and among formal groups (e.g. Rotary, Young Fellows, Lions Club) and informal discussions among community members. More than a third of interviewees (n=15) specifically discussed how strong informal communication networks could be utilized to achieve local purposes, "when you want something done, but don't want to talk to local officials, you talk in the coffee shops, then everyone will know (WG38)!" Informal communication networks, such as interpersonal communication (e.g. neighbor-to-neighbor communication), were stated by the majority of participants (n=31) as the most common means to get information about the community.

Cenovus has attempted to address potential conflicts between the company and locals (e.g. sour gas smell, potential leaks) through their community relations' official who was born and raised in Weyburn. It was clear in discussions with those in the area that this community relations' official was well trusted in the community and people felt they could talk to her or others in the company. For example one respondent said that it was easy to talk with people in the oil field, "if we ever wanted to talk about the oil industry and geology I could phone up a geologist and say let's have a chat about something. I don't understand this can you explain this to me (WG10)." The alleged CO_2 leak in Weyburn has proved an exception to these clear

communication channels. Four residents in the Goodwater area commented that since the leak they are more concerned about talking about the oil companies' operations. For instance locals were wary about reporting potential impacts resulting from the oilfield operations (e.g. rapidly rusting grain bins) in the area because they didn't want to be perceived as "trouble makers like the Kerr's."

Presence of local champions

Approximately one in four respondents (n=10) acknowledged that there were a number of local champions in the community *and* that these local champions contributed to support for the EOR project. One participant described the importance of local leaders in influencing community perception of local issues:

> [What] makes a strong community? The people. There are champions within the community who build that community. They set the enthusiasm and the attitude within the community. These people build it and see a vision and they're the ones who support it (WG32).

Specific people and positions were mentioned as local champions. These included people such as the reeve, mayor, local government, business owners and other informal leaders around the community. Those who worked in the oil field were also frequently mentioned as local champions via their membership on boards, roles in organized events or help in mitigating disasters.

> We had a one in a hundred year flood this year…some of the oil patch people have donated all kinds of equipment to the municipality, man power, money, all kinds of stuff to help. We need these people in the community (WG16).

Community Networks

It was clear in discussions that residents of Goodwater and Weyburn have used community networks to mobilize against risks in the area, particularly in response to natural disasters. One of the most common examples included the large floods that had occurred in early 2011 (see Images 7.10). A retired resident stated, "I think a strong community is based on how everybody works together in the community. I think everybody pulls together and really works hard together…Weyburn is definitely that way (WG24)." There were plenty of examples of the community mobilizing without the oil industry. For example, residents mobilized to rebuild their neighbors' homes if they were damaged, or to raise money for those with cancer. Yet respondents also described how the oil industry had contributed to the mobilization of community resources or in the raising of funds. In this respect, the oil company was functioning in its role as a member of the community. "It's oil and gas down here so they're very responsive…especially when the community needs something…so very responsible corporate citizens but also very giving (WG19)."

Images 7.10. Remnants of the 2011 Spring Flood

Left: The main highway between Estevan and Weyburn. Six months after the spring floods water remains in the field. **Right:** Road closed signs were a common sight in the area due to flooding and road damage. Many farmers in the area were unable to plant crops due to the floods.

Demographic and Community Sustainability Characteristics

Presence of multi-generational residents

More than 75% of the residents in the Weyburn and Goodwater area are third or more generational residents. A quarter of the residents interviewed (n=10) stated that they wanted to heed the wishes of their ancestors and keep (or look after) the land their family owned. Those who made a living off of working the land (e.g. farming) commonly discussed the importance of keeping their land for future generations, often by permitting oil extraction on their land. A farmer in the Goodwater area described this desire to perpetuate farm life in the area:

> Well I live out on a farm… the land's been in the family for generations, they settled on this land so no I'm not going to give it up. It's sentimental value; it's not necessarily value from like commercial wise. No this is where my parents grew up and my kids are going to grow up and their kids are going to grow up and their kids, kids (WG35).

Desire for population growth and economic sustainability

Participants in Weyburn and Goodwater suggested there were numerous benefits of the carbon injection project related to their community. Much of this benefit involved community growth. Over half of the interviewees (n=18) discussed how oil recovery (i.e. the carbon injection project) would provide benefits to local businesses: "the oil industry brings a lot of business here for offices and vendors (WG22)." Residents mentioned benefits such as an increase in new stores, full hotels, increased business for stores and benefits to the local college. Three-quarters of the interviewees (n=30) indicated that development and city growth were a major benefit of the project to the city and nearby area. One city employee discussed the growth in jobs and other benefits that oil production brought:

> Most people are excited to see the growth and development. People are excited to see new stores opening up and new jobs. People are excited when their kids are coming home from Calgary to work… I know lots of people who have moved back…You know they left in the

> 80's and 90's to go out to Alberta and they're coming home now cause there's good jobs here. Love that and it's huge. Our shopping experience is better…The city just this week allotted a big swath of land for another football field. A huge new football field. Big new soccer field being built this year. Crescent point [an oil company] just gave the city a swack of cash last year. Our rink was massively upgraded. It is beautiful in there. Huge new high school…People like the jobs, people like the fact that their property values tripled. People like the fact that the wages are going up and their kid's wages are going up right. It's good, it's good (WG05).

The oil industry was also important to a number of smaller communities surrounding Weyburn. These smaller communities are dependent on the larger city center (i.e. Weyburn). As an example, Goodwater is 40.2 km from Weyburn and yet it has no gas stations, grocery stores, or restaurants closer than Weyburn. These smaller locations are at least partially dependent on the oil industry because of the resources it brings into Weyburn and the job opportunities it provides. One respondent stated that with the presence of the oil industry: "the smaller communities are going to survive, the two or three hundred population communities now have grown to five hundred and they can still have that community (WG25)." A government representative in the area indicated: "Every town I have visited [in the area] is doing a new subdivision … Communities that do not have the oil patch are dying and the only growth business in the area is the funeral homes (WG08)." Another resident in the oil industry noted:

> Lots of the smaller centers, the farms, they wouldn't be around if it weren't for this [oil industry growth]. You look at Stoughton, would Stoughton be able to support the forty-three suite hotel that was built last year? Without the oil field Stoughton is gone (WG014).

Dependence on industry

Community dependence on oil companies such as Cenovus was one of the most common themes in the interviews – mentioned by 36 of 38 participants – and permeated almost all other factors discussed in this case study. Almost all interviewees discussed the importance of the presence of Cenovus and other oil related industries in the community. As stated in the previous section oil companies were perceived as bringing money, jobs, resources and growth to communities (see Images 7.11). It was also credited as allowing younger residents to remain or return to the area. Many stated that the community would "have died" or "disappeared" without the oil fields. Another resident encapsulated this sentiment by articulating, "in my opinion Weyburn would not be here without the oil patch so they can drill holes wherever they want [referring to both carbon injection and oil extraction] (WG30)." Twenty-five residents mentioned the importance of the agricultural industry, *but also* admitted that the oil industry was one of the reasons for the stability of the agriculture industry because it allowed farmers to have supplemental incomes.

Images 7.11. Wor-kin Shop Truck Donation

Many residents discussed Cenovus' truck donation to the 'Wor-Kin Shop' as an example of how they help the Weyburn community. The Wor-Kin Shop is a non-profit charity that provides work opportunities for residents with developmental and intellectual disabilities.

Place-Based Knowledge and Experience

Local people's experience with developments

There is considerable experience and history with the oil industry in the Weyburn and Goodwater areas. The majority of residents interviewed indicated that oil industry developments

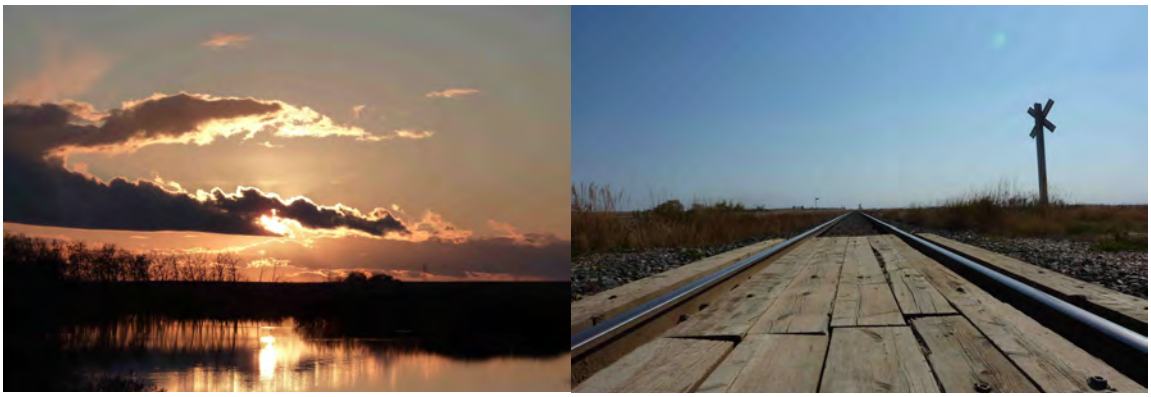
have been very beneficial to the area with the exception of the small minority who claimed that the CO_2 had leaked and done irreversible damage to their farmland. While the majority of respondents interviewed for this research reported positive experiences with the oil companies, 12 residents acknowledged risks such as oil spills. These acknowledgements also commonly came with the recognition that the companies usually reconciled damages. One service industry resident from Weyburn stated, "You're are going to have the odd spill…that stuff happens, but for the oil patch generally speaking we got some of the best corporate people around…and they're pretty conscious about what's going on (WG33)." Another retired resident described the good relationship between the public and oil companies:

> I do think that we have good regulations and good people involved in the oil companies… everybody seems to be very conscious. That's not to say that accidents can't happen or that environmental spills couldn't happen but I do believe we all accept that. There is some risk to everything we do in life…and what is important is that there's people monitoring, watching over and that there's regulatory powers that are doing what there supposed to be doing (WG01).

Place attachment

The majority of the interviewees (n=21) in Goodwater and Weyburn articulated an affinity for the area they live in. This was particularly true of those who lived in the area for many years, have parents or grandparents who lived on the same land, or those who live on farms outside of Weyburn. Many discussed not only the flatness of the land, but also the beauty of the area (see Images 7.12). One resident in the service industry stated, "most people just drive through the area and think what a flat place, but there is a beauty to this area and I think you have grown up here to truly know how special this place is (WG27)."

Images 7.12. Landscape of the Weyburn and Goodwater Area



Left: A lake south of Weyburn. **Right:** This view of railroad tracks demonstrates the topography in the region.

When asked if oil developments (e.g. pump jacks, CO_2 injection, pipelines, and roads) affect how residents think about the area, over half of the respondents (n=25) answered that it did not affect their perceptions of the area or landscape. A number of residents acknowledged that the oil industry had been present in the area for a long time and that they were used to the sight of wells and pump jacks. As one farmer described, "I grew up with all of this [oil] industry, it's not new to me and doesn't affect how I see the land, but this all came in when my dad was farming and he didn't like it, he didn't ever get used to it (WG02)." Others (mostly from town) stated they liked seeing the oil wells and pump jacks because that reminded them of the prosperity of the area (see Images 7.13).

Images 7.13. Oil and the Landscape

Pump jacks located in the Weyburn and Goodwater areas.

Local independence and pride

International notability and fame was discussed by one in two respondents (n=18) as one of the benefits of having the CCS project in the Weyburn area. The project has brought international scientists, politicians and researchers to the area. As an oil worker described, "the project is very significant in the world and one of the bigger things that is happening out there (WG14)." A few respondents specifically mentioned that the United States president knew about the project: "The average guy in Toronto probably couldn't tell you where Weyburn, Saskatchewan is, but Barack Obama can…when he first came to Canada he spoke about Weyburn Saskatchewan, that's a pretty big deal (WG38)." Four residents also suggested that CCS could not only increase the well being of the area but would help the *province and Canada* get through the recession. Others were proud that there was a possibility of developing a technology that can be used internationally:

> I think people see it as a good thing because of the technology being used you know, there's worldwide interest in it and environmentally the interest is in using that technology to reduce greenhouse gas…I think most people see it largely as a positive (WG031).

Five people thought that the technology development occurring in the Weyburn/Goodwater area was important for the sustainability of resources for generations to come:

> Developing this kind of industry is valuable to everybody. I really think that when they develop these areas and technology for oil development people see that as not only adding income but they see us doing good with that and we have enough resources for these people that live and not only for us but whoever else that they're selling to…we have to continue to do this to be able to ensure that our generations of people have these resources (WG27).

The carbon injection project was certainly framed as an enhanced oil recovery project and *not* as a strategy to reduce CO_2 emissions from entering the atmosphere. This is possibly

why the project was seen as a positive. There were six participants in the Weyburn and Goodwater area who mentioned the environmental benefits of the carbon injection project. However, the large majority – five of six – of these respondents were very adamant that climate change is not occurring. Reasons that the EOR project is perceived as 'environmental' by interviewees include that it does not use as much water resources as other oil recovery methods or that it will reduce greenhouse gas emissions. However the same residents would state that climate change was "a hype (WG05)," "bogus (WG16)," or "hocus pocus (WG31)." Two suggested it is good to reduce greenhouse gases and therefore help "combat the ozone hole (WG34, WG08)", repeating a frequent misconception of the greenhouse gas problem as being the same as the ozone hole problem. One suggested that they trust experts about the need to reduce CO_2 but could not explain why we need to reduce CO_2.

Many residents commented on how proud they were to be from a rural area and the desire to remain self-sufficient in their communities (see Images 7.14). Six residents stated this was a reason why they desired the oil industry in Weyburn, because it was a way for them to "stay rural" and live in the area. Many stated how hard times were in the 1930s and they try to make a good living off of oil and agriculture in case another depression should arise. One resident summed up this pride and the hard times of the 1930s:

Images 7.14. Old Farm Building

Residents in Weyburn discussed pride in their 'rural roots.'

> …In the thirties they had to be tough because of the terrible winters, all the agricultural land being swept away by storms and winds and everything. They haven't forgotten that. They haven't forgotten that and even though they couldn't bang pennies together in the thirties and now they pay for coffees with twenty-dollar bills, but their mentality is the same. That hasn't changed. Because it's kind of like okay, we're waiting for the next wave of difficult times to come. Right now they're in the middle you know just an amazing boom and that allows them to forget you know about for a while of how harsh the place can be and how harsh it's been. There's a kind of loyalty here but it's mainly from people who are here of long standing (WG20).

Concern over ecological and health issues

While growth was considered a positive for Weyburn and Goodwater residents, there were some negatives as well; "there's a lot of pulls on resources like labor and people and management. It's growth right, there's challenges (WG05)." The two concerns mentioned most with regards to enhanced oil recovery associated growth were the increase in traffic and housing shortages. In total, 13 residents indicated that the increase in traffic was a negative associated with the oil industry in the area and 25 expressed concerns about housing shortages in southeastern Saskatchewan. Housing shortages were particularly a concern for those who did not have a large income (e.g. working in the service industry). As a resident who worked at a local hotel explained, "I can't afford to live here (WG31)." Another local government official stated they can't keep up with housing: "housing does remain a problem which leads to the problem of there's a lot of jobs but can you provide a place for them to live if you bring in people (WG15)."

There were very few concerns about ecological or health issues in the area. Almost all of the interviewees *within the Weyburn city limits* stated that there was no health concerns associated with the project. However, there were a few people who lived in the nearby rural municipalities who thought there *could potentially* be issues, either with CO_2, with the chemicals already in the ground or other chemicals used in the injection of CO_2. As one rural resident

described "I'm more concerned about the H_2S than the CO_2…and I've expressed that, it's funny how wire on fences are rusting in this area and stainless steal rusts before the CO_2 ever came in, H_2S is scary in our minds (WG28)." Concern over ecological and health issues is linked to the alleged Weyburn leak; therefore, the discussion is continued in the following section.

Concerns about focusing events (in this case an alleged CO_2 leak at the Weyburn-Midale CO_2 Project)

The majority of interviewees – 31 of 38 – did not think there was a CO_2 leak from the Weyburn-Midale CO_2 Project. There were two residents who acknowledged that there could be a leak, three who indicated that there was likely a leak and two who chose not to respond to the question. Two of those who thought there could be a leak or that the project was likely leaking suggested that they were confident that Cenovus would fix the problem:

> Obviously Cenovus is dealing with it and the scientists are there and the outcomes will be what they are but I'm confident with Cenovus that they will come out and prove that this project is okay. I am not losing any sleep at night. None (WG12).

One of the biggest reasons respondents believed there was not a leak was the high level of trust in Cenovus to operate the carbon injection project. This sentiment was due to the large number of workers Cenovus had in the area. Over half of the interviewees (n=23) specifically acknowledged that they trusted the oil companies in the area. As a resident stated, "Cenovus would do everything in their power to make sure there was not a leak because many of their workers live in the community (WG31)." Another resident described the trust he had in Cenovus and the scientists:

> Cenovus did extensive testing before hand to see what CO_2 was being emitted from the ground and they've done extensive testing after the fact and I believe there is actually less CO_2 coming out of the ground in that area of question than there was before. They didn't

> just put CO_2 in the ground to see if it worked. It's scientifically tested and retested and retested. No oil company is going to put people's lives at risk for the sake of profits and I truly believe that. For the most part all companies, oil companies included have the best interests of their community at heart (WG18).

Two in five respondents (n=15) indicated a high level of trust in scientists and researchers to monitor the development of EOR technology (including the Petroleum Technology Research Council, IPAC-CO_2 and independent investigators). One resident explained it this way, "Can I say it's not going to come up? No, but there's a lot smarter people than me that developed it and telling me its not going to happen so I'm not scared (WG13)."

Conversely, there was little belief in the Kerrs' claims of the alleged leak, especially among those who lived within the city limits. Within the community many questioned the credibility in the Kerrs' statements (e.g. they were "forum shopping (WG06)," "paranoid (WG18)," "looking for a pay out (WG34)"). However, there were some living within the Goodwater area who were sympathetic to the Kerrs' concerns:

> I've known Cam all our lives. I really believe what Cam thinks is right in his mind and he doesn't care what anybody else thinks…and if there's something wrong, if he is absolutely right, I'll be so glad that he has done what he has done…let him have peace of mind when it's over (WG28).

There were five participants within the rural municipalities who stated that they were glad that the Kerrs' said something (even if they didn't think that the Weyburn project was leaking), just to get the issue examined. A couple of residents near Goodwater indicated that they did not want to bring up concerns that they had about the carbon injection or oil field operations:

> There is one family that has been quite outspoken about the CO_2 project and it's kind of made the rest of us not want to say anything because we don't want to be labeled like a trouble maker…even at a public meeting nobody really wants to say anything because they don't want to be labeled (WG09).

Therefore, residents were supportive of independent tests (even if they did not think there was a problem) because they felt it would help reduce concerns and reduce conflict in the community, especially between the Kerrs and the other residents.

Living off the land

For some farmers, the presence of the oil industry, and the extra income it provided through secondary job opportunities or the leasing of land for wells and pump jacks, provided a way to retain the land and the lifestyle they sought to perpetuate.[47] As one resident in the service sector stated, "people might think the oil patch is ugly and dirty… my dad essentially lost his farm, I would rather see 10 pump jacks on my land and keep my farm afloat (WG21)."

Images 7.15. Weyburn Inland Terminal

The Weyburn Inland Terminal, located south of Weyburn, is one of the largest grain terminals in Canada (Weyburn Inland Terminal, 2012). There are many residents who farm in the area.

Eight farmers (retired or currently farming) discussed how important the oil industry was to the sustainability of farming (see Images 7.15). The additional income was especially critical during the past few years because there had been trouble planting the crops because of flooding. A local government official in Weyburn commented on the importance of the oil industry to the agriculture industry:

[47] This area has a large agricultural industry; therefore, this category overlaps with the previous 'multi-generational residents' category.

> You know a lot of those people that have the oil activities opened up to them, you know as tough as agriculture is… it's just one more thing that has helped them stay where they are and enjoy that lifestyle. It's not easy on the farm. You know but they choose that lifestyle to live. So I think that they have thought that's really great. I think generally the oil activity has been a blessing in the area that it has not only for the individual farmer but those smaller communities that maybe weren't going to survive and are now surely going to survive (WG23).

Case Study: Fairview, Alberta

Awareness of Carbon Capture and Storage

Interviewing Fairview residents provides an opportunity to examine the knowledge base about carbon capture and storage among a rural population that is not directly affected by it. Forty-four residents in the municipal district of Fairview were interviewed during the course of six weeks. Of the 44 people interviewed, 29 stated that they had heard of CCS. However, only half of the interviewees (n=21) were able to provide a very basic description of this technology (i.e. the subsurface injection of carbon dioxide).[48]

Overall, community members had relatively little understanding of CCS as compared to the other two communities. There was some confusion among residents when asked, "have you heard about carbon capture and storage?" Four residents assumed carbon capture and geological storage was the same as carbon sequestration by forests and plants. There also was uncertainty about *why* carbon dioxide in the atmosphere needed to be reduced. For example, a resident asked, "why are you taking carbon out of the air? Isn't it good to have it in the air (FV05)?" Another resident assumed it was a technology used in hydraulic fracturing operations.

---

[48] The disparity between the number of residents who indicated knowledge of CCS versus those who could actually provide a general description could be attributed to 'demand characteristics,' which refers to when a participant

Interviewees articulated a number of conceptions about why carbon dioxide needed to be reduced. For example, three interviewees stated that CO_2 in the atmosphere needs to be reduced only because it contributes to the ozone hole – not to mitigate climate change. Others (n=7) did not know why CO_2 should be reduced, but stated that CO_2 should be reduced and this would improve the environment.

Community Perspectives of CCS

Fairview residents gave three primary responses when asked about the community's reaction to a possible large-scale CCS project in the area: 1) twelve residents stated that the community would support and actively pursue this development in the area; 2) seventeen said that the community members would be indifferent or ambivalent; and 3) seven suggested the community would actively oppose the development (eight residents were not clear in their response of whether they thought the community would support or oppose a project). Fairview had the most diverse responses to a possible CCS project among the case studies included in this research. The advantages and disadvantages of a large-scale project in the community are illustrated in Table 7.3 and discussed in depth in the following section.

Table 7.3 Fairview Residents' Perspectives of Positive and Negative CCS Attributes in the Community

CCS in The Community	
Positive	Negative
Increase jobs	Increase traffic
Increase oil production (EOR)	Decrease land values
Positive perceptions of the area	Possible earthquakes
Town and M.D. growth	Possible leaks (health and safety issues)
Additional income source for landowners	
CO_2 for plant growth (from leaks)	

Those who were most likely to support a CCS project in the area were those who believed there was little risk involved *and* assumed that there would be economic benefits for the town and surrounding areas. Those who owned land were more likely to support a project if they would also gain money from the injection of CO_2 on (or under) their land. A farmer from the area stated:

> They'd [community residents] be all over it like a dirty shirt. Oh Sure! Pump some air down the ground if you like. We'll take your money. If you're dumb enough to pump air down the ground we'll take your money (FV14).

Residents (particularly business owners) were predominantly supportive of a CCS project in the area if it would bring the town growth, jobs or economic benefits. A business person stated, "Fairview would take anything...if it would create employment and opportunities for our youth to stay in our community. Yes, Fairview would take just about anything (FV25)."

More than a third of interviewees (n=17) stated they would be ambivalent or would not care if there were a CCS project in the area. Those who showed ambivalence often cited that it would probably be a normal oil field operation. Seven of the 17 residents also suggested that CCS would be more accepted if the project were managed by Devon (the gas extraction company in the area). A farmer stated, "people will be indifferent, they couldn't care less, we have holes drilled around here all the time…people won't care especially if it is run by Devon (FV22)."

One in six interviewees (n=7) were against the idea of a CCS project in the area. People who lived outside of town were usually more negative than those living within town limits. One retired farmer stated, "well, I'd certainly want to know more about it…anything that messes with mother nature cannot be good (FV38)." Others were against CCS because they did not believe

in anthropogenic influences on climate change. A resident in the service sector stated: "if its just a natural phenomenon that our temperature changes then it doesn't matter whether the CO_2 is floating around, in fact plants love carbon dioxide (FV09)." The following section will provide a greater explanation of the reasons for and against CCS in the area.

An Examination of Factors Influencing the Perceptions of CCS

Fairview does not have a CCS project planned or proposed for the area. However studying this community affords an opportunity to understand the factors that have led to community perceptions about other energy systems (in this case oil and gas, nuclear, hydroelectric projects). In that respect it provides insight on how such a community may respond to a CCS development. The following section will describe the factors that respondents indicated as contributing to public support or opposition to past or future energy developments in Fairview. Factors are organized using the framework used in the other two case communities (demographics and community sustainability characteristics; place-based knowledge and experience; and interactions and relationships among residents).

Interactions and Relationships Among Residents

Community identity and relationships

Almost all – 43 out of 44 – of the residents interviewed in Fairview described the importance of community bonds in the area (see Images 7.16). The bonds between people in Fairview and their attachment to the community were also cited as a primary reason for residents to live in Fairview. As one long time resident of Fairview (service industry) described: "I live here [Fairview] mostly for the community, it just feels like home here (FV25)." The strong sense of

bonds between people and a desire to enhance their collective well being were also discussed as a reason to resist future developments. For many it was important to be perceived as a "good neighbor" and to not cause conflict between residents. Implicit in these feelings was the perception that some energy developments may harm neighbor relations or the livelihood of residents.

Images 7.16. Events in the Fairview Area

Left: Fairview hosts the 2011 Alberta Senior Summer Games. **Right:** Annual "Fly-In Breakfast" at the Fairview airport.

The effects of energy development on existing community dynamics and functioning were a primary concern of approximately a third of the residents (n=16) interviewed. The following quote from a Fairview resident clarifies this concern: "Issues like the hydro dam, nuclear energy, that type of thing, a reason why we stay out of these things more than we should is because we don't want to hurt the community (FV12)." Another resident discussed why they would not want a nuclear power plant in the area, "no one would dare build a nuclear plant in Friedenstal [smaller farming area within M.D.], it would cause ripples and fights, and if you were a good neighbor you wouldn't allow that (FV37)."

Communication networks

The most common information source cited by Fairview residents – 40 out of 44 – were informal communication networks. This was especially true when residents sought information about what is happening in the community (including possible developments). As one resident in the service industry described, "when people in this community want information they usually go to their neighbors, that may not be the best, but perhaps your neighbors have heard something… most people stay within the community [for information] (FV16)." Half of the interviewees (n=22) cited coffee shops as the most common place to get and share information, partly because they did not want to share their views publically. One farmer stated, "most of the town issues get solved in the coffee shops (FV14)." Another resident stated:

> Sometimes they [councilors, mayors, chamber of commerce] can be intimidating to people, when it comes to a point where people feel strongly enough about it they will speak out and maybe not in a formal way, but they'll talk in the coffee shops and that always gets back to everybody. There are no secrets in the coffee shops (FV29).

Others developed more formal groups to share information about local energy developments. For example, a group of local residents had developed an information exchange where they shared articles, publications and other information on nuclear developments in the area through a list serve. Others used Fairview-specific information sources such as the local RCMP, town council, the local 'Devon[49] Land Man,' or *The Fairview Post*.[50]

Presence of local champions

---

[49] Devon is the major natural gas extraction company in the Fairview area.
[50] The Fairview Post is the local Fairview newspaper.

"If the community wants something, it doesn't always happen – it just depends on who is put in charge (FV22)." This quote exemplifies Fairview residents' perspectives about the importance of local champions in mobilizing support or opposition of local developments, including energy developments. A third of interviewees (n=15) noted the importance of local champions when challenging or encouraging a development in the area. Of particular importance was the description of "informal" leaders, who are typically not elected officials, but rather are influential citizens who others respect. For example one resident described how informal leaders emerge in times of need:

> There's good people in office…but in a crisis situation the people that may be in the leadership roles right now will not turn out to be the leaders, I think that's what happens in a crisis, the real and true leaders show up (FV40).

Community Networks

Residents of Fairview have organized informal groups in the past to address perceived problems. One previous instance was to discuss support or opposition of the nuclear power plant. When a problem or risk event occurred, residents indicated that these organizations would influence perception and address the problem. Fairview residents were confident that their community would develop collective perception regarding issues that concern residents, "I think a group of people would lead. I think everybody would just band together and say this is what we need to do (FV26)." They also described confidence that personal issues among residents would be put aside and that residents would help each other if a hazard event occurred: "you know people that don't get along to good, they will still come together, if there's a disaster, they bury the hatchet (FV18)." It was less clear what would happen if an issue arose that caused problems amongst

residents (e.g. something like an energy development that benefited some and adversely affected others).

Demographic and Community Sustainability Characteristics

Presence of multi-generational residents

Fairview residents who inherited land from their parents or those who were planning to pass on their land to their children described a greater need to care for the land and be cautious of new developments. Ten residents indicated that they would be concerned about new developments because they wanted to pass the land down to future generations. As one Fairview farmer described:

> If you have a next generation child, that's when it becomes really important to take care of it [the land], I think there's people in the community that don't have that situation and really don't care that much as long as it serves their purpose and they make money (FV28).

These multi-generational residents or those who planned on passing on their land to another generation were more likely to perceive additional energy development as a potential negative impact to their landholdings or their children's perpetuation of their farming lifestyle. For instance residents discussed the importance of sustaining the land tenure and uses during the next generation:

> FV39: We have to take care of it [the land]. It's our legacy. Like I tell my kids, I can't really control what they do with the land after I'm gone, but its not going to be sold while I'm still alive.
> FV40: Yeah, ours is not mine to sell either. It's our kids, and their kids.
> FV39: It's my time to work with it and my names on the title. When it comes to the next generation. Hopefully the children will keep it for the next generation. It doesn't mean they'll be farming it. Hopefully they keep it; they'll keep the land.
> FV40: I agree.

Desire for population growth and economic sustainability

Residents living in the town of Fairview were likely to discuss the need for economic development to create a 'sustainable' community. Ten town residents indicated that they feared the community would become a ghost town or become like one of the other neighboring towns where there was no commerce and few people. Residents who discussed the need for growth were more likely to say that Fairview needed economic development like the kind offered by energy developments. That being said, a smaller minority of town residents stated Fairview doesn't need additional income when compared to other area towns.

> Fairview is relatively well off so if there's a prospect of a new industry, a nuclear plant, a power dam or a gas plant we say that's good, but when you run that through dead and gone, Alberta, somewhere where they don't know where their next meal comes from, then a nuclear power plant looks pretty darn attractive so… I think we're a little complacent here. Were not starving to death here so I think that's where the perception comes…how bad do you need it [energy development] (FV08)?

Residents of Fairview stated that there could be many advantages to hosting a CCS project in the area. The most common benefit, mentioned by half of the interviewees (n=17), was the possibility of economic growth and jobs. Town growth was mentioned by many residents, such as a business owner who stated: "a lot of people in this community would like to see Fairview as bigger than it is; there is a lot of people that want to see a stable economy and a stable community to attract more people (FV27)." Others compared potential CCS development to other possible developments in the area. As one local government official said: "It's not like nuclear where we're all afraid of it. If it's something…like nuclear then we don't want it, but it [CCS] would bring money into the economy. It would bring people, jobs. If you could bring more people into Fairview that would be great (FV43)."

Another economic benefit was the possibility of producing or recovering more oil in the area. Participants speculated that CCS could bring more money into the municipality as well as more jobs. As a retired resident suggested, "if it could increase oil production, that would be OK (FV03)."

Fairview, like Weyburn, is the hub for a number of smaller communities and towns. The greater M.D. of Fairview contains multiple smaller farming communities. Examples of small communities in the Fairview area include Friedenstal, Highland Park, Vanrena and Gage (see Images 7.17). Residents described how these different communities work together and depend on one another to maintain the well being and functioning of the area. The following is a statement from a resident of a smaller farming area in the M.D. of Fairview:

> Our community is so dependent on the greater community. You have to give credit to the greater community because we are able to exist because the communities around us are successful, good communities. We are not an island. Our community is able to thrive because we are surrounded by other communities that are doing well (FV24).

Images 7.17. Communities in the M.D. of Fairview

A Fairview resident holds an old M.D. map illustrating some of the smaller sub-communities in Fairview (e.g. Vanrena, Friedenstal, Highland Park).

Residents commented that the sustainability of the larger 'Fairview community' was important – eight specifically commented that they would be more likely to support industry growth or development to protect the *region*. Another service industry resident commented on the need for the sustainability of the larger Fairview community for the health of the smaller communities:

> People just want to see the betterment and sustainability of communities and that's a scary thing when you're talking about a community disappearing. They're disappearing all the time…lots of the surrounding villages and hamlets aren't economically feasible…if it weren't for their neighboring rural partners they should, they would probably disappear (FV34).

Dependence on industry

The majority of the interviewees (n=34) also described the importance of the natural gas industry in supplementing and supporting the economic vitality of the area (see Images 7.18). Some residents discussed their pride regarding the strength of the oil industry in Fairview and the benefits it provides to the community. For example one respondent went so far as to say: "we think they [natural gas companies] are the backbone of the community (FV44)." As in Weyburn, economic benefits associated with the oil industry extend to both farmers and the town itself. There was also an acknowledgement that there was a dependency on the fossil fuel industry (particularly Devon) for jobs in Fairview. One respondent described this dependence:

> We can't survive without the big boys [Devon] you've got to have them in your backyard and you've got to have them as good corporate citizens and you've got to have their employees and their expenditures and their students in school and round and around it goes (FV15).

Images 7.18. Natural Gas and the Landscape

Farmland and natural gas wells often coincide in the Fairview area.

Respondents in Fairview demonstrated quiescence when it came to arguments against the fossil fuel industry. This quiescence stemmed from the importance of the oil industry to the local area. As one resident described:

> We had problems with one of our sour gas wells… but we didn't know what to say because a lot of our community works for Devon…enough that you don't want to hurt them, their livelihood. So when it becomes personal you don't fight too hard (FV23).

One of the most common factors cited as influencing potential support or opposition of future energy development concerned how the existing relationship between the company conducting the development and the Fairview community. For instance one respondent talked about the existing relationship of Fairview residents with one oil company in the area, "if Devon came along, because they've been here for so long, been established for so many years, have so many community members working for them. If they were the company to come in and put it in place the community wouldn't even argue (FV23)." Another farmer acknowledged that if it were an "outside company" conducting a CCS project it would be very difficult to gain local acceptance: "If you were an outsider you might be able to put a CCS project in, but it wouldn't be easy. Every cow that died in the next twenty years would be your fault if you put it in (FV05)."

Place-Based Knowledge and Experience

Local peoples experience with developments

Fairview residents have had a number of experiences with proposed energy developments (e.g. nuclear and hydro) and the area hosts existing energy projects (i.e. oil and gas). Dealings between the Fairview community and energy developers have resulted in both negative and positive outcomes, however most suggested that the overall outcomes to individuals and the

community from energy development have been positive. As discussed previously, the fossil fuel industry brought both economic development and employment to Fairview in the past.

Past instances of environmental impacts such as oil spills or pipeline problems were generally described by respondents as "small" and usually resolved without incident (see Images 7.19). For instance one resident described the history of development by companies operating in the area:

> We were very fortunate having Devon or Anderson originally as companies that started developing here because if you look at other communities where other companies operate they don't do nearly as good job at taking care of facilities as Devon does (FV19).

These past dealings have engendered trust among many community members and energy developers, and thus increased the likelihood of future support. One famer stated that, "oil and gas is just like the land now, we just accept it and for the most part it's been very good to the community (FV36)."

Images 7.19. Pipeline and H_2S Gas Warning

Pipeline and H_2S gas warning signs in the M.D. of Fairview. Many residents acknowledged the risks of natural gas extraction in the area.

Place attachment

Every resident interviewed in Fairview discussed the beauty of the area and the Peace Country more generally (see Images 7.20). The most common sentiment was: "Fairview is the most beautiful place on earth." The beauty of the area was a major factor in residents choosing to live in the area and they felt that living in such an area enriched their lives. Long-term residents or those with relatives who had lived in the area for multiple generations discussed how strongly they felt about the landscape and area. One retired resident stated, "The beauty of the land makes my living worthwhile, I can look out and see those coulees and of course our wind breaks and things like that, it makes me feel like home I guess (FV08)."

Images 7.20. Landscape of Fairview Area

Left: Sky and spruce trees during late sunset. **Right:** Teepees at Dunvegan Provincial Park.

Another resident summed up a common feeling regarding how ties to or attachment to the local landscape made it difficult for some to accept energy developments in the area:

> We are living on the fringe, away from the core population. We are tied to the land. If you're living in a remote area or semi-remote area there's a reason why. It's because you are trying to get away from the mainstream and that relates right back to the environment so that's why you get people in these remote areas in northern communities that are opposed to some of these projects (FV30).

Results from six interviews indicate that there may be more approval for *underground* storage of CO_2 in the area when compared to leaving it in the atmosphere. Examples of comments include: "it's better than going up into the atmosphere (FV10);" "it's less negative because it's underground and you can't see it (FV43);" "I don't think it would be any more negative than having a garbage dump nearby, it might be less negative because you can't see it (FV19)."

Fairview is very familiar with the oil industry; consequently, the injection of CO_2 was often compared to existing oil projects. A participant from the agricultural industry stated: "there's stuff getting pumped down a hole that's ten times worse than CO_2 right now and nobody's worried about it (FV22)." Often, residents told stories of their experiences. One recounted the introduction of an acid injection well and how they lobbied for underground storage instead of releasing it into the atmosphere.

> They were going to bring these wells to a central point and burn off the sulfur or whatever, put out a really tall stack so it would spread over a much bigger area. We weren't too sure how it might affect the soil but they gave us an option of putting it down this abandoned well. We thought just to get rid of that it would be well worthwhile to put it down an old abandoned well and as far as I know they are still doing it that way too. You see it might have affected our farming… and it might affect the cattle. If it is down below it's down there for good and as far as I know there wouldn't be any repercussions (FV06).

A quarter of the respondents (n=11) stated that the risk of CO_2 leakage was moot. A resident commented that carbon originated from the ground, "if they can find a way to keep it out of the air…and put it underground, I'll be alright with it, rather it be down there than up above and it was down there to begin with so what the heck (FV36)." Another maintained, "If you can catch the stuff and push it down in the ground for the most part you're replacing something that you sucked out as far as I understand (FV27)."

Local independence and pride

A quarter of the participants in the Fairview area (n=12) discussed how others (i.e. non-residents) would perceive the town if they hosted a CCS project. Of the 12 participants who mentioned perceptions of the community, 10 suggested that outsiders' perceptions of the town hosting a CCS project would be positive. One service industry participant stated,

> it's the public perception that matters, we are willing to put up with Devon and the oil because it looks like the community has money. We perceive that there is no money in feedlots so we are not going to put up with that (FV09).

Another self-employed resident stated, "we would want to say that we do this [have a CCS project] and therefore we have an attractive town (FV04)."

Many Fairview residents took pride in the fact that they come from a rural area that they perceive is self-sufficient. There were 19 interviewees in particular who mentioned pride in local self-sufficiency or coming from a rural area. This was particularly true of those who had grandparents and great grandparents in the area. There was a robust desire to sustain the area and not to rely on other people. For example, 15 Fairview residents expressed support for a hydroelectric plant in the area *because* it could produce electricity for the region.

A desire for independence was described as influencing Fairview residents' need to protect their landscape. One resident commented, "it's a frontier community…people have their land and that's their little kingdom and they will protect that (FV41)." Another retired resident built on this sentiment: "these farmsteads are continuing on and getting bigger and better so to speak and the pride has never diminished though all of those generations and pride in what they do and what they accomplish (FV26)."

This same pride and independence was described by 12 residents as making the community more aggressive and efficient at pursuing what they wanted. One resident described

how local independence and its roots make the community more adaptable, "Our small farming communities they still have that community sprit…they come from pioneers and that pioneer spirit is still alive…they're kind of more aggressive and they're willing to change, improve things" (FV17) (see Images 7.21).

Images 7.21. Early Days in Fairview

Left: Image of Fairview in 1945 (source unknown, 1945) **Right:** An early ferry on the Peace River before the Dunvegan Bridge was built (source unknown, date unknown).

Concern over ecological or health impacts

One concern among Fairview residents regarding CCS development was the possibility of leaks and earthquakes. Fifteen interviewees discussed the possibility of leaks and eight were worried about earthquakes. As one resident stated, "what if it [CCS] caused an earthquake and I became inundated with carbon (FV05)?" However, residents often utilized 'local knowledge' in *refuting* concerns about leaks. For example, a couple of participants stated that it could *not* harm drinking water as the potable water comes from the Peace River and not underground aquifers: "I guess we won't have any water issues in our area, you couldn't do this in Whitelaw [neighboring town], their aquifer is a kind of sacred thing, that is one of the reasons why they couldn't get the nuclear plant to go (FV42)." Another interviewee from the oil industry stated, "there's no well

water here and if there is an escape of CO_2 well no big deal (FV07)." A resident who works for the service industry used his observations of the area to back up his concern about the stability of reservoirs by stating: "When you go into a river valley or something you see exposed strata. At first they aren't always flat, they go up and they have cracks in them, they don't look all that solid to me (FV42)."

Concerns about focusing events (in this case the alleged CO_2 leak at the Weyburn-Midale CO_2 Project)

Five interview participants in Fairview brought up the alleged Weyburn leak without prompting. These respondents commented on the alleged negative side effects from CCS that happened on the Kerr farm. A farmer asked, "wasn't it there in Saskatchewan where they had all of a sudden some cows die (FV28)?" Another resident stated: "From what I hear about in Saskatchewan they don't like it to much. They think it can really affect the water and everything (FV02)." Four of the residents who heard of the allegations of the leak in Saskatchewan expressed concern about the possibility of a leak in Fairview. Another resident brought up the Lake Nyos[51] tragedy:

> In Rwanda they had a great carbon dioxide burp on the lake about 30 years ago…that came out of the bottom of the lake…and it killed like 80,000 people. That was a natural CO_2 bubble that formed and so it can happen. So if you pump a whole cavern full of carbon dioxide and it burps bad things can happen. Hopefully the technology is good enough that it's not going to. We don't know that (FV39).

There were three main responses when residents were asked what they thought of the alleged CO_2 leak: 1) Fifteen residents would request verification that there was a leak: "you can't discredit it until someone has measured it (FV22)." Another resident stated, "A leak wouldn't

[51] Lake Nyos is a crater lake in Northwest Cameroon. On August 21, 1986 a large cloud of CO_2 suffocated approximately 1,700 people and 3,500 livestock up to 25 kilometers away (Kling et al., 1986).

change my thought, I would want to hear what they are doing to check to see if it is [leaking], what are they doing to monitor it in regards to finding out what is causing it (FV16)." 2) Ten respondents suggested that people who allege leaks are often looking for money: "It hasn't been proven… you see we all have a little greed in the back of our minds. When it's oil companies they believe that they have endless money and I want to get that (FV25)." 3) Nine residents suggested that a leak was inevitable, "if you put a pipeline somewhere it is going to leak (FV05)."

Living off the land

Agriculture is a significant industry in the Fairview area (see Images 7.22). Farmers perspectives on energy development were typically influenced by the following factors: 1) the additional income brought by surface payments (e.g. payment in exchange for allowing companies to build roads, place pump jacks, drill wells); and 2) the desire to take care of the land and not allow for the implementation of energy systems. Many farmers already receive money from oil companies in exchange for placing roads, pipelines or wells on portions of their land. These farmers thought surface payments were very beneficial and were more supportive of energy development. As one service industry resident stated about the fossil fuel industry, "I don't think any of the farmers really mind because they are getting compensated, and some years you really need that if it's a bad year (FV09)."

Images 7.22. Agriculture in Fairview

Left: Cattle in a pasture outside of the Town of Fairview. **Right:** A field of wheat at sunset.

Sixteen residents (these were mostly landowners and farmers) also indicated that they or other landowners could receive additional income by renting their land to a potential CCS project. According to one farmer, "if you want to rent five acres from me and drill the hole over here, yeah I'll sell, I'll rent it to you cause that's money (FV39)." Four respondents in the agriculture or forestry industry commented on the possible benefits of CO_2 leaks. They speculated that if there was a leak it could benefit plant and crop growth in the area. One of the farming participants claimed, "if it leaks or they spill it, I guess you would just have greener grass in the area (FV24)." Another farmer stated, "I wouldn't mind extra CO_2, they add 5-7% CO_2 to make things grow faster so it's kind of good for us farmers (FV14)."

However, seven farmers were conflicted regarding energy development because it ran counter to their strong desire to take care of and be stewards of the land. These farmers often were concerned about energy developments on their or nearby lands and what impacts it would have on the soil, crops, or animals.

Chapter Summary

The above results indicate there were a wide variety of perspectives regarding CCS in each case study location. Priddis area residents were for the most part opposed to the proposed local carbon storage project. The majority of interviewees had heard of CCS and the proposed university research project. Results from Priddis illustrate that residents perceived a risk to their 'place' and community. Many residents viewed the project as potentially causing conflict among residents. The large majority felt it was 'industrial' and did not belong in an area that was perceived as valuable ecologically and natural. It was particularly important to respect the wishes of the Cross family and ancestors who protected the area from developments. Past developments had brought concern and conflict to the residents – particularly a past natural gas well and subdivision activity. The community of Priddis developed collective perceptions due to a number of factors, including the number of residents who are willing to stand up as leaders and organizations that are geared to environmental protection and the sense of place fostered by generational longevity. The Priddis case study provides an excellent example of what happens when people are highly attached to an area and will protect their land and community well being as they defined this on their terms.

The majority of Weyburn and Goodwater area residents endorsed the EOR operation. This support for carbon injection was related to oil production in the region and therefore growth and economic development. Most Weyburn/Goodwater participants had a high awareness of carbon injection (for EOR purposes not for climate change mitigation purposes) and of the project in the area. Residents in the Weyburn/Goodwater area perceive the oil industry as part of their community. This is one of the primary reasons that the overarching theme in this case study was the desire for Cenovus and other oil companies to continue their operations in the Southeast

corner of Saskatchewan. The carbon injection project was viewed as something that sustained the agricultural industry and other businesses and services in the area. Carbon injection is seen as enhancing oil recovery and thus perpetuating business in the area. Farmers and landowners in the area see oil as a *part* of their land and an activity that sustains their ability to continue a farming way of life. Residents are proud of the oil development in the area and the wealth it brings to its people. Rather than disrupting attachment to place, the majority of residents viewed these outcomes as strengthening their affinity for the area.

Fairview residents had varying opinions of a proposed CCS project in their community. There were both positive and negative factors that contributed to the community's perspectives of CCS. It also was clear that there would have to be benefits for *both* individuals living in the area *and* for the overall community in order for CCS to be supported. The fossil fuel industry is important for both the town of Fairview and the surrounding farming areas. Many residents in the area viewed the natural gas industry as being part of the land and community. However this was not true for all in the area, especially those who saw developments as harming the land. Residents felt that Devon's presence in the community was very important for jobs, growth and economic development. Many suggested that projects were perceived as more positive if Devon was managing them. This implies that trust and good relationships with local residents are essential in any future energy development. The Fairview community has reacted in the past against (and for) things such as nuclear and hydroelectric projects. Among the primary factors driving this collective perception was the presence and strength of local champions, community organizations, and communication networks in the area.

There are a number of factors that determine whether a community will actively come together to support or oppose an energy development project including demographic and

community sustainability characteristics; place-based knowledge and experience; and interactions and relationships among residents. Each of the study area communities has demonstrated that community reactions differ when it comes to the oil industry or a CCS project. The following chapter discusses some of the similarities and differences between community perspectives about the oil industry, CCS and the potential or actual reactions they have had to energy development in their locality. This discussion will build on and expand the theoretical framework used in this chapter.

CHAPTER EIGHT: ANALYSIS AND DISCUSSION OF LOCAL RISK PERCEPTIONS ABOUT CCS

Introduction

In chapter seven I presented the perceptions of CCS developments among populations in each of the case study communities researched for this dissertation. This chapter compares results of the case studies and provides a discussion about the role of community and sense of place in the support for or opposition to CCS projects. I examine the following original research questions through the lens of interactional field theory: 1) how do communities view key issues surrounding CCS; 2) what factors contribute to perceptions of CCS; and 3) how do locally affected populations view the potential impacts of CCS or other energy developments on community (ties to area and local relationships). Discussion of my case study conclusions about these research questions provides insight as to why communities may have different perceptions of CCS and why some projects are ultimately supported while others are opposed.

The discussion presented in this chapter is divided into three parts. First, I briefly review the overall support for or opposition to CCS in the three case study communities. Second, I compare the results from the three community case studies, including: demographic and community sustainability characteristics, place-based knowledge and experience factors, and the interactions and relationships among residents. The discussion closes with a re-visitation of the not-in-my-backyard argument, comparison of results to other locally-affected community research, and the consideration of alternative reasons influencing support for or opposition to a technological development.

A Review of Support for or Opposition to CCS in Case Study Communities

There were significant differences among the three communities regarding participants' overall support for CCS in their area. Most participants in Weyburn and Goodwater were very supportive of the CCS project and felt that EOR was a positive endeavor for local communities and the region. In contrast, Priddis participants were generally very opposed to the proposed carbon storage research project in their area. Interviewees affirmed that the CCS project was not consistent with their existing views of the area and the large majority thought that the project would not result in any community benefits. Fairview participants had mixed views about a hypothetical CCS project in their area. Some participants supported the idea of a project in the area and felt it would bring additional community growth and sustainability. Others in Fairview opposed the idea because they thought it would bring community conflict or may cause harm to their local environment. These case studies clearly indicate that perceptions of a technological development such as CCS can vary significantly among communities. Variation in support or opposition to CCS is noteworthy and provides the opportunity to study the complex perceptions that surround technological development. The following section provides a potential explanation for the variance in views of CCS by comparing study results through the lens of interactional field theory.

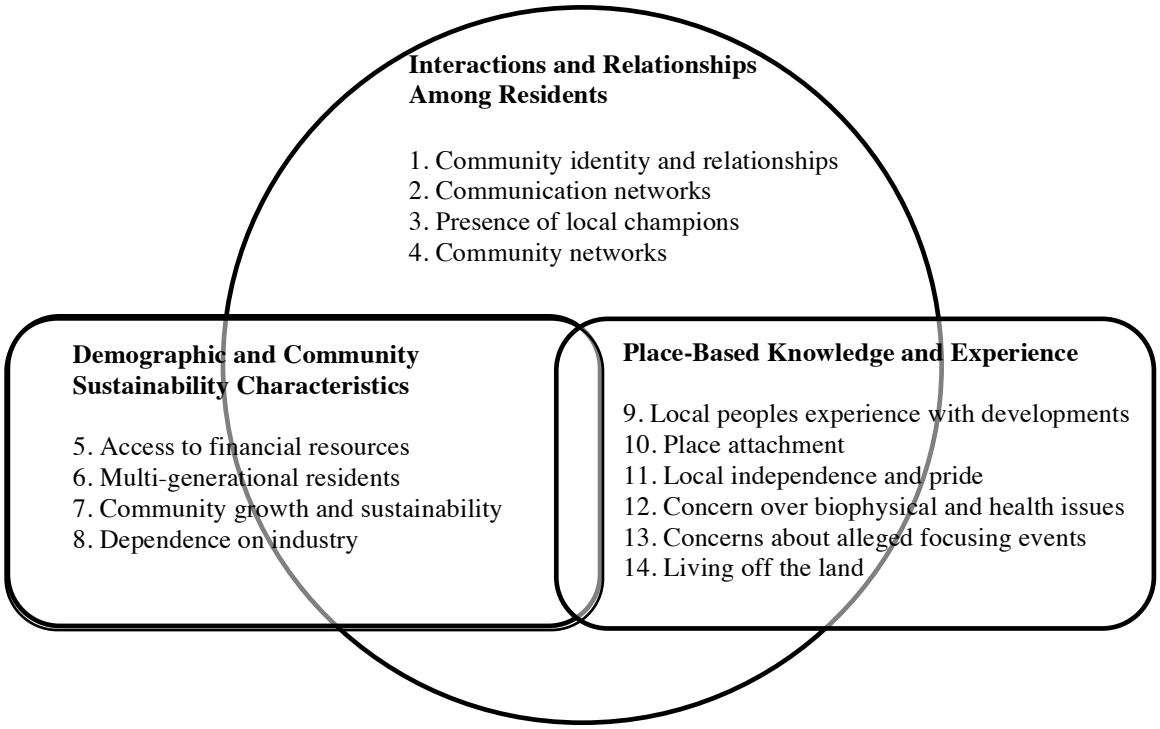
Assessing Perceptions: A Comparison of Three Communities

Chapter three outlined the many existing studies that examine public perceptions of energy technologies. This study establishes that the views of what a 'benefit' or 'risk' is might differ among residents and communities, particularly depending on how they viewed their 'place' and how they thought the proposed or actual development would affect their community. Given this

variation in perceptions of benefits or risks, the local context of a place can greatly influence public support of energy developments and perhaps the implementation a CCS project in a region. The results presented in this study are consistent with others that compare communities' support for or opposition to energy developments, such as the importance of local context on the acceptance of wind turbine development in the UK (Devine-Wright, 2005) or in Canada (Ferguson-Martin and Hill, 2011), natural gas extraction in the United States (Theodori et al., 2007), or nuclear power in the UK (Venables et al., 2009). In this section I focus on the perceived risks and benefits of CCS among members of each case study community and compare these views across cases to draw lessons regarding local perceptions of the technology.[52] The discussion presented here enhances the risk perception literature by comparing three communities at different stages of technological implementation *and* divergent support for (or opposition to) the technology in question. Figure 8.1 provides an overview of the variables that factor into how communities perceived CCS or other energy developments.

[52] Appendix I demonstrates how communities differ regarding participants views of the risks and benefits of CCS.

Figure 8.1 Diagram Illustrating Factors in Community Perceptions of CCS



[a]Numbers beside variables correspond to numbers in Tables 8.1, 8.2, 8.3.

Interactions and Relationships Among Residents

This category includes characteristics that define continued interaction and relationships among residents in a geographic region. It includes factors such as the informal or formal networks of interaction, willingness to mobilize, presence of local champions and relationships among residents. Table 8.1 outlines the four categories that demonstrate the interactions between residents and provide a conduit for developing community risk perceptions of an energy system development.

Table 8.1 Summary of Interactions and Relationships Among Residents

Priddis	Weyburn and Goodwater	Fairview
1. Community identity and relationships		
• Relationships among residents are perceived as important and a major reason for living in the area. • Importance of relationships also stated as a reason to dispute developments because it may cause community tension.	• Relationships among residents seen as very important. • Supporting oil industry seen as a way to support the community and relationships between residents. • Oil companies (particularly Cenovus) seen as 'part' of the community.	• Relationships among residents seen as critical and a major reason to live in area. • Supporting the natural gas extraction industry is seen as a way to support community and relationships. • Importance of relationships also seen as a reason to dispute developments because it may cause community conflict.
2. Communication networks		
• Strong informal and formal networks, especially interpersonal communication networks. • Used communication networks to mobilize against project developments.	• Strong informal and formal communication networks. • Clear communication channels, except a few participants were worried to speak out against oil industry.	• Strong informal and formal communication networks. • Networks used to exchange information about developments such as the proposed nuclear power plant or sour gas issues.
3. Presence of local champions		
• The Cross family (local champions) played a notable role in the opposition of the CCS project.	• Many formal and informal leaders in the area are from the oil industry. • Residents who work in oil industry contribute to community functioning via membership on boards, organizing events and mitigating disasters.	• Leaders described as important when mobilizing support for or opposition to projects.
4. Community networks		
• Residents have established groups to mobilize against developments. • Residents hold open houses and host speakers to talk about water issues etc. • Could use existing groups and networks to challenge CCS project.	• There are many organizations in the area that are willing to collectively mobilize—particularly against natural disasters (ex. floods). • Oil industry viewed as contributing to resources and raising funds.	• Residents discussed ability to mobilize at times of need and to support and oppose developments. • Community organizations created to address development problems.

Participants in each of the three communities described the importance of relationships and close bonds among locals in the community. The large majority of residents in each of the three areas acknowledged that their close relationships with other residents were both a major reason for living in the area and an important aspect of community functioning. A major

difference between the three communities was how residents viewed the role of industry in their community and local relationships, that is, whether residents' viewed industry as *part* of their community. In Priddis, residents perceived industry as *separate* from their community. Residents in Priddis had homes located in the area, yet many commute to work in the City of Calgary. Industry and industrial activities were seen as something that should be located elsewhere. This was due in large part to residents' perceptions that the Priddis landscape was natural and untouched by industry. Industry and developments were perceived as something that would cause potential conflicts among existing neighbors and community members. These potential conflicts were a motivation for opposing projects such as CCS developments. This idea is consistent with Gross's (1985) Australian study that linked opposition of wind farms to concerns about maintaining social well being among residents.

In contrast to the Priddis case, the majority of Weyburn residents (and to a lesser extent Fairview residents) saw the fossil fuel industry as *part* of their community. The presence and need for industry in the area factored into local perceptions about how the community and place would be affected by a technological development. Weyburn residents were more likely to support existing and potential oil developments because they viewed the oil industry as part of their community. This was partially because many of the oil industry workers were part of the community and that the presence of Cenovus enhanced the local economy and provided community sustainability. These community perceptions are consistent with other studies demonstrating that residents are more likely to accept developments in their area if there are perceived economic benefits for the local area (Rabe, 2000). Fairview residents were more divided about how they viewed industry in relation to their community. Some participants thought that supporting the natural gas extraction industry was a way to support their neighbors

who were employed by such industries. Residents also saw new energy developments as a potential source of conflict among neighbours and a reason to oppose new developments – they previously saw local relationships degrade during the conflict that ensued over a nuclear power proposal. Comparing the results from the three communities, it is clear that support for developments will depend on: 1) whether residents see industry as part of *or* separate from their community; and 2) how residents think a development will affect the existing functioning of their community and the relationships between local people.

Communication networks and the presence of local champions were important in developing cohesive bonds between residents and sharing information or perceptions about how developments could impact their 'place.' Residents in all three case study areas discussed the strong formal and informal communication networks present in their communities and stated that they used these networks to mobilize their collective efforts against various risks. In Weyburn, many local champions were members of the oil industry. Many local champions in Priddis also were members of the oil industry; however, these members did not extract oil *in the Priddis area*. There are a number of influential people in Priddis, such as the Cross family, who voiced their opposition to the University of Calgary project in regional newspapers. Some residents mentioned that they became opposed to the CCS project once the Cross family publicly contested the proposal. An important conclusion is that developers must be able to identify the influential (and well trusted) people in a community and work with these individuals to disseminate information about a project. If these local champions are opposed to a proposal it may be difficult to implement a project because they can influence collective perceptions. On the other hand, if a community does not want a project it would behoove local residents to

identify local champions and encourage them to speak out against the project in order to convince others.

Each of the three case study communities have strong community networks that have experience with past mobilization of collective efforts – residents had a history of relating to one another and working together to accomplish community goals. The majority of Weyburn residents stated that community networks have formed to deal with risks such as natural disasters. A number of residents stated that Weyburn could mobilize because there were many volunteers in the area and also due to the large resource contributions (financial and human capital) from the oil industry and took into account the fact that many industry members functioned as *part* of their community. Fairview residents also described the formation of community networks to mobilize against both natural disasters (e.g. flooding) and potential developments (e.g. pig barns, nuclear power plant proposal) but did not tie mobilization efforts to the natural gas industry in the area. There were no organizations in Priddis dedicated to the CCS project; however, there were groups dedicated to organizing in opposition to other developments. For example, the *Priddis Millarville Residents Association* debated developments[53] and hosted speakers to talk about water issues. Participants stated that these organizations had the capacity to reorganize and focus their efforts on the CCS project. Priddis residents mentioned the large number of volunteers, partially due to the many retirees and community groups in the area.

This research also may help explain why 'NIMBY sentiments' do not automatically occur when residents *first* hear about local CCS plans. Researchers in the Netherlands found that

---

[53] Debates included residential and recreational developments.

residents became opposed to existing CCS demonstration projects (such as the Beeskow and Barendrecht CCS projects) at a later point in project development (Terwel and Daamen, 2012). The Netherlands research is constant with findings from the Priddis case study, as it seemed that residents were not initially opposed to the local CCS project. Terwel and Daamen (2012) provide three reasons for why opposition may begin at a later date including: 1) public knowledge of CCS increases as a project develops and local residents may begin to fear certain aspect of CCS that they were originally not aware of; 2) issues such as lack of trust in decision makers (e.g. issues other than the technology itself) could instill negative feelings about local projects; 3) poor public engagement practices could create skepticism among community members. This study provides a fourth reason for opposition to CCS to begin at a later date. After residents hear about a project they may discuss shared concern about community and place with other local residents and negative (or possibly positive) perceptions of developments can ensue from those discussions.

Demographics and Community Sustainability Characteristics

Demographic and community sustainability characteristics include factors such as in-migration, access to financial resources and dependence on industry. The discussion provided here is based on interviews, attending community events, observations and census data. Table 8.2 outlines the four primary demographic and community sustainability factors that influenced case study residents' perceptions of CCS or other energy system developments. Perceived or actual changes to these local factors as a result of the energy development also have the potential to impact local perceptions of a project.

Table 8.2 Summary of Demographic and Community Sustainability Characteristics

Priddis	Weyburn/Goodwater	Fairview
5. Access to financial resources		
• Family income is double the AB average. • Many residents do not rely on income from natural resource extraction in the immediate area.	• Income is equal to SK average. • Many residents have gained financial resources from the oil extraction industry in the area.	• Income is equal to AB average. • Many residents have gained financial resources from the natural gas extraction industry in the area.
6. Multi-generational residents		
• Many multi-generational families seen as local leaders. • Locals discussed need to respect ancestors' wishes to keep land undeveloped and 'natural.'	• Some farmers discussed the need to keep the oil industry in the area to continue family farms (additional oil income kept multi-generational farms operational).	• Some farmers saw energy developments as detrimental to the area (e.g. need to care for the land and protect it from developments). • Residents discussed the need for additional income from gas extraction to keep multi-generational farms operational.
7. Community growth and sustainability		
• Majority did not see a need for additional developments in the area. • Population growth associated with the project was not discussed, as there would not likely be any change. • Most participants felt the local economy was stable and did not want additional growth.	• Majority stated population growth from EOR was beneficial. • Population is increasing due to EOR (this is perceived as positive). • Growth of economy and jobs viewed as critical for ongoing sustainability of community. • Oil extraction and carbon injection seen as a path to continue to build community in the area.	• Majority stated that population growth was needed for community stability. • Population is decreasing. • Need for community growth and jobs viewed as major reason for supporting energy developments.
8. Dependence on industry		
• Low dependency on industrial activities in the Priddis area.	• There is a high dependence on industry in the area (particularly agriculture and oil). • Oil industry supplements many farmers' incomes.	• Majority discussed the importance of the fossil fuel industry in the area because it supplemented incomes and created jobs.

This study demonstrates that access to financial resources (and where the communities financial resources come from) was a factor in perceptions of a project. The average Priddis resident had a family income that is double the average Albertan's family income; yet this income was not often tied to natural resource extraction or industrial development in the immediate area. In Fairview and Weyburn, the average resident had a much lower income than those living in Priddis and these financial resources may be linked to the industry developing the

energy project. Therefore, residents in Fairview and Weyburn would be more likely to accept an EOR project if it would sustain local existing industry or attract new business to the area.

The presence of multi-generational families was an important aspect in community and place based risk perceptions in the three communities (more than 67% of residents in the three communities were at least third-generation residents). Residents in each of the three case study communities mentioned that multi-generational residents living in the area were often respected and would protect the community from potential risks (this is related to the local champions factor discussed in the earlier section). The presence of multi-generational families resulted in different outcomes regarding support for CCS. These outcomes can be explained by the framework used in this dissertation and its theoretical understanding that varying characteristics of a local population intersect to result in different outcomes of the same local characteristic (e.g. different legacies or perceptions based on multi-generational residency). In all three communities it was apparent that multi-generational residents desired community sustainability and a continued way-of-life that they and/or their ancestors created. However, what differed was the way-of-life that these residents had cultivated and which current residents wanted to perpetuate. Multi-generational farmers in Weyburn and Fairview discussed the need to respect their ancestors by keeping family farms in business. Keeping the farm often meant drawing on oil or gas revenue during poor-yielding years, thus increasing support for energy development. Weyburn and Fairview, residents also expressed trepidation about young people leaving their communities, leading to more support for resource extraction to increase the number of jobs in the area and retain residents. In Priddis, multi-generational residents commonly expressed concern about preserving the natural character of the landscape that their ancestor's cherished, a character that was threatened by a potential increase in residents and industry. Thus it is the

intersection of multi-generational family presence with other community characteristics that influence outcomes. Another important difference between locations, and one that intersects with the characteristics described above are the different ties to land that exist among residents in the three communities. These differences further affect the outcomes observed with relation to CCS perceptions. In Fairview and Weyburn there is a history and pride in the agriculture and fossil fuel industry. These are people who respect the practice of "working on the land," provided it is done in a way that does not harm the environment. These ties to the land, multi-generational practices of "working the land" and need for economic stability manifests in the acceptance (or encouragement) of oil industry to maintain community, ties to the land and way of life. In contrast, Priddis residents' ties to the land are based on its "natural" character and their desire to respect their ancestors' wishes to conserve the area. Their significant financial resources ensure that they do not need the added economic benefit that may come from a CCS development, nor do they particularly want more industry in the area. Thus while all three areas contain some of the same local characteristics (e.g. multi-generational families, ties to the land, desire to maintain ecosystem health) it is the variable expression of these characteristics, and the way they play out with relation to each other, that lead to different outcomes in terms of support for or opposition to CCS.

The most salient factor in the 'demographic and community sustainability characteristics' category included residents' perceived need for population and local economic growth. CCS developments may have the capacity to bring additional residents and commerce to the local area. The possibility of growth or increased visitors in Priddis was generally viewed as a negative. Residents chose to live on the outskirts of the City of Calgary partly to experience the rural 'natural' environment that contained fewer developments and local businesses. In contrast

to Priddis, an increase in population and developments were viewed as one of the greatest benefits tied to CCS in the Weyburn and Fairview areas. Both Weyburn and Fairview residents were also concerned about the potential depopulation of the surrounding smaller communities. This was not necessarily a concern for Priddis residents, because Priddis is a smaller community and Calgary is the major business hub of the region. Economic growth was not a priority for Priddis residents because: 1) there were fewer local businesses, 2) it was primarily a residential area, 3) residents had higher incomes in comparison to other study sites, and 4) an influx of residents was not desirable. Both Weyburn and Fairview residents wanted community growth to provide economic sustainability for the city (or town) and the outlying regions. Weyburn residents saw carbon injection as a way to increase oil production in the area, which would provide jobs and growth. Many Fairview residents perceived a need to bring more industrial development to the area. Therefore, some participants stated that they would accept any kind of development whether it was waste disposal, mining, or energy development – so long as it promoted growth. The increase in economic development tied to CCS (or EOR) was seen as one of the greatest benefits of the technology in the Weyburn and Fairview areas. This is consistent with other research that has demonstrated how the need for economic sustainability can outweigh residents concern about risks or changes to the landscape. Examples include communities' support for hazardous waste disposal sites (Rabe, 2005), tourism development (Perdue et al., 1990; Lankford and Howard, 1994), mining development (Esteves, 2008) or waste incineration facilities (Petts, 1992).

Local economic dependence on industry, specifically the oil or natural gas industries, was found to have a large influence on residents' support for CCS. Priddis residents did not mention this factor because most are not dependent on *local* industry. There are a large number of people

in Priddis who work in the oil or fossil fuel industry, but this occurs mainly outside the area they live in. Hence, Priddis residents perceive their locality primarily as a residential area that they want to protect *from* development. Statistics Canada (2006) indicates that residents in Priddis are highly educated and work in a variety of industries (e.g. they are less dependent on one industry). Both Weyburn and Fairview have economies that depend heavily on the *local* fossil fuel industry. Almost half the residents in these communities work in natural resource industries (e.g. agriculture and fossil fuel extraction). There are also fewer residents who have post-secondary education and are more likely to work in the trades. Therefore, it is conceivable that residents would be less likely to oppose additional activities from local industry. In other words, locals in Fairview and Weyburn do not want to oppose industries that are perceived as supporting their community.

Place-Based Knowledge and Experience

Factors associated with 'place-based knowledge and experience' include 'sense of place' and connections to the land. This category also incorporates attachment to or reverence for local wildlife and the landscape or intimate knowledge of the local area or its ecology. Table 8.3 illustrates six place-based knowledge and experience factors that influenced case study residents' perceptions of local energy system development.

Table 8.3 Summary of Place-Based Knowledge and Experience

Priddis	Weyburn/Goodwater	Fairview
9. Local peoples experience with developments		
• Negative experience with a past natural gas drilling operation. • Industry, housing, and recreational	• Great deal of experience with oil industry, many residents grew up with oil infrastructure	• Great deal of experience with drilling and natural gas extraction industry.

developments are generally not encouraged in the area.	(not a new risk). • Majority stated that their experience with development has been positive.	• Majority stated that their experience with natural gas drilling has been positive. • Most acknowledged that problems with drilling and pipelines were resolved quickly.
10. Place attachment		
• Almost all commented on 'picturesque' landscape and desire to keep it in a natural state.	• Oil infrastructure perceived as a source of pride and part of the landscape.	• Some described the beauty of natural landscape; this was often associated with concern about developments. • Some described fossil fuel industry infrastructure as a source of pride and part of the landscape.
11. Local independence and pride		
• Many stated that they were proud to live in a 'rural' area and be independent.	• Pride in being 'rural' and most expressed a desire to continue with rural lifestyle. • Oil industry seen as something that would allow local populations to continue independent lifestyle.	• Residents described a desire to be self-sufficient. • Many discussed the 'pioneer spirit' of the area and stated that residents were more aggressive in pursuing developments (like energy systems) to continue rural lifestyle.
12. Concern over biophysical and health issues		
• Concerned about CO_2 contaminating water sources. • Concerned about wildlife and impacts to local conservation area. • Concerned about possible earthquakes.	• Very little concern about EOR issues. Some concerned about contaminants affecting water sources. • There have been few negative experiences with EOR. • Concerned about possible earthquakes.	• No concern about CO_2 contaminating groundwater. • Concern about possible earthquakes as a result of CO_2 injection. Residents argued that injecting CO_2 would cause underground pressure.
13. Concerns about focusing events (i.e. alleged CO_2 leak at the Weyburn-Midale CO_2 Project)		
• High awareness about allegations of a CO_2 leak. • Some residents were concerned about the possibility of a similar leak in area. • Some residents were not concerned because they did not think a leak would occur in Priddis.	• High awareness of the leak allegations. • Majority did not believe there was a leak. • High trust in Cenovus. • Knowledge of monitoring and trust in many scientists in area.	• Residents had varying concerns about leak. • Some thought pipeline leaks were inevitable. • Some thought that those who made leak allegations were just trying to get money. • Residents thought monitoring was important.
14. Living off the land *(regarding agriculture)*		
• Few discussed this factor.	• Many (particularly farmers) discussed importance of holding onto their farms, particularly in low-yielding years. • Oil industry supplemented income.	• Agriculture significant industry in the area and some farmers rely on surface payments. • Some felt it was important to look after the land and protect it from developments.

Local residents' past experience with industrial activities was a crucial factor in whether they would support or oppose a project. The overarching question involving past experience was: How did past developments benefit (or harm) the community? There have been few 'industrial' developments in Priddis. One exception was a natural gas well that negatively impacted the health of residents. This development tainted residents' views of future projects such as CCS, even though the proposed University of Calgary project may not have similar issues. Upreti (2004) discusses a similar situation in his study of biomass development in the UK. He concluded that researchers must understand communities' past experiences with developments in order to understand residents' support for or opposition to local projects.

There have been many industrial developments in Fairview and Weyburn and these projects were generally perceived as benefiting the communities and residents through economic growth and jobs. Residents in Weyburn and Fairview acknowledged that there were problems with fossil fuel extraction, but most mentioned that issues were resolved quickly and satisfactory. For these reasons they were supportive of additional developments. Therefore, communities where industrial activity has benefited the community and has been seen as positive are more receptive to additional activity in their region.

Perceived stigma is often discussed as a reason for project opposition (Slovic et al., 1994). However, stigma towards energy development was not a factor in Fairview or Weyburn. Both Weyburn and Fairview residents indicated they would be or were proud of CCS development in their area. This phenomenon is similar to the case described in chapter three where building a waste disposal site at Swan Hills resulted in community pride (Kuhn and Ballard, 1998). In Fairview, residents stated that a CCS project could be perceived as beneficial because: 1) residents were seen as doing something "good" for the environment; or 2) other communities

would perceive that the community "had money" because it was associated with fossil fuels (if it was an EOR project). Residents in Weyburn felt pride in ongoing CCS developments because they 'were pioneering' innovative technology to help continue fossil fuel extraction. This could also be due to the framing of the Weyburn project strictly as a carbon injection EOR project – even the name 'The Weyburn-Midale CO_2 Project' reflects that it is not framed as a GHG reduction technology. Residents in Weyburn were proud: 1) of the international notability of the project; 2) that high profile people like Barack Obama knew of the area; and 3) that scientists came to the area to study the local project.

Residents in all three case study communities felt a strong affinity for the locality they live in. The main difference between cases was the meaning that residents imbued that place with and what it *meant* to locals in that community. As described previously, Priddis residents viewed their area as *natural* or *untouched* and they wanted to keep it that way. This idea is illustrated by the communities' *support* for the Rothney Astrophysics Observatory (RAO).[54] The RAO was consistent with Priddis residents' values (e.g. natural preservation of the landscape through dark skies) but CCS was inconsistent with their values (i.e. 'unnatural' development). In contrast, Weyburn residents perceived industry and its development (e.g. oil wells, infrastructure) as part of their landscape, partly because many people grew up with industry and oil infrastructure.

Residents of all three case study communities expressed pride that they lived a 'rural lifestyle.' However, Priddis residents did not require local jobs to continue to live in the area,

---

[54] The RAO is located on the same parcel of land as the proposed CCS project. It is a research facility for the University of Calgary's Department of Physics and Astronomy. Further discussion of this project is located in chapter 6.

they could work in Calgary and 'live' in Priddis. This allowed them to pursue the idea of a 'natural' area through conservation and restricted growth. In Fairview and Weyburn there are fewer opportunities to make a living and residents perceived a need to use local resources to continue a 'rural lifestyle.' Thus this study reveals that there is a strong link between support for CCS in an area and the desire to 'live off the land.' There have been periods of flooding and droughts in Weyburn and many residents employed in agriculture have relied on secondary jobs or income. This includes working in the oil field and/or receiving surface lease payments from the oil industry. In Fairview, some residents had similar sentiments about the need for secondary income to continue 'living off the land.' However, there were also those who felt that 'living off the land' meant protecting it from developments such as CCS.

An increase in road traffic was a potential or actual negative outcome of CCS development in all three case study communities. Priddis residents were the most troubled by the potential increase in traffic. Other research also has found that the increase in traffic is often a concern among residents faced with an energy development. Examples include biomass developments in the UK (Upreti, 2004) and wind turbines in the Netherlands (Pederson, 2004). Fairview and Weyburn residents acknowledged that traffic was a negative outcome associated with CCS but also recognized that it was associated with growth and development. Hence, population and economic growth outweighed the increased traffic associated with developments. Residents in Priddis also were concerned with the increase in overall noise.[55] Similar concerns were not mentioned in Fairview and Weyburn, and could be due in part to the strong perception

[55] Increased noise was associated with more traffic, machines, equipment and people.

that Priddis had a 'natural setting'—noise would disrupt wildlife and conception of a natural landscape.

Priddis residents commonly discussed the pleasure of having wildlife in their backyard, which added to the natural setting. The potential impact of energy development on wildlife is often a common concern for residents, for example wind turbines harming birds and bats (Devine-Wright, 2005). Concern about wildlife was not discussed in Fairview or Weyburn. In fact, Fairview residents discussed the need to reduce deer populations because of the damage they cause to crops. It was clear that most participants in Weyburn and Fairview recognized their surrounding landscape as a place where they resided *and* worked. For many respondents in Priddis, the area was a place to reside and work was done elsewhere.

A biophysical hazard, such as a possible CO_2 leak, was a concern in all three of communities. The salience of this concern could have been exacerbated by the January 2011 allegation of a leak at the Weyburn-Midale CO_2 Project. The threat of a CO_2 leak contaminating drinking water was one of the reasons for opposition of the proposed CCS project in Priddis. A couple of people in the Weyburn area were worried about the local drinking water. No one mentioned the concern to drinking water in Fairview because the area does not get water from local ground sources; it is transported to the town and municipality by pipeline from the Peace River. Thus it is important to understand: 1) what people know about their region, and 2) residents' existing concerns about the area. Wustenhagen et al. (2007) state that developers need to ask: "Is specific local, tacit knowledge used or is the community only expected to say 'yes'?" (p. 2686). Put another way, acknowledging local knowledge could be a factor in *procedural fairness*. Procedural fairness was discussed in chapter three and refers to whether individuals feel they have had a voice in a decision making process (McLeod et al., 1999).

Residents in all three communities mentioned seismic events as a potential risk from CCS. Fairview residents were the most concerned about seismic events. This could be linked to two past earthquakes near Fairview and the fact that many residents associated these seismic events to fossil fuel extraction activities. The U.S. Department of Energy reports that there has been no harmful induced seismicity associated with any CCS or EOR project as of February 2011 (NETL, 2013). It is currently difficult to assess the risks of induced seismicity from CCS, partly due to fact that there are few large-scale CO_2 storage projects (National Academies, 2012). However, a report from the National Academies (2012) has stated that CCS *may* have the potential for inducing seismic events due to increases in pore pressure over time suggesting that intuitive fears may not always be groundless.[56] This again points to the importance of knowing residents' history, prior concerns regarding the area and traditional ecological knowledge. Traditional Ecological Knowledge (TEK) is a well-established concept in Indigenous research (Berkes et al., 2000). A definition of TEK is "a sophisticated knowledge possessed by a group or individual about an environment as a result of having lived in and observed an environment for generations. It is both evolving and current, and incorporates an historical, cultural and spiritual perspective of existence in that environment" (U.S. Fish and Wildlife Service, 2010). Many developments that affect Indigenous groups are either encouraged or required to take into account TEK in environmental assessments and technological development decisions. It could be argued that this concept could also be applied to rural communities with inter-generational residents, particularly the three communities studied as the majority of residents are third (or

[56] The risk of induced seismic events can be minimized by in proper site selection, design, and the operation of storage sites (National Research Council, 2012; NETL, 2013; IEA GHG, 2012).

more) generation residents – many of whom have a deep connection with and understanding of the land.

How residents view focusing events (such as allegations of the CO_2 leak near Weyburn) also have the potential to impact support or opposition of a CCS project. The three communities viewed the allegations of a leak at the Weyburn-Midale CO_2 Project very differently. Many Priddis residents stated that the allegations affected their views of the proposed CCS project; particularly if a CO_2 leak could cause harm to the local drinking water or to Pine Creek. Other residents acknowledged that Priddis was a different 'place' than Weyburn and stated that a leak may not happen in Priddis because they recognized the differences in the two areas in regards to geology, industry development and other place specific characteristics. In Weyburn most participants stated that there was no leak. Most participants said that they were aware of the extensive CO_2 testing and monitoring in the area; were aware of the number of scientists who studied the enhanced oil recovery processes; and furthermore most residents had experienced 10 years[57] with no major problems associated with the local project. Fairview residents had varying concerns about the allegation. Some Fairview residents thought there would definitely be a leak (in Weyburn and possibly in Fairview if a project were built) – because residents had experience with the risks associated with fossil fuel extraction and recognized that risks (such as leaks and contamination) are inevitable. Residents in Weyburn were not as concerned about the allegations of a leak because they trusted Cenovus and believed that the company would not put residents at risk.

[57] The project had been operating for approximately 10 years at the time of this case study.

Towards a Theory of Community Risk Perceptions

The framework derived from interactional field theory and used in this analysis can provide an increased understanding of the factors influencing risk perceptions among residents who are affected by energy developments. It acknowledges that the connections between individuals in a community (Wilkinson, 1991) and between a community and its environment (Field and Burch, 1988) provide important context influencing communities' support for or opposition of CCS development and the reasons why reactions to the technology differ among communities. The research presented here extends interactional field theory and demonstrates that community interactions (between community members and their environment) can be the foundation for collective risk perceptions in pursuit of a greater well-being at the local scale (see Brennan, 2007; Luloff and Swanson, 1995; Kemmis, 1990). In the following sections I reiterate how such interactions influenced risk perceptions in the three cases studied for this dissertation and how this framework and theoretical perspective has been extended to examine community risk perceptions.

Residents in the three areas displayed shared or 'community risk perceptions' towards energy development in their area. The Priddis case study demonstrates the role of place and community factors in the shared negative perceptions and ultimate opposition of the CCS project. Residents utilized their community networks, relationships and communication networks as a conduit to bond over and discuss concerns about their place and community. In Weyburn, residents' relationships and networks included the oil industry; the CCS project was seen as beneficial for their community and would allow residents to continue living in the area. The *lack* of action against the project demonstrates that there was a shared perception of benefit to both individuals and community. In Fairview, the risk perceptions of CCS were hypothetical; yet, the

findings still demonstrate that through networks and relationships, the community developed shared risk perceptions about their community and place.

The following diagram illustrates how shared risk perceptions emerge among those who share concern about their place and community.

Figure 8.2. Diagram Demonstrating Process of Shared Community Risk Perceptions

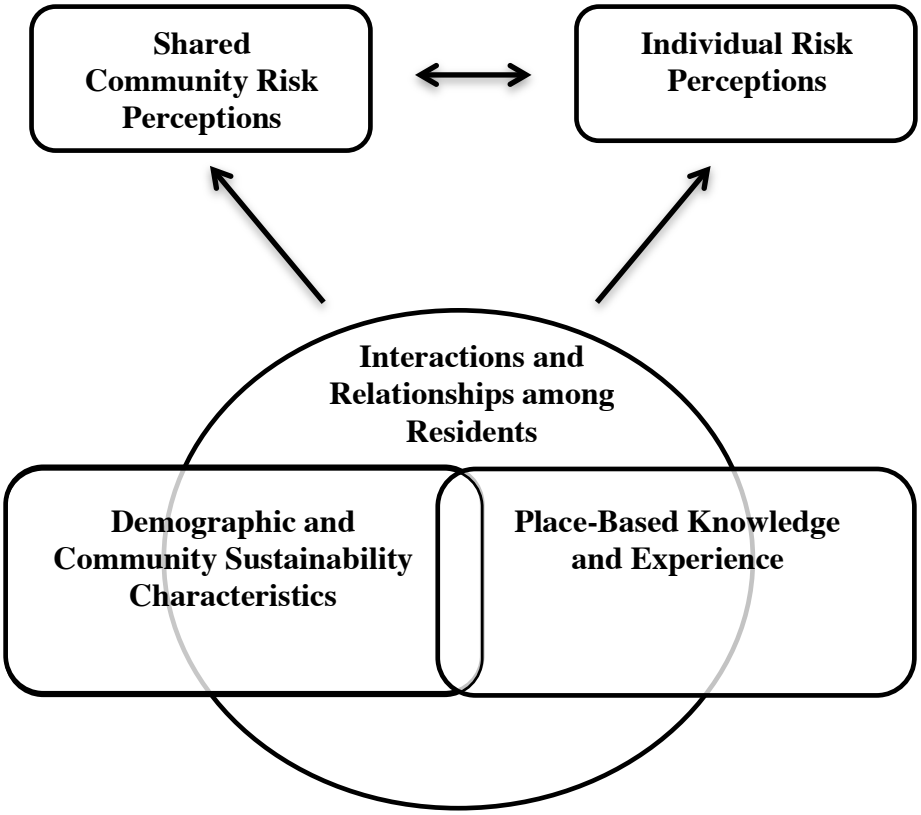


Diagram Explanation - Shared risk perceptions can emerge from interactions among people who care about each other and the place they live. Residents in communities will discuss or interact on shared issues about CCS such as how the project will affect: 1) demographic and community sustainability characteristics, and 2) place-based knowledge and experience. These communications and interactions can cement a shared meaning of place that reinforces and

reflects the social construction of risk regarding CCS. The shared understanding of a risk to community (place and local residents) develops both individual risk perceptions (e.g. risk to oneself; how will a development affect me?) and a shared community risk perception (e.g. risk to the community; how will a development affect my place and the people living in it?). Furthermore, these individual and community risk perceptions reinforce each other. In other words, a risk may affect community well being which may ultimately affect individual well-being and vice-versa.

Conclusions About Collective Perceptions About Place and Community

In each community, residents' perceptions of how a development would affect place and community variables resulted in different perceptions of CCS. Future examination of how these variables interact and the communication practices present in different communities faced with energy developments could provide the basis for a systematic approach to predict how a community may perceive the risks and benefits of these projects. While each characteristic identified in this study factored into perceptions of CCS, it was the variable expression of three key factors that seemed to play the most significant role in community support of a development including: 1) the community's relationship with and attachment to place, 2) previous experience with industrial developments, and 3) the perceived need for further development to maintain community sustainability. By variable expression, I mean that communities often differed with respect to these characteristics. For instance, the relationship with and attachment to place in Priddis was one characterized by stewardship and a view of 'naturalness,' while in Fairview and Weyburn the relationship with and attachment to place is one of working landscapes and rural farming. This does not mean one attachment is stronger or more useful that the other. Likewise,

the form of these expressions for key characteristics drives their function on community support. In Priddis, the attachment observed led to opposition because it would harm the existing attachment to place. In Weyburn, CCS development would allow that attachment to be perpetuated. Thus it is important to conceive of the characteristics identified here as a variable continuum or axis of potential attachments, perceptions or local resources. The expression of these characteristics, that is, how they play out in the local context, and their combination with other elements, will ultimately help better understand support or opposition. For example, would Weyburn be as supportive of CCS development if they did not think local oil industry was part of their community and rely on them for economic growth? What about if their perception of the landscape did not include oil extraction? Perhaps they might then oppose CCS development. By examining the factors described throughout this chapter researchers may be able to better understand how a community is likely to perceive a project in their area.

Comparison with Other 'Locally-Affected Community' Research About CCS

Chapter three provides an in-depth review of studies examining locally affected residents' perceptions of CCS. This section examines how the Priddis, Weyburn or Fairview case studies compare to other CCS studies examining local residents' perceptions about technical risks, benefits to the community, and perceived perceptions of place.

Similar to other studies in the United Kingdom (Shackley et al., 2005) and the United States (Wong-Parodi and Ray, 2009), residents in Weyburn, Fairview and Priddis were concerned about catastrophic leaks and induced seismicity (albeit their concern levels differed). Priddis residents were concerned about the experimental nature of the proposed CCS project and did not want to be 'guinea pigs,' which is analogous with residents in the United Kingdom faced

with a proposed CCS project (Shakley et al., 2005). Residents in Weyburn reacted differently from those in Priddis or the UK with regards to CCS as they thought the local project was well understood and perceived little technical risk associated with the project. As such, this research further substantiates how perceptions of CCS may differ among communities in various geographic areas.

The majority of CCS case studies have concluded that communities require local benefits that result from technology development (see for example Oltra et al., 2010; Wong-Parodi and Ray, 2009; Bradbury et al., 2009). Research on risk perceptions in the Netherlands demonstrates that compensation (e.g. direct monetary payments, creation of local jobs, community development), while not a panacea, has the potential to help prevent or solve CCS siting controversies (ter Mors et al., 2012). The Weyburn and Fairview case studies presented in this dissertation partially support ter Mors and colleagues' research on compensation (2012), and also helps illuminate cases where compensation will not be effective or even inappropriate. Many of the residents in these two communities assumed that they *would* receive compensation from the CCS developer. This was in part due to the fact that landowners in Weyburn and Fairview already received payments from other energy development activities (i.e. gas extraction in Fairview and oil extraction in Weyburn). Therefore, if a CCS project is located in an area where residents already receive land-use payments, residents may *expect* compensation for CO_2 injection on their land. However, it was unlikely that compensation would engender support for CCS development in Priddis, as residents were less interested in financial compensation for land use and more invested in land use preservation values.

This dissertation research supports European studies that conclude 'community fit' is an important factor in public acceptance of a CCS project (Oltra, 2012). Researchers (see Mahon,

2012) have hypothesized that local perceptions may be more positive in areas where there is a history that fits well with the concept of CCS – for example, a place with natural resource extraction history. Community fit was stated as a reason why the Ketzin CCS research project was accepted – the region was already familiar with the natural gas industry (Oltra, 2012). Similarly CCS was likely viewed as positive in Weyburn and Fairview because there was already a history of natural resource extraction in the areas.

The Priddis case study provides a contrast for other risk perception research on experimental CCS projects (e.g. Ketzin and Hantomin). Case study research on experimental (i.e. non-commercial) CCS projects concluded that there was more support for projects led by research institutions because they are more trusted than industry representatives (Oltra et al., 2012). In addition, residents who lived near the Ketzin and Hantomin projects (experimental CCS projects) felt their local communities would benefit from visitors, such as researchers, to the region (Oltra, 2012). However, as demonstrated by the Priddis case study, it is not always true that a project will be accepted if it is lead by a research institution. Even though the University of Calgary had strong, positive relationships with the community through the RAO and the geoscience field school, local residents did not support the proposed carbon storage project. Residents also did not perceive there would be a benefit from increased visitors to the region, a factor demonstrated in the other experimental CCS projects (Oltra, 2012). This indicates that even communities with similar types of projects may have different perceptions about the benefits or risks associated with CCS.

This research provides the opportunity to further examine how perceptions associated with the *amount* of CO_2 stored in an area as part of a CCS project influences support for the project as a whole. Approximately 6,500 tonnes of CO_2 per *day* is injected in the Weyburn area.

It was proposed that 600 tonnes of CO_2 per *year* would be injected at the Priddis site. An interesting finding was the complete lack of participant discussion about the amount of CO_2 stored (i.e. no resident in Priddis or Weyburn referred to the amount of CO_2 stored). This contradicts research by Oltra et al. (2012) who concluded that residents living near the proposed Ketzin CCS project felt more comfortable with the project due to the minor quantities of CO_2 injected. In this study, Priddis residents only cared that there would be CO_2 injected in the area, not that it was a relatively small amount of CO_2. There could be two possible explanations for why the relatively small amount of CO_2 did not engender support for the project: 1) residents may have difficulty comprehending the amount of CO_2 injected because it is stored underground and cannot be seen; or 2) Priddis residents felt the practice of injecting CO_2 was contrary to the values they placed on the land (i.e. it was natural and untouched) and even a small amount of CO_2 would affect their views of the land. The viewpoints of Weyburn and Priddis residents can be, at least partially, explained when these viewpoints are situated within the context of relationships to a particular place.

Critique of the 'NIMBY' Argument

Chapter three provided a history and summary of the not-in-my-backyard argument. Proponents of the NIMBY argument suggest that local populations will not support a technological risk in their locality. The common belief associated with this argument is that residents who are resisting a development are being irrational and selfish (Mazmanian and Morell, 1990). The research presented here demonstrates that this argument may not hold true for all communities. There were no interviewees who opposed CCS *and* provided no reason for opposing the technology or specific projects. Rather, residents discussed what was important to them as an

individual and community and why the project did or did not fit with the values of their community or sense of place. In the following paragraphs I revisit arguments critiquing the NIMBY concept and discuss them in the terms of this research.

A major critique of the NIMBY concept is that it is a simplistic description of very complex positions of support or objection (Devine-Wright, 2005; Ellins et al., 2007). As discussed throughout this dissertation, there are very complex factors behind the support for or opposition to an energy development project. This is illustrated by the fact that all three communities studies had different perceptions of CCS, which are in turn influenced by varying perceptions about local industry, different historical contexts, community sustainability and locals' attachment to the landscape. There was a local context behind each community's decision to accept or oppose a project. To ignore the fact that there is a local context behind residents' perceptions of CCS or other energy developments means that stakeholders will likely not understand the communities' perspectives or be able to develop the communications required for a two-way discussion with residents.

Devine-Wright (2005) argues that the NIMBY argument does not account for cases that find positive views toward technology among people who live close to risks. The research presented in this study confirms this is a valid critique of the NIMBY argument. The concept behind this phenomenon (i.e. that local populations most often will not support a technological risk in their locality) was false among two community populations studied here. Residents such as those in Fairview and Weyburn were very supportive of energy development 'in-their-backyard' for a variety of reasons.

A final critique of the NIMBY is that focus is placed on the importance of individual (instead of group) conceptions for health concerns and property, or what roles local residents

play in fostering opposition to facilities and developments (Steelman and Carmin, 1998). The research presented here illustrates that 'community' plays a significant role in the perceptions of CCS. Residents took into account the risks and benefits not only to themselves but also to the whole community. This study accounts for shared community risk perceptions in the opposition (and support) of a CCS or other energy developments.

This study demonstrated that in the case of CCS development, the typical NIMBY argument is too simplistic and may not account for community support or the complex nature of residents' perceptions. Whereas the NIMBY argument is typically used to represent a generic opposition to a given project, the framework utilized throughout this dissertation can be used to highlight the specific local characteristics and relationships that help explain why a community reacts in a specific way to technological development. Such recognition provides a more nuanced understanding of support for or opposition to any development. I argue that the continued utilization of the NIMBY term by academics, industry and policy makers negatively impacts relationships with potentially affected communities by not recognizing well-founded concerns or suggesting residents are being selfish or irrational (Dear, 1992). It is important to recognize local contexts and residents' concerns about their community and place rather than repudiating a communities' perceptions as irrational – only then can research on local residents' perceptions accurately account for support for or opposition to CCS or other potentially risky technological developments.

Chapter Summary

Residents' desire for positive interrelationships and to 'maintain the peace' between residents was an important factor in the support for or opposition of CCS and other potential energy

developments. Communities who viewed industry as *part* of the community were more likely to be supportive of further industrial activities. In contrast, residents who perceived industry as *separate* from the community were more likely to oppose industrial projects.

One of the most important factors in community agency was the presence of formal or informal local leaders or champions. In Priddis, the Cross family was instrumental in the opposition of the University of Calgary CCS project, partially because of their influence and respect in the community. Residents respected the Cross family's wishes to keep the area 'natural' and were unlikely to go against the Cross family in support of a CCS project in the area. In Weyburn, local champions were important to mobilization, but residents often recognized the importance of local champions who work in the oil industry. These Weyburn local leaders, who also depended on the oil extraction industry for their livelihood, would be less likely to oppose the industry and oppose a CCS (or EOR) project in the area.

Demographic and community sustainability factors played a key role in a community's ability to mobilize in support of or opposition to energy developments. Communities where residents have large incomes independent of local industry (e.g. Priddis) are potentially less apt to need or be dependent on the economic boost that industries can bring to an area. Residents' desire for population growth and community sustainability was one of most important reasons to support developments. If residents felt their community or larger region was at risk for becoming a 'ghost town' they were more likely to support a development because energy development could revitalize the local economy and provide jobs. Multi-generational families or residents were a final critical influence on ability to mobilize and opinions of CCS because residents wanted to support their ancestors' wishes for the land and to maintain traditional

farming or rural lifestyles. This meant protecting the land through preservation, keeping it in the family or continuing to farm.

How residents viewed or valued their place was a component in the support for or opposition to CCS or other energy developments. Priddis residents viewed their area as natural and separate from industry, as such they fought against developments to keep it this way. In Weyburn (and to an extent, Fairview) residents viewed their area as, at least partially, industrialized. Thus it is important to understand how a community views their area and if development is consistent with or contrary to the values they associate with their area.

This research also demonstrates developments may be perceived positively by locals if they need additional economic development to maintain their rural lifestyle. Priddis residents generally did not depend on or need additional development to bolster the local economy, whereas Fairview and Weyburn residents perceived that they required resource development (including energy sources) for them to continue living off the land. Even though many residents in Weyburn and Fairview realized the downsides of development, most perceived that the benefits outweighed the risks. This highlights the importance of place-based attachment and community sustainability in residents' support of energy developments in their locale.

Participants past experience with drilling and other industrial developments are another factor influencing place-based attachment, and ultimately, their views on energy development. If residents had past experiences with industries that were generally positive, then additional developments could be seen as potentially positive. If past experiences with developments were negative, then additional industrial developments would be viewed as negative as well. Perceptions of 'focusing events' such as the allegations of a CO_2 leak are a form in which these past experiences are integrated into future decision-making. However, this research illuminates

that residents may perceive focusing events very differently depending on their sense of place and community relations with industry.

This research demonstrates that perceptions of risks are often very complex. The results demonstrate the importance of sense of place and community when examining a risk. It is also important that stakeholders consider the risks and benefits of technological development to both individuals and community. Potential risks to community stability, whether economic or in terms of their way of life, may invoke residents to react to preserve local well-being. Chapter eight completes the discussion and analysis of this research. The following chapter concludes this dissertation and provides a summary of the major contributions of this research to risk research and CCS development.

CHAPTER NINE: CONCLUSION

Introduction

Carbon dioxide capture and geological storage has emerged as one potential component in global climate change mitigation strategies. However, as discussed throughout this dissertation, public support of CCS is a major component in the successful deployment of the technology. Results from this study also reinforce the fact that people who reside near proposed or current energy development projects will have an impact on whether and how the technology will be implemented in an area. The literature review I presented lays out the considerable body of research regarding how the general public perceives technological risk, yet there is less research on how residents living near potential or current CCS sites perceive the risks and benefits of these developments. Studies of technological developments emphasize the importance of trust in developers, meaningful community engagement and fairness in siting procedures. There have also been many risk perception studies that have focused on residents' views of biophysical risks, concerns about economic development and the cultural and psychological impacts associated with 'risky' technological developments. However, a gap exists in the risk communication and perception literature regarding the role of "community" and "sense of place" in the shaping of such perceptions regarding local developments. This dissertation has endeavored to address that gap in the literature by focusing on how community and sense of place help us better understand how affected (or potentially affected) residents view energy development in their region and why. I argue that an expanded focus on the concept of community in risk research provides a lens that affords a better understanding of the social context that is reciprocally shaped and influenced by the perceptions of individuals. As such, the more robust inclusion and conceptual development of community (i.e. relationships between

people in a locality and their interaction with "place") in risk studies provides a more comprehensive approach to examining perceptions and broader societal trends regarding support or opposition for technological developments.

The research presented here studied three Western Canadian communities based on the status of carbon capture and storage or other energy developments in each area. It revealed that community relationships and sense of place played a considerable role in how residents viewed the risks and benefits of CCS. People from Weyburn saw CCS (through EOR operations) as benefiting not only individual residents but also their community as a whole. Enhanced oil recovery was viewed as a way to sustain the local rural lifestyle and allowed residents to continue living in the area. The oil industry infrastructure in these areas was seen as a *part* of the land. In contrast, Priddis residents viewed CCS as a potential source of conflict in their community and perceived industrial infrastructure as separate from and detrimental to their 'natural' area. Residents from Fairview recognized that energy developments could potentially sustain their rural lifestyle, yet many thought these developments would likely cause conflict among area residents. These various influences on perceptions of CCS or other energy developments demonstrate the importance of understanding the local context in potential support or opposition of a project.

Chapter nine provides closure to this study by addressing the following three components. First, I elucidate the empirical and theoretical implications of this research. Second, I discuss the limitations of the study and some possible areas for future research on public perceptions of CCS and energy developments. I conclude the chapter by providing policy and risk communication recommendations regarding communities affected by CCS or other energy developments.

Research Findings and Theoretical Implications

Contributions to Risk Perception Theory and Research

Risk perception and communication research has made significant progress towards understanding how residents view technological developments in their locality. Factors that have been shown to influence risk perceptions include trust between stakeholders (Siegrist et al., 2005), the engagement process (Besley, 2010), stigma of development (Flynn et al., 2001), and perceptions of biophysical risk (Breakwell, 2007) among other factors (for overview see Wustenhagen et al., 2007). Research on "sense of place" has begun to receive more attention in risk literature (for example in studies of public opposition to wind turbines due to perceived changes in the landscape). However, the concept of "community" has never received as much attention or traction in risk research. Current risk perception research has not adequately accounted for the significant influences that individuals or groups of people in a locality have upon each other with regards to risk and the actions they collectively enact to reduce it. The results presented in this dissertation suggest that researchers need to take into account the bonds that local people have in the place they live and the community risk perceptions that emerge from technological (or risky) developments in their area. This includes community, sense of place and collective risk perceptions:

Community – People not only assess risk as a danger to their individual well being, but also consider how it might affect their social well being—the bonds they have established with a landscape and the people who reside there. Future risk perception research should take into account: 1) the importance of the ties that bind the local populations where a project is proposed

and how residents perceive that a development will affect those relationships; 2) the benefits (e.g. economic growth, sustainability, increase jobs) or harm (e.g. decrease populations or overall incomes, affect community relations) that a population thinks a development will bring to their community. In the case of CCS, this may also include the stated purpose of CO_2 injection (e.g. enhanced oil recovery vs. a research project) and whom (or what) residents include in their definition of community (e.g. neighbors, industry). The importance of examining risk through the lens of community is especially important in situations where residents perceive a risk to sense of place, their social well being and community sustainability.

Sense of Place – Sense of place or place attachment reinforces and reflects the social construction of risk in the local environment and can be seen as central to the way people select and interpret risks associated with technological developments. This study revealed that sense of place goes beyond just the appearance of a technological development on the landscape (e.g. a wind turbine changing the visual landscape of an area). Carbon capture and storage provides a unique case in the sense that CO_2 is underground. There has been little research regarding how far 'place' extends. The parameters of 'place' may differ in different communities. In Fairview, it was clear that many residents thought that CO_2 would be better underground than in the atmosphere. Yet, in Priddis the CO_2 was considered more dangerous underground than above. Place for Priddis residents' extends beyond the visible to what lies beneath the surface. The long-held significance of the safety and adequacy of their water supply gave a different cast to underground storage of CO_2, as did the virtues of solitude, wildlife, and preservation, all markers of place for Priddis residents. The research presented in this dissertation demonstrates that need to better understand the tangible and intangible nature of places.

Examining CCS and sense of place also provides a unique case in that there are very little visible changes to the landscape. Therefore, the concept of place and its meaning to residents is extended by examining people's deeper underlying values and attachment to the land rather than just perceptions of the visual landscape. Future studies that examine sense of place should take into account *not only*: 1) how people view the appearance of a technological development and how they perceive a project will change the original appearance of the land; *but also*, 2) the types of developments residents grew up with (e.g. are residents familiar with or appreciate the sight of fossil fuel extraction infrastructure?); 3) past experience with and knowledge of risks in the area (e.g. earthquakes, water contamination); *and* 4) the perceived meanings and values that residents associate with a place (e.g. is the area seen as industrial or as natural). While there has been some research on the first three concepts, less research has focused on how people view and value their land. If a technological development does not "fit" with the existing meanings residents have for a place, they are more likely to see the development as a contradiction or harm to their connection with the area and oppose the project.

Community Risk Perceptions **–** The dominance of risk research focuses on largely cognitive, individual approaches to understanding risks. This individual approach to understanding risk perceptions fails to account for the significant influence individuals or groups of individuals have upon each other in regards to risk—during its initial conception, in the strategies used to live with it, and in the actions that are collectively enacted to reduce it – or to sustain or amplify benefits. However, as illustrated by this research, people not only assess risk as a danger to their individual well being, but also will form collective risk perceptions. A community risk perception has a tendency to arise when people who live together interact with

one another on place relevant matters (Wilkinson, 1991). These shared risk perceptions may arise from natural place-based disasters (e.g. when a place is affected by a hurricane, tornado, flood, drought, etc.) or from technological or 'man-made' risk (e.g. siting a nuclear waste disposal site, transmission towers, energy systems development, etc.). Therefore, when examining how residents (especially rural residents) perceive a risk, it is not only important to understand individual, cognitive risks, but also collective risk perceptions.

Contribution to Theory

This study of CCS risk perceptions makes several important contributions to existing theory. First, this study demonstrates that locally affected communities can be examined through the lens of interactional field theory. This theory places emphasis on the mutually defined locality, local society and the ongoing *processes* of locally oriented collective actions or perceptions. It encompasses the resources community members have at their disposal, the attachments they form with place and the aggregate abilities they build or utilize while attempting to both sustain and adjust their community function (Flint et al., 2008). Conflict over development is inherently a geographical issue—but the geography of interest is often defined by the people and relationships that form among residents' within a commonly associated place. This study provides an organizational heuristic to enhance understanding of how 'interactional field theory' is operationalized and how it can be utilized to examine community risk perceptions. It also acknowledges that not all places or communities are the same—that local social context must first be assessed in a given area in order to understand how they perceive a risk in the area.

This study demonstrates that residents may integrate 'scientific' knowledge or information provided by developers into their perceptions of a development. However, residents

will *also* incorporate their own place-based knowledge when considering the impacts of technological development (e.g. residents' knowledge of ground water issues or animal migratory paths). Likewise, peoples' *experiences* with place may influence whether they perceive industrial development as a threat or opportunity (e.g. past experience with natural gas drilling operations, area recreational activities, perceptions of the area as natural and untouched). The use of interactional field theory provides a framework to better understand these connections and a means to provide a potential explanation for how residents view specific risks associated with technological developments.

An interactional field theory approach can also help researchers and professionals examine a communities' potential for collective action (e.g. mobilization in support or opposition for development). The interacting and often differing expressions of factors identified in this study (e.g. viewing industry as a means to preserve the local way of life or as a threat to it) provide an expanded means and approach to understand why residents might perceive technological development in various ways. Using this framework can provide another scale at which to understand where residents risk perspectives come from, how they interact with larger social systems and how they determine the collective action that is often the basis for policy, industry and government decisions related to technological development.

The conceptual framework developed in this study can be extended further to better understand collective risk perceptions. This study has contributed to the development of heuristics that can better operationalize interactional field theory. Future risk perception research can utilize this study as a stepping-stone to develop a systematic framework for characterizing the factors that influence 'community risk perceptions' and how sense of place and community factors can influence residents' views of a development in their area. In addition to the factors

studied here, future studies should examine other factors that may influence risk perceptions or community action about CCS. This study has examined "community" or "place" through several lenses: discussing individuals' perspectives, observing community and place factors, and examining the demographic and historical profiles of three locales. While this may not necessarily illustrate or capture all aspects of a collective risk perception, it does begin to demonstrate factors in community risk perceptions and is a step in the direction towards better understanding of how a collective of people construct and understand a risk (or benefit, as the case may be) to their shared area.

Limitations of the Dissertation Research

While the case study research described in this dissertation expands and enhances influences on residents' perceptions and actions in response to CCS and energy developments, there are some limitations to the research. First, the scope of the research is limited to mainly perceptions of storage (or disposal) of CO_2. As discussed in chapter two, there are three main components of CCS including the capture, transportation and storage of CO_2. I asked general questions about perceptions of CCS developments in an area, yet it may be beneficial to ask questions specifically about carbon *storage* and *transportation* (i.e. separate the two components of CCS). The majority of studies have focused on the *storage* of CO_2 (see Shackley and Dutschke, 2012) but there could be risks associated specifically with CO_2 pipelines as discussed by a few residents in Weyburn and Fairview.

It could have been beneficial to examine other types of geological storage projects – such as large-scale saline aquifer storage projects. It may also be advantageous to study local perceptions of different CO_2 sources, including cement factories and coal or natural gas fired

power plants. It is possible that the CO_2 source could factor into perceptions of the project (e.g. a participant could be against the continuation of coal fired-power plants and therefore against a CCS project that is coupled with their local coal fired-power plant). In addition, the case studies and theoretical approach used in this research recognize that communities are often unique with regards to residents' history, experiences and context of CCS. It is unlikely that the exact same situation will be replicable. That being said, examining even a few communities should still allow for comparisons and provide valuable lessons learned about how these different local contexts will affect perceptions.

There are three methodological limitations of this research. First, I did not reside in all three communities for the same duration of time, which was primarily due to the lack of a homestay in all locations. Living in Weyburn was particularly expensive and difficult to find vacant hotel rooms. As a result, the observation period in this community was not as long as the other two locations. In addition, while in Priddis I had to stay overnight in Calgary as I could not find a homestay and there are no hotels in the area. Second, a segment of the questions included in this research dealt with predictions regarding how residents would respond to additional energy developments in their locality. This does not mean that residents will actually react to a development in that manner. For example, Fairview residents were asked how their community would respond to CCS – this provides an insight into what may happen, yet in actuality residents may react differently than their stated reaction (i.e. examines perception and not behavior). Third, as discussed in Chapter 2, CCS can be framed and explained from a number of different perspectives. The background information I provided to interviewees is one possible way to frame and describe CCS. Another way of describing CCS could be to compare the costs of this technology to other low GHG emission energy technologies or discuss a wide range of

perspectives from government, environmental non-governmental organizations, industry, etc. Future studies could include an examination of how perspectives of the risks and benefits of the technology are affected by the way that CCS is framed.

Future Areas of Study

The research presented here provides a number of opportunities for future study. This research examined three communities' views of CCS. More specifically, I was able to examine a project that was: 1) perceived positively and was supported; and 2) perceived negatively and rejected. The framework and insights from this research could be expanded through the additional case study of a project that was perceived negatively but was not rejected (if such a project emerges). This additional case study would allow researchers to better understand why communities might fail in halting a project. Additional case studies could examine other CCS projects proposed for Canadian communities (for example, the perceptions of those living in Estevan, Saskatchewan towards the Boundary Dam project).[58] Examining other communities could allow for a better understanding of how CCS can impact communities by examining other local contexts and situations. Questions could include: Will a community support CO_2 injection into a local saline aquifer (not for EOR purposes)? How does a community view CCS if storing the CO_2 will help save a local industry (e.g. a coal-fired power plant) that would have to be shut down if they did not reduce GHG emissions? How would perceptions of a CCS project be affected if an 'outside' company developed the project and there was no benefit to current local industry? Answers to

[58] The Boundary Dam Integrated Carbon Capture and Storage Demonstration Project will capture CO_2 at the Boundary Dam Power Station near Estevan, Saskatchewan and utilize the CO_2 for EOR purposes. It is a $1.24 billion partnership between the Government of Canada, Government of Saskatchewan and SaskPower.

these types of questions could further the development of a framework that examines how place and community variables affect risk perceptions and community action.

The examination of CCS perceptions and community factors influencing them could be expanded by the development of a survey tool. The research undertaken in this dissertation was exploratory and therefore group and individual interviews were the most advantageous method to understanding residents' perspectives. Interviews can be valuable as a primary step for identifying potential directions for future research (Malone et al., 2009; Denzin and Lincoln, 1994). A survey could be deployed to the communities of Fairview, Weyburn/Goodwater and Priddis. This would allow for a larger sample size and the use of quantitative measures to better predict residents perceptions and community action. This survey could also be utilized for other communities where CCS is proposed to better understand residents perceptions of the development and perhaps if they ultimately support or oppose the local project.

Third, the theoretical framework and approach used in this research could also be used to examine other energy systems and technological risks. While there are specific risks involved with carbon capture and storage, the examination of risks using an interactional field theory approach could shed new light on studies of other technological and energy system developments with regard to community perceptions. This conceptualization could be utilized to examine residents' perceptions about wind turbines, hydroelectric power plants and nuclear power in ways that incorporate community and sense of place.

Fourth, additional follow-up studies could take place in Weyburn. Terwel and colleagues (2012) discuss the benefits of follow-up studies in communities where technological development is occurring. These benefits include: 1) monitoring any change in local awareness or perceptions; 2) better understanding how perceptions change (or stay the same) should events

occur (e.g. a CO_2 leak, change in company ownership, etc.); or 3) monitoring how general CCS and project specific knowledge develops to aid in evaluating or developing communications.

Finally, the timing of the alleged CO_2 leak at the Weyburn CCS project afforded me the opportunity to examine how these allegations may affect perceptions of CCS developments. While the CO_2 leak allegations were not the major research focus of this dissertation, future research could further enhance how focusing events such as leaks can affect technological developments and the potential ripple effects of such events into other communities. The ubiquity of online and social media potentially makes such impacts immediate and pronounced beyond the locality. Future research could potentially include an examination of residents' views regarding CCS and the CO_2 leak allegations now that reports have demonstrated that there was no lead of CO_2. Research questions could include: Did residents hear (or seek out) media about the reports dismissing the allegations of a leak? What information can they recall? Did the final reports make a difference in their perceptions of the alleged leak or about CCS in general?

Recommendations for the Public Understanding and Communication of CCS

This study illuminates the importance of examining the local contexts that influence decisions. Research by Greenberg and colleagues (2009) stressed the need for conducting a 'social site assessment' when determining how to communicate with populations near technological developments. This is not unlike the need for a 'geological site assessment' before beginning work on a CCS development. This study reinforces the need to perform a social site assessment to better understand local concerns and to facilitate communications in a local area. More specifically developers must understand how residents perceive the risks and benefits of the development and how it impacts their sense of place and community relationships. These

perceptions should factor into communications with a community and may even influence a developer's decision whether or not to implement a project in the area. Industry and government often develop and deliver generalized risk communications. This research demonstrates that a universal risk communication approach is not ideal. For example, before industry provides messages about the 'benefits of additional visitors[59] to an area', it is important to understand if that is actually a perceived benefit (i.e. in Priddis this was a downfall of CCS whereas in Weyburn this was a benefit). It is also important to understand what residents know about their area, concerns about their place and support for the technology before developing community communications. These factors are critical because a project may affect a community in a way that a developer (particularly a developer who has not operated in an area) may not understand or predict. Risk communications must take into account local *understanding* of a technology. For example, many Weyburn residents stated that the local project was a 'carbon injection project,' not CCS. Any communications that discussed the project as a 'GHG reduction strategy' or as 'CCS' could be problematic or unclear because residents did not think that the local project was associated with any kind of anthropogenic CO_2 mitigation approach.

It is important to reiterate that communication is necessary for community support of a project. However, good communication practices *do not* ensure community support. This was demonstrated in Priddis, where many residents stated that the communication on behalf of the University of Calgary was good, yet they still did not want the project in the proposed location.

It is important to note that just because all three communities perceive that there is a similar risk or downfall to CCS (e.g. increased traffic), it does not mean factor is the *most*

---

[59] Additional people in the area could include workers, scientists, etc.

important and that it should be the only or main focus of risk communication. For example, residents in all three communities mentioned the risk of CCS induced earthquakes. However, the possible occurrence of earthquakes were not considered the most harmful issue associated with CO_2 storage and the perceptions of this risk were unlikely to halt CCS development in any of the communities studied. Bearing this in mind I suggest that risk communication about CCS developments need to identify two risk perception factors: 1) the concerns that are likely to be found in every community where CCS is proposed (e.g. CO_2 leaks, increased traffic, earthquakes); 2) concerns that are specific to communities (e.g. concerns about population growth, animal migration).

Stakeholders who are affected by a development (whether it be the developers or communities) need to examine area residents' knowledge and experience of their locality, how the development will affect community functioning and the demographic and community sustainability characteristics of an area. Effective two-way communication and engagement about the development will occur only when developers understand the perspectives of local residents and vice versa. Much risk communication research has focused on what people know and what they need to know to make informed decisions (Morgan et al., 2001). I argue that we also need focus on what developers and policy makers need to know about an area in order to make an informed decision about implementing a technological development. This means taking into account local resident's perceptions of the risk and their place-based knowledge and experience.

Recommendations for Policy Implementation or Industry Best-Practices

I propose the following three recommendations for policy implementation or industry best practices based on the results of this research. First, it is critical that policy makers develop regulations and/or that industry creates best practices for the monitoring of CO_2. Weyburn residents' awareness of monitoring practices at the Weyburn-Midale CO_2 Project was an important factor in trust and support of the development. Residents in Fairview also stated the importance of continuous and transparent monitoring for the support of a project in their area. It is critical to have these monitoring practices for the general support of CCS; yet, it is especially important to have continuous monitoring when residents or others make allegations of a possible leak. If monitoring data is not readily available to residents and media at the time of an allegation, negative perceptions of CCS will be difficult to mitigate.

Second, strong regulations regarding the implementation and management of CCS projects are needed to ensure that the technology is developed cautiously. It is clear that a problem at one CCS project can affect perception of other CCS projects. Focusing events, such as allegations of a CO_2 leak, have the potential to elevate the attention of the possible problems associated with a technology (Birkland, 1997). The allegations of a CO_2 leak in Weyburn caused concern about CCS in both Priddis and Fairview communities. Even though independent reports disputed the claims of a leak at the Kerr farm, it is likely that there will be long-lasting effects of these allegations. The news stories about these allegations are still present with a simple Internet search and even the Wikipedia page defining CCS discusses the allegations of a leak. These focusing events can be long lasting in the collective publics' mind. For instance, there were residents in Fairview who recalled the Lake Nyos tragedy and equated it to the possible risks and concerns about their 'place' associated with a CO_2 leak from a CCS project.

Local Public consultation is important for understanding if a community will support or oppose a project in a given area. It is also critical for local residents' support of CCS or other energy development. Consultation was important to Weyburn residents regarding carbon injection or other oilfield developments and to Fairview residents regarding local energy systems projects. Community consultation was mentioned as important in Priddis as well. Even though the University of Calgary research project was not supported, many residents reported respect for the University of Calgary communication process. Residents had indicated that the University was being a 'good neighbor' by consulting residents and stated that relations between the University and residents would have been greatly affected if they had not been consulted. If the research project was implemented without consent and residents had found out about the injected CO_2 at a later date, there would likely have been community outrage, damaged relationships between residents and researchers, and suspicion about future projects on the University land. Consultation does not equate to public support, yet it helps better understand the community and the needs of the residents that live in the area. It also may equate to greater trust in the developers and perceived procedural fairness. Both outcomes may make it easier for developers to reach a compromise with local residents that allow development to occur in such a way that is mutually beneficial to both parties. Good consultation practices and routines early in the area they also may make developers' better able to predict if a project is desired in an area or if it will be opposed. As stated previously, there may not be any amount of communication that can move a project forward if a community does not want it. It may save the developers time and finances if they determine early on in their consultation process that a project does not correspond with the values residents place on the land (e.g. residents perceive their area as 'natural') or that the project is not desired by or perceived as beneficial to the community.

Recommendations for Locally Affected Communities

This study illuminates the importance of *community* as a factor in understanding and addressing risk perceptions. Results from the three case studies highlight two primary categories of recommendations for communities who are faced with or considering hosting developments in their region. The first category involves recognizing the needs of the residents—factors such as peoples' history with or ties to place and requirements for community sustainability. The second category involves examining and understanding community organization, mobilization and communication networks.

The first category of recommendations concerns the need for community stakeholders and planners to examine and understand residents' ties to place. This includes the meanings residents' associate with the land (e.g. industrial or natural, a "working" landscape or one that should be conserved as "wild") and predictions about how these ties would influence community support for a project before agreeing to host or pursuing a development in the area. If community members know that there is a technological development proposal for the area, it may be useful to create a community long-term sustainability plan that outlines community needs. When communities develop long-term or sustainability plans, it is important to take into account communities' sense of place. Communities could use the framework developed in this dissertation to better understand if residents would support or oppose a project in the area. Furthermore, it would be prudent for community planners and leaders to determine any differentiation between areas in a given locality with regards to special landscape meanings or ties. This could help determine whether residents' feel that some areas should remain 'natural' or 'untouched' and if any other areas are amenable to developments, natural resource extraction and

industry. Such recognition could open the door to negotiations about developments in a way that avoids community opposition.

The second major category of recommendations concerns the need to examine and understand community organization, mobilization and communication networks. This involves knowing the communication gatekeepers in a community and the way that residents obtain their information or interact with each other (e.g. communication networks). Communication gatekeepers may include people and groups such as government officials, unofficial leaders and multi-generational residents. These people can be called upon to lead the community, serve as intermediaries in negotiations or communication with residents, and to better predict how local residents' will respond to potential developments. Related to this point is an understanding of where residents' voice their concerns. An honest discussion about the risks and benefits of a development may not always occur within the offices of the local municipality, but rather in the local coffee shops and places where community members gather. In this regard it is important to understand and distinguish between residents' "official" views and the perspectives they share with one-another, especially if a development wants to be "part of the community." It also is important to understand how community members search for and obtain information and the social networks that facilitate these processes. Strengthening communication channels and understanding the best way to deliver communications to residents may be potential strategies for increasing or reducing opposition to a development. It can also help in other risk communication efforts such as communicating about imminent hazards, such as floods. If community leaders understand communication networks, stakeholders will know how to rally the community, determine what networks should be tapped and how the community can mobilize against an event.

Concluding Statements

While the conception of community and its basis as a means for understanding societal trends has changed in industrial societies, certain truths remain. We are, at least in part, defined by the people we interact with; by the settings in which we live or spend time in; by the ways we identify with groups of people (Wilkinson, 1991). For that reason I argue that community still matters to the study of risk; for the understanding of how people respond to change, and in the ways they develop their individual perceptions about potential impact. For many residents who are faced with a technological development, the conceptions of community described in this study serve important societal functions and certainly factor into their risk perceptions. This is especially true in rural locations, as these are areas where many of Canada's future technological developments will occur. Understanding how rural communities will react to technological development, ensuring that it does not disrupt community functioning and promoting healthy communities in its wake necessitates that researchers renew their focus on the ways that community still matters.

REFERENCES

Adler, P., & Adler, P. (1994). Observational techniques. In N. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research*. Thousand Oaks: Sage.

Agrium. (2008). Enhance Energy and Agrium Sign CO_2 Agreement. Retrieved January 15, 2010, from http://www.agrium.com/news/05784_8835.jsp

Aitken, M. Wind power and community benefits: Challenges and opportunities. *Energy Policy, 38*(10), 6066-6075.

Alberta Carbon Capture and Storage Development Council. (2009). *Accelerating Carbon Capture and Storage Implementation in Alberta*. Edmonton.

Alberta Geological Survey. (2009). Deep Injection of Acid Gas (H_2S) in Western Canada. Retrieved December 12, 2009, from http://www.ags.gov.ab.ca/co2_h2s/co2_acidgas.html

Altman, I., & Low, S. (Eds.). (1992). *Place Attachment*. New York: Springer.

Anderson, C., Schirmer, J., & Abjorensen, N. (2012). Exploring CCS community acceptance and public participation from a human and social capital approach. *Mitigation and Adaptation Strategies for Global Change, 17*(6), 687-706.

Ansay, S. J., Perkins, D. F., & Colonel, J. N. (2004). Interpreting outcomes: Using focus groups in evaluation research. *Family Relations, 53*(3), 310-316.

Apache. (2011). Display at Weyburn EOR Exhibit. Weyburn, SK.

Arson, J. (1994). A pragmatic view of thematic analysis. The Qualitative Report. Retrieved February 3, 2008, from http://www.nova.edu/ssss/QR/BackIssues/QR2-1/aronson.html

Ashworth, P., Boughen, N., Mayhew, M., & Millar, F. (2010). From research to action: Now we have to move on CCS communication. *International Journal of Greenhouse Gas Control, 4*(2), 426-433.

Axelrod, R. (1986). Modeling the evolution of norms. *American Political Science Review, 8*, 1095-1111.

Bachu, S. (2007). CO_2 Storage in geological media: Role, means, status and barriers to deployment. *Progress in Energy and Combustion Science, 34*, 254-273.

Bachu, S., & Gunter, W. D. (2004). Overview of Acid-Gas Injection Operations in Western Canada. Retrieved from http://science.uwaterloo.ca/~mauriced/earth691-duss/CO2_Bachu_Gunter_AcidGasInjectionAlberta_2005.pdf

Bachu, S., & Stewart, S. (2002). *Geological Sequestration of Anthropogenic Carbon Dioxide in the Western Canada Sedimentary Basin: Suitability Analysis*: Alberta Geological Survey.

Bäckstrand, K., Meadowcroft, J., & Oppenheimer, M. (2011). The politics and policy of carbon capture and storage: Framing an emergent technology. *Global Environmental Change, 21*(2), 275-281.

Baker, F. (1990). Risk communication about environmental hazards. *Journal of Public Health Policy, 11*(3), 341-359.

Banyard, V. L., & Miller, K. E. (1998). The powerful potential of qualitative research for community psychology. *American Journal of Community Psychology, 26*(4), 485-505.

Barbour, R., & Kitzinger, J. (Eds.). (1999). *Developing Focus Group Research: Politics, Theory and Practice*: Sage Publications Limited.

Baum, A., Gatchel, R. J., & Schaeffer, M. A. (1983). Emotional, behavioral, and physiological effects of chronic stress at Three Mile Island. *Journal of Consulting and Clinical Psychology, 51*(4), 565-572.

Beck, U. (1992). *Risk Society*. London: Sage.
Bellona. (2010). CCS communication: Lessons learnt from Barendrecht. Retrieved March 20, 2012, from www.bellona.org/news/CCS_communication_lessons_learnt_Barendrecht
Bender, T. (1978). *Community and Social Change in America*. New Brunswick, NJ: Rutgers University Press.
Bergerson, J. A., & Keith, D. W. The truth about dirty oil: Is CCS the answer? *Environmental Science & Technology, 44*(16), 6010-6015.
Berkes, F., Colding, J., & Folke, C. (Eds.). (2002). *Navigating social and ecological systems: Building resilience for complexity and change*. Cambridge: Cambridge University Press.
Bernard, J. (1973). *The Sociology of Community*. Glenview, IL: Scott, Foresman and Company.
Besley, J. C. (2010). Public engagement and the impact of fairness perceptions on decision favorability and acceptance. *Science Communication, 32*(2), 256-280.
Besley, J. C., & McComas, K. A. (2005). Framing justice: Using the concept of procedural justice to advance political communication research. *Communication Theory, 15*, 414-436.
Biernacki, P., & Waldorf, D. (1981). Snowball sampling: Problems and techniques of chain referral sampling. *Sociological Methods and Research, 10*(2), 141-163.
Bijker, W. E., & Hughes, T. P. (Eds.). (1987). *The Social Construction of Technological Systems*. Cambridge, MA: MIT Press.
Binney, S. E., Mason, R., Martsolf, M. S., & Detweiler, J. H. (1996). Credibility, public trust, and the transport of radioactive waste through local communities. *Environment and Behavior, 28*(3), 283-301.
Birkland, T. A. (1997). *After Disaster: Agenda Setting, Public Policy and Focusing Events*. Georgetown University Press.
Bohm, M. C., Herzog, H. J., Parsons, J. E., & Sekar, R. C. (2007). Capture-ready coal plants-options, technologies and economics. *International Journal of Greenhouse Gas Control, 1*(1), 113-120.
Bord, R. J., & O'Connor, R. E. (1992). Determinants of risk perceptions of a hazardous waste site. *Risk Analysis, 12*(3), 411-416.
Bourdieu, P. (1983). The forms of capital. In J. Richards (Ed.), *Handbook of Theory and Research for the Sociology of Education*. New York: Greenwood Press.
Boyatzis, R. E. (1998). *Transforming Qualitative Information: Thematic Analysis and Code Development*. Thousand Oaks, CA: Sage.
Boyd, A.D. and Einsiedel, E.F. 2011. *Canadian Perspectives of Carbon Capture and Storage: Results of a National Survey Comparing Energy Systems*. International Symposium for Society and Natural Resources. Madison, Wisconsin. (June)
Boyd, A., Liu, Y., Stephens, J., Wilson, E., Pollak, M., Peterson, T., et al. (2013). Controversy in technology innovation: Contrasting media and expert risk perception of the alleged leakage at the Weyburn Carbon Dioxide Demonstration Project. *International Journal of Greenhouse Gas Control*.
Bradbury, J., Branch, K. M., Heerwagen, J. H., & Liebow, E. (1994). *Community Viewpoints of the Chemical Stockpile Disposal Program*. Washington, DC: Pacific Northwest National Laboratories.
Bradbury, J., Ray, I., Peterson, T., Wade, S., Wong-Parodi, G., & Feldpausch, A. (2009). The role of social factors in shaping public perceptions of CCS: Results of multi-state focus

group interviews in the U.S. *Energy Procedia, 1*(1), 4665-4672.
Brandenburg, A. M., & Carroll, M. S. (1995). Your place or mine? The effect of place creation on environmental values and landscape meanings. *Society & Natural Resources: An International Journal, 8*(5), 381-398.
Breakwell, G. M. (2007). *The Psychology of Risk*. Cambridge, NY: Cambridge University Press.
Brehm, J. M. (2007). Community attachment: The complexity and consequence of the natural environment facet. *Human Ecology 35*, 477-488.
Brennan, M. A., Flint, C. G., & Luloff, A. E. (2009). Bringing together local culture and rural development: Findings from Ireland, Pennsylvania and Alaska. *Sociologia Ruralis, 49*(1), 97-112.
Breukers, S., & Wolsink, M. (2007). Wind power implementation in changing institutional landscapes: An international comparison. *Energy Policy, 35*(5), 2737-2750.
Bridger, J. C., & Luloff, A. E. (1999). Toward an interactional approach to sustainable community development. *Journal of Rural Studies, 15*(4), 377-387.
Brion, D. J. (1991). *Essential Industry and the NIMBY Phenomenon*. New York: Quorum.
Brown, B., & Perkins, D. (1992). Disruptions in place attachment. In I. Altman & S. Low (Eds.), *Place attachment*. New York: Plenum Press.
Brown, G., & Raymond, C. (2007). The relationship between place attachment and landscape values: Toward mapping place attachment. *Applied Geography, 27*(2), 89-111.
Brown, V., & Pitcher, J. (2005). Linking community and government: Islands and beaches. In M. Keen, V. Brown & R. Dyball (Eds.), *Social Learning in Environmental Management: Towards a Sustainable Future*. London: Earthscan.
Brunsting, S., de best-Waldhober, M., Feenstra, C. F. J., & Mikunda, T. (2011). Stakeholder participation and onshore CCS: Lessons from the Dutch CCS Case Barendrecht. *Energy Procedia, 4*, 6376-6383.
Bullard, R. D. (1990). *Dumping in Dixie: Race, Class, and Environmental Quality* (Vol. 3). Boulder, CO: Westview Press.
Bullard, R. D., & Johnson, G. S. (2002). Environmentalism and public policy: Grassroots activism and its impact on public policy decision-making. *Journal of Social Issues, 56*(3), 555-578.
Burningham, K. (2000). Using the language of NIMBY: A topic for research, not an activity for researchers. *Local Environment: The International Journal of Justice and Sustainability, 5*(1), 55 - 67.
Burningham, K., Barnett, J., & Thrush, D. (2006). The limitations of the NIMBY concept for understanding public engagement with renewable energy technologies: A literature review. University of Manchester.
Callaghan, E. G., & Colton, J. (2008). Building sustainable & resilient communities: A balancing of community capital. *Environment, Development and Sustainability, 10*(6), 931-942.
Campbell, B. (2011). Cross family concerned about proposed CO_2 storage project. *Western Wheel*.
Canadian Environmental Assessment Agency. (2009). Federal Government Response to Hydroelectric Project. Retrieved September 5, 2012, from http://www.ceaa-acee.gc.ca/050/DocumentID=34151
Carroll, M. S., Higgins, L. L., Cohn, P. J., & Burchfield, J. (2006). Community wildfire events as a source of social conflict. *Rural Sociology, 71*(2), 261-280.

Cass, N., & Walker, G. (2009). Emotion and rationality: The characterization and evaluation of opposition to renewable energy projects. *Emotion, Space and Society, 2*(1), 62-69.
CCS101. (2011). CCS Communities. Retrieved November 17, 2011, from http://ccs101.ca/ccs_communities
Cenovus. (2011). Site Assessment, Weyburn Unit SW30-5-13W2. Retrieved November 2011, from http://www.cenovus.com/operations/oil/Cenovus-summary-of-investigation.pdf
Cenovus. (2012). Operations-Weyburn. Retrieved August 10, 2012, from http://www.cenovus.com/operations/oil/weyburn.html
Charpentier, A. D., Bergerson, J. A., & MacLean, H. L. (2009). Understanding the Canadian oil sands industry's greenhouse gas emissions. *Environmental Research Letters, 4*.
City of Weyburn. (2011). Weyburn Profile. Retrieved January 18, 2010, from http://www.weyburn.ca
CO2CRC. (2010). General CCS Images & Videos. Retrieved March 10, 2010, from http://www.co2crc.com.au/imagelibrary
Collins, D. L., Baum, A., & Singer, J. E. (1983). Coping with chronic stress at Three Mile Island: Psychological and biochemical evidence. *Health Psychology, 2*(2), 149-166.
Corbin, J., & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks, CA: Sage Publications.
Court of Queen's Bench Alberta. (2009). Blatz v. Impact Energy Inc. *ABQB 506*
Covello, V. T., Peters, R. G., Wojtecki, J. G., & Hyde, R. C. (2001). Risk communication, the West Nile Virus epidemic, and bioterrorism: Responding to the communication challenges posed by the intentional or unintentional release of a pathogen in an urban setting. *Journal of Urban Health, 78*(2), 383-391.
Cresswell, T. (2004). *Place a Short Introduction*. Malden, MA: Blackwell Publishing.
Cross Conservation. (2012). About Ann and Sandy Cross Conservation Area. Retrieved August 10, 2012, from http://www.crossconservation.org/about-us
Crowe, J. (2010). Community attachment and satisfaction: The role of a community's social network structure. *Journal of Community Psychology, 28*(5), 622-644.
Curry, T. E. (2004). *Public Awareness of Carbon Capture and Storage: A Survey of Attitudes toward Climate Change Mitigation*. MIT, Cambridge, MA.
Cuthbertson, B. H., & Nigg, J. M. (1987). Technological disaster and the nontherapeutic community: A question of true victimization. *Environment and Behavior, 19*(4), 462-483.
Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social vulnerability to environmental hazards. *Social Science Quarterly, 84*(2), 242-261.
Daly, D., Bradbury, J., Greenberg, S., Myhre, R., Peterson, T., Tollefson, L., et al. (2010). *Road-testing the Outreach Best Practices Manual: Applicability for Implementation of the Development Phase Projects by the Regional Carbon Sequestration Partnerships*. Paper presented at the International Conference on Greenhouse Gas Technologies (GHGT).
David Suzuki Foundation. (2009). Are we digging ourselves into a hole with carbon capture. Retrieved January 15, 2010, from http://davidsuzuki.org/blogs/science-matters/2009/02/are-we-digging-ourselves-into-a-hole-with-carbon-capture/
de Figueiredo, M. A. (2000). *The Hawaii Carbon Dioxide Ocean Sequestration Field Experiment A Case Study in Public Perceptions and Institutional Effectiveness*. MIT, Mechanical Engineering.
Dear, M. (1992). Understanding and overcoming the NIMBY syndrome. *Journal of the*

American Planning Association, 58(3), 288-300.
Denzin, N., & Lincoln, Y. (1994). Introduction. In N. Denzin & Y. Lincoln (Eds.), *Handbooks of Qualitative Research*. Thousand Oaks: Sage.
Devine-Wright, P. (2005). Local aspects of UK renewable energy development: exploring public benefits and policy implications. *Local Environment, 8*(2), 125-139.
Devine-Wright, P. (2009). Rethinking NIMBYism: The role of place attachment and place identity in explaining place-protective action. *Journal of Community & Applied Social Psychology, 19*(6), 426-441.
Devon. (2012). Ingenuity at Dunvegan creates multiple benefits. Retrieved September 5, 2012, from http://www.devonenergy.com/CorpResp/initiatives/Pages/Dunvegan.aspx
DOE (Department of Energy). (2011). Enhanced Oil Recovery/CO_2 Injection. Retrieved October 20, 2011, from http://www.fossil.energy.gov/programs/oilgas/eor/index.html
Donaldson, E. C., Chilingarian, G. V., & Yen, T. F. (Eds.). (1985). *Enhanced Oil Recovery*. Amsterdam, The Netherlands: Elsevier Science Publishers.
Douglas, M., & Wildavsky, A. (1983). *Risk and Culture*. London: University of California Press.
Dover, F. (2011). Carbon capture project posses unacceptable risk. *Western Wheel*.
Dutschke, E. (2011). What drives local public acceptance - comparing two cases from Germany. *Energy Procedia, 4*, 6234-6240.
Dynes, R. D. (1970). Organizational involvement and changes in community structure in disaster. *American Behavioral Scientist, 13*(3), 430-439.
Earle, T. C. (2010). Trust in risk management: A model-based review of empirical research. *Risk Analysis, 30*(4), 541-574.
Edelstein, M., & Kleese, D. A. (1995). Cultural relativity of impact assessment: Native Hawaiian opposition to geothermal energy development. *Society & Natural Resources: An International Journal, 8*(1), 19-31.
Einsidel, E.F., Boyd, A.D., Medlock, J.& Ashworth, P. (2013). Assessing Sociotechnical Mindsets: Public Deliberations on Carbon Capture and Storage in the Context of Energy Sources and Climate Change. *Energy Policy*. 53(2013): 149-158.
Eisenhardt, K. (1989). Building theories from case study research. *The Academy of Management Review, 14*(4), 532-550.
Ellis, G., Barry, J., & Robinson, C. (2007). Many ways to say no, different ways of saying yes: Applying Q-methodology to understand public acceptance of wind farm proposals. *Journal of Environmental Planning and Management, 50*, 517-551.
Elwyn, G., Edwards, A., Kinnersley, P., & Grol, R. (2000). Shared decision-making and the concept of equipoise: The competences of involving patients in healthcare choices. *British Journal of General Practice, 50*, 892-897.
Environment Canada. (2005). Report on Energy Consumption. Retrieved February 24, 2009, from http://www.ec.gc.ca/soer-ree/English/Indicator_series/new_issues.cfm
Environment Canada. (2012). Canada's Greenhouse Gas Emissions. Retrieved October 12, 2012, from http://www.ec.gc.ca/ges-ghg/
Environment Canada. (2012). Greenhouse Gas Emissions Data. Retrieved July 15, 2012, from https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=BFB1B398-1
Erikson, K. (1995). *A New Species of Trouble*. New York: Norton & Company Inc.
Esteves, A. M. (2008). Mining and social development: Refocusing community investment using multi-criteria analysis. *Resources Policy, 33*(1), 39-47.

European Environment Agency. (2007). *Climate Change: The Cost of Inaction and The Cost of Adaptation* (No. Technical Report No 13/2007).

Falk, I., & Kilpatrick, S. (2000). What is social capital? A study of interaction in a rural community. *Sociologia Ruralis, 40*(1), 87-110.

Field, D. R., & Burch, W. R., Jr. (1988). *Rural Sociology and the Environment*. Westport, CT: Greenwood.

Fischer, F. (2004). Citizens and experts in risk assessment: Technical knowledge in practical deliberation. *Theory and Practice, 2*(13), 90-98.

Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S., & Combs, B. (1978). How safe is safe enough? A psychometric study of attitudes towards technological risks and benefits. *Policy Sciences, 9*, 127-152.

Flint, C. G. (2006). Community perspectives on spruce beetle impacts on the Kenai Peninsula, Alaska. *Forest Ecology and Management, 227*(3), 207-218.

Flint, C. G., & Luloff, A. E. (2005). Natural resource-based communities, risk, and disaster: An intersection of theories. *Society and Natural Resources, 18*, 399-412.

Flint, C. G., & Luloff, A. E. (2007). Community activeness in response to forest disturbance in Alaska. *Society and Natural Resources 20*, 431-450.

Flint, C. G., Luloff, A. E., & Finley, J. C. (2008). Where is "community" in community-based forestry? *Society & Natural Resources: An International Journal, 21*(6), 526 - 537.

Flint, C. G., Luloff, A. E., & Theodori, G. I. (2010). Extending the concept of community interaction to explore regional community fields. *Journal of Rural Social Sciences, 25*(1), 22-36.

Flynn, J., Burns, W., Mertz, C. K., & Slovic, P. (1992). Trust as a determinant of opposition to a high-level radioactive waste repository: Analysis of a structural model. *Risk Analysis, 12*(3), 417-429.

Flynn, J., Peters, E. M., Mertz, C. K., & Slovic, P. (2001). Risk, Media, and Stigma at Rocky Flats. In J. Flynn, P. Slovic & H. Kunreuther (Eds.), *Risk, Media and Stigma: Understanding Public Challenges to Modern Science and Technology* (pp. 309-330). London: Earthscan.

Flynn, J., Slovic, P., & Mertz, C. K. (1993). The Nevada initiative: A risk communication fiasco. *Risk Analysis, 13*(5), 497-502.

Frazer, E. (1999). *The Problem of Communitarian Politics*. Oxford: Oxford University Press.

Freudenburg, W. R., & Gramling, R. (1992). Community impacts of technological change: Toward a longitudinal perspective. *Social Forces, 70*(4), 937-955.

Freudenburg, W. R., & Pastor, S. K. (1992). Public responses to technological risks: Toward a sociological perspective. *The Sociological Quarterly, 33*(3), 389-412.

Frewer, L. J. (2004). The public and effective risk communication. *Toxicology Letters, 149*, 391-397.

Galphin, C. (1918). *Rural Life*. New York: The Century Company.

Gamble, D. J. (1978). The Berger Inquiry: An impact assessment process. *Science, 199*(3), 946-952.

Garvin, T. (2001). Analytical paradigms: The epistemological distances between scientists, policy makers, and the public. *Risk Analysis, 21*(3), 443-456.

Gaventa, J. (1980). *Power and Powerlessness: Quiescence and Rebellion in an Appalachian Valley*. Urbana, IL: University of Illinois Press.

GCCSI. (2012). What is CCS? How it works and why it is necessary. Retrieved July 10, 2012, from http://www.globalccsinstitute.com
Gieryn, F. (2000). A space for place in sociology. *Annual Review Sociology, 26*, 463-496.
Gilles, G. (2009, February 17). Obama compares oil sands to coal. *Seattle Times*. Retrieved from http://seattletimes.nwsource.com/html/nationworld_apcanadaobamaenergy.html
Goetz, J. P., & LeCompte, M. D. (1984). *Ethnography and Qualitative Design in Educational Research*. New York: Academic Press.
Government of Alberta. (2008). Carbon Capture and Storage Full Project Proposal Applicants. Retrieved February 1, 2009, from http://www.energy.alberta.ca/Org/pdfs/CCSFPPlist.pdf
Government of Alberta. (2010). Energy Facts and Statistics. Retrieved January 3, 2010, from http://www.energy.alberta.ca/OilSands/791.asp
Government of Alberta. (2010). Oil. Retrieved January 15, 2010, from http://www.energy.alberta.ca/OurBusiness/Oil.asp
Government of Canada. (2007). Canada-U.S. Energy Relations. Retrieved March 30, 2012, from http://www.canadainternational.gc.ca/washington/bilateral_relations /energy.aspx
Government of Canada. (2010). National Greenhouse Gas Emissions. Retrieved August 10, 2010, from http://www.ec.gc.ca/indicateurs-indicators/default.asp
Government of Canada. (2010). Canada's Economic Action Plan – Budget 2009. Retrieved March 9, 2009, from http://www.budget.gc.ca/2009/pdf/budget-planbugetaire-eng.pdf
Gramling, R., & Freudenburg, W. R. (1992). Opportunity-threat, development, and adaptation: Toward a comprehensive framework for social impact assessment. *Rural Sociology, 57*(2), 216-234.
Greenpeace. (2008). Carbon Dioxide Capture and Storage. Retrieved January 15, 2010, from http://www.greenpeace.org/international/en/publications/reports/CCS-briefing/
Griffiths, M., Cobb, P., & Marr-Laing, T. (2005). Carbon Capture and Storage: An arrow in the quiver or a silver bullet to combat climate change? Retrieved January 15, 2009, from http://pubs.pembina.org/reports/CCS_Primer_Final_Nov15_05.pdf
Gross, C. (2007). Community perspectives of wind energy in Australia: The application of a justice and community fairness framework to increase social acceptance. *Energy Policy, 35*, 2727-2736.
Gross, C. (2007). Community perspectives of wind energy in Australia: The application of a justice and community fairness framework to increase social acceptance. *Energy Policy, 35*(5), 2727-2736.
Gurabardhi, Z., Gutteling, J. M., & Kuttschreuter, M. (2004). The development of risk communication: An empirical analysis of the literature in the field. *Science Communication, 25*(4), 323-349.
Gurabardhi, Z., Gutteling, J. M., & Kuttschreuter, M. (2005). An empirical analysis of communication flow, strategy and stakeholders' participation in the risk communication literature 1988-2000. *Journal of Risk Research, 8*(6), 499-511.
Gusfield, J. (1975). *Community: A Critical Response*. Oxford: Basil Blackwell.
Ha-Duong, M., Nadaï, A., & Campos, A. S. (2009). A survey on the public perception of CCS in France. *International Journal of Greenhouse Gas Control, 3*(5), 633-640.
Harper, S. (2009). Capture and Storage Speech. Retrieved January 15, 2010, from http://pm.gc.ca/eng/media.asp?id=2686
Harpham, T., Grant, E., & Thomas, E. (2002). Measuring social capital within health surveys:

Key issues. *Health Policy and Planning, 17*(1), 106-111.
Haythornwaite, C. (2002). Strong, weak, and latent ties and the impact of new media. *The Information Society, 18*, 385-401.
Heath, R. L., Bradshaw, J., & Lee, J. (2002). Community relationship building: Local leadership in the risk communication infrastructure. *Journal of Public Relations Research, 14*(4), 317-353.
Heckathorn, D. D. (2002). Respondent-driven sampling II: Deriving valid estimates from chain-referral samples of hidden populations. *Social Problems, 49*(1), 11-34.
Hidalgo, M. C., & Hernamdez, B. (2001). Place attachment: Conceptual and empirical questions. *Journal of Environmental Psychology, 21*(3), 273-281.
Hiller, E. (1941). The community as a social group. *American Sociological Review, 6*(2), 189-202.
Hinshelwood, E., & Tawe, A. A. (2000). Community funded wind power – the missing link in UK wind farm development? *Wind Engineering, 24*(4), 299-305.
Holroyd, P. (2008). *Towards Acceptable Change: A Thresholds Approach to Manage Cumulative Effects of Land Use Change in the Southern Foothills of Alberta*. University of Calgary, Calgary.
Huijts, N. M. A., Midden, C. J. H., & Meijnders, A. L. (2007). Social acceptance of carbon dioxide storage. *Energy Policy, 35*, 2780-2789.
Human Resources and Skills Development Canada. (2011). NOC Definitions. Retrieved April 3, 2012, from http://www5.hrsdc.gc.ca/NOC/English/NOC/2011/
Humphrey, R. (1993). Life stories and social careers: Ageing and social life in an ex-mining town. *Sociology, 27*(1), 166-178.
IEA. (2008). *IEA Statistics, Electricity Information*. Paris: OECD/IEA.
Indian and Northern Affairs Canada (INAC). (2007). *Reflections on Success: A Sustainable Future in a Changing Climate*.
Integrated CO2 Network (ICO2N). (2010). Potential CCS Hubs. Retrieved May 1, 2010, from http://www.ico2n.com/thevision.php
IPAC-CO2. (2011). Kerr Investigation: Final Report. Retrieved December 2011, from http://www.ipac-co2.com/projects/investigations
IPCC. (2005). *IPCC Special Report on Carbon Capture and Storage - Summary for Policymakers*. Cambridge and New York.
IPCC. (2007, February 20, 2009). Climate change 2007: Synthesis report-summary for policymakers from http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar_syr_spm.pdf
Ipsos-Reid. (2007). *ecoENERGY Carbon Capture and Storage Task Force: Public Views on Carbon Capture and Storage*. Calgary.
Jaccard, M., & Sharp, J. (2009). CCS in Canada. In J. Meadowcroft & O. Langhelle (Eds.), *Caching the Carbon*. Cheltenham, UK: Edward Elgar Publishing Ltd.
Jakes, P., Fish, T., Carr, D., & Blahna, D. (1998). Functional communities a tool for national forest planning. *Journal of Forestry, March*, 33-37.
Jakes, P., & Langer, E. R. (2012). The adaptive capacity of New Zealand communities to wildfire. *International Journal of Wildland Fire, 21*(6), 764-772.
Jepson, P. (2005). Governance and accountability of environmental NGOs. *Environmental Science and Policy, 8*, 515-524.
Jones, C. R., & Eiser, R. J. (2009). Understanding 'local' opposition to wind development in the

UK: How big is a backyard? *Energy Policy, 38*(6), 3106-3117.
Joubert, A., Laborgne, P., & Mimer, S. (2007). Local acceptance of wind energy: Factors of success identified in French and German case studies. *Energy Policy, 35*(5), 2751-2760.
Kasarda, J. D., & Janowitz, M. (1974). Community attachment in mass community. *American Sociological Review, 38*(June), 328-339.
Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., et al. (1988). The social amplification of risk: A conceptual framework. *Risk Analysis, 8*(2), 177-187.
Kaufman, H. F. (1959). Toward an interactional conception of community. *Social Forces, 38*(1), 8-17.
Kaufman, H. F., & Wilkinson, K. (1967). *Community Structure and Leadership: An Interactional Perspective in the Study of Community*. State College: Mississippi State University of Social Science Research Center Bulletin -13.
Keith, D., Ha-Duong, M., & Stolaroff, J. (2006). Climate strategy with CO_2; Capture from the air. *Climatic Change, 74*(1), 17-45.
Keith, D. W. (2009). Why Capture CO_2 from the Atmosphere? *Science, 325*, 1654-1655.
Kemmis, D. (1990). *Community and the Politics of Place*. Norman, OK: University of Oklahoma Press.
Kerr, C. (2011). Personal Communication: Kerr Property. Regina.
Kling, G. W., Clark, M. A., Wagner, G. N., Compton, H. R., Humphrey, A. M., Devine, J. D., et al. (1987). The 1986 Lake Nyos Gas Disaster in Cameroon, West Africa. *Science, 236*(4798), 169-175.
Krause, R. M., Carley, S., Warren, D. S., Rupp, J., & Graham, J. D. (2012). Not Under My Backyard: Geographic proximity and public acceptance of Carbon Capture and Storage (CCS) facilities.
Krueger, R., & Casey, M. A. (2009). *Focus Groups: A Practical Guide for Applied Research*: Pine Forge Press.
Kuhn, R. G. (1998). Social and political issues in sitting a nuclear-fuel waste disposal facility in Ontario, Canada. *The Canadian Geographer, 42*(1), 14-28.
Kumagai, Y., Edwards, J. A., & Carroll, M. S. (2006). Why are natural disasters not "natural" for victims? *Environmental Impact Assessment Review, 25*, 106-119.
Kumamoto, H., & Henley, E. J. (2000). *Probabilistic risk assessment and management for engineers and scientists*: IEEE Press.
Kunreuther, H., & Easterling, D. (1990). Are risk-benefit tradeoffs possible in siting hazardous facilities? *The American Economic Review, 80*(2), 252-256.
Kunreuther, H., & Slovic, P. (2001). Coping with stigma: Challenges and opportunities. In J. Flynn, P. Slovic & H. Kunreuther (Eds.), *Risk, Media and Stigma: Understanding Public Challenges to Modern Science and Technology* (pp. 331-352). London: Earthscan.
Lambert, S. D., & Loiselle, C. G. (2008). Combining individual interviews and focus groups to enhance data richness. *Journal of Advanced Nursing, 62*(2), 228-237.
Langhelle, O., & Meadowcroft, J. (2009). CCS in comparative perspective. In J. Meadowcroft & O. Langhelle (Eds.), *Caching the Carbon*. Cheltenham, UK: Edward Elgar Publishing Ltd.
Lankford, S. V., & Howard, D. R. (1994). Developing a tourism impact attitude scale. *Annals of Tourism Research, 21*(1), 121-139.
Lawton, D. (2010). Personal Communication: Proposed University of Calgary Geoscience Field

Research Station. Calgary.
Lawton, D. (2011). University abandons project at observatory. *Western Wheel*.
Lawton, D. (2012). Personal Communication: Proposed University of Calgary Geoscience Field Research Station. Calgary.
LeCompte, M. D., & Schensul, J. J. (2010). *Designing and Conducting Ethnographic Research* (Vol. 1): AltaMira Press.
Lee, B., & Carroll, M. S. (1991). *Community and Society*. Seattle, WA: The United States Forestry Service.
Leiss, W. (1996). Three phases in the evolution of risk communication practice. *The Annals Of The American Academy Of Political And Social Science, 545*(1), 85-94.
Leopold, A. (1949). *A Sand County Almanac and Sketches Here and There*: Oxford University Press.
Lind, E. A., Kanfer, R., & Earley, P. C. (1990). Voice, control, and procedural justice: Instrumental and non-instrumental concerns in fairness judgments. *Journal of Personality and Social Psychology, 59*(5), 952-959.
Lind, E. A., & Tyler, R. T. (1988). *The Social Psychology of Procedural Justice*. Springer.
Lindlof, T. R., & Taylor, B. C. (2002). *Qualitative Communication Research Methods* (2 ed.). Thousand Oaks, CA: Sage Publications.
Loomis, J., Kent, P., Strange, L., Fausch, K., & Covich, A. (2000). Measuring the total economic value of restoring ecosystem services in an impaired river basin: Results from a contingent valuation survey. *Ecological Economics, 33*(1), 103-117.
Lukes, S. (2005). *Power: A Radical View* (2 ed.). New York: Palgrave Macmillian.
Lupton, D. (1999). *Risk*. London: Routledge.
M.D. of Foothills No 31. (2012). Dark Night Initiative. Retrieved August 10, 2012, from http://www.mdfoothills.com/council/boards_committees.html
Mabon, L. (2012). Values, places and bodies: Opportunities for forging a deeper understanding of public perceptions of CCS. *Energy & Environment, 23*(2/3), 329-343.
Maguire, L. A., & Lind, E. A. (2003). Public participation in environmental decisions: stakeholders, authorities and procedural justice. *International Journal of Global Environmental Issues, 3*(2), 133-148.
Mansbridge, J. J. (Ed.). (1990). *Beyond Self Interest*. Chicago: University of Chicago Press.
Marchetti, C. (1977). On geoengineering and the CO_2 problem. *Climate Change, 1*(1), 59-68.
Marcus, C. (1992). Environmental Memories. In I. Altman & S. Low (Eds.), *Place Attachment*. New York: Plenum Press.
Masuda, J. R., & Garvin, T. (2006). Place, culture, and the social amplification of risk. *Risk Analysis, 26*(2), 437-454.
Mazmanian, D. A., & Morell, D. (1990). The NIMBY syndrome: Facility siting and the failure of democratic discourse. In N. Vig & M. Kraft (Eds.), *Environmental Policy in the 1990s: Toward a New Agenda* (pp. 233-250). Washington, DC: CQ Press.
McFarland, J. R., & Herzog, H. J. (2006). Incorporating carbon capture and storage technologies in integrated assessment models. *Energy Economics, 28*(5-6), 632-652.
McLaren Loring, J. (2007). Wind energy planning in England, Wales and Denmark: Factors influencing project success. *Energy Policy, 35*(4), 2648-2660.
McLeod, J. M., Scheufele, D. A., & Moy, P. (1999). Community, communication, and participation: The role of mass media and interpersonal discussion in local political

participation. *Political Communication, 16*, 315-336.
McLeod, J. M., Scheufele, D. A., Moy, P., Horowitz, J. M., Holbert, R. L., & Zhang, W. (1999). Understanding deliberation: The effects of discussion networks on participation in a public forum. *Communication Research, 26*, 743-774.
Meadowcroft, J., & Langhelle, O. (2009). The politics and policy of carbon capture and storage. In J. Meadowcroft & O. Langhelle (Eds.), *Caching the Carbon*. Cheltenham, UK: Edward Elgar Publishing Ltd.
Meppem, T. (2000). The discursive community: Evolving institutional structures for planning sustainability. *Ecological Economics, 34*(1), 47-61.
Miller, E., Bell, L., & Buys, L. (2007). Public understanding of carbon sequestration in Australia: Socio-demographic predictors of knowledge, engagement and trust. *Australian Journal of Emerging Technologies and Society, 5*(1), 15-33.
Miller, K. (2005). *Communication theories: perspectives, processes, and contexts*. New York: McGraw-Hill.
Miller, S. (2001). Public Understanding of science at the crossroads. *Public Understanding of Science, 10*, 115-120.
Mills, C. W. (1958). The structure of power in American society. *British Journal of Sociology*, 29-41.
Morgan, D. L. (1996). *Focus Groups as Qualitative Research* (Vol. 16). Sage Publications.
Morgan, G. M., Fischhoff, B., Bostrom, A., & Atman, C. J. (2002). *Risk Communication: A Mental Models Approach*. Cambridge: Cambridge University Press.
Morison, B. (2002). *On Location: Aristotle's Concept of Place*. New York: Oxford University Press.
National Energy Technology Laboratory. (2009). *Public Outreach and Education for Carbon Storage Projects* (No. DOE/NETL-2009/1391). DOE.
Natural Resources Canada. (2006). *Carbon Dioxide and Storage: A Compendium of Canada's Participation* (No. M4-39/2006E-MRC). Ottawa: Office of Energy Research and Development.
Natural Resources Canada. (2008). The ecoENERGY Carbon Capture and Storage Task Force. Report to the Minster of Alberta Energy. Retrieved April 16, 2009, from http://www.nrcan-rncan.gc.ca/com/resoress/publications/fosfos/fosfos-eng.pdf
Natural Resources Canada. (2010). Energy Policy. Retrieved June 8, 2010, from http://nrcan.gc.ca/eneene/polpol/index-eng.php
Newman, L., & Dale, A. (2005). Network structure, diversity, and proactive resilience building: A response to Tompkins and Adger. *Ecology and Society, 10*(1).
Nisbet, R. A. (1953). *The Quest for Community: A Study in the Ethics of Order and Freedom*. New York: Oxford University Press.
NRCan. (2008). The ecoENERGY Carbon Capture and Storage Task Force. Report to the Minster of Alberta Energy. Retrieved April 30, 2010, from http://www.nrcan-rncan.gc.ca/com/resoress/publications/fosfos/fosfos-eng.pdf
NRCan. (2012). *Paskapoo Groundwater Study*: Geological Survey of Canada.
O'Hare, M. H., Bacow, L., & Sanderson, D. (1983). *Facility siting and public opposition*. New York: Van Nostrand Reinhold.
ObamaBiden. (2008). Report: New Energy for America Plan. Retrieved March 3, 2009, from http://my.barackobama.com/page/content/newenergy

Oltra, C., Upham, P., Riesch, H., Boso, A., Brunsting, S., Dutschke, E., et al. (2012). Public responses to CO_2 storage sites: Lessons from five European cases. *Energy & Environment, 23*(2/3), 227-248.

Orum, A. M., Feagin, J. R., & Sjoberg, G. (1991). Introduction: The Nature of the Case Study. In J. R. Feagin, A. M. Orum & G. Sjoberg (Eds.), *Case for the Case Study*: The University of North Carolina Press.

Owens, S. D., Louise. (2008). How to change attitudes and behaviors in the context of energy. *Energy Policy, 36*, 4412-4418.

Palmer, J. (1997). Public Acceptance Study of the Searsburg Wind Power Project: One Year Post-Construction.

Parformak, P. (2008). *Community Acceptance of Carbon Capture and Sequestration Infrastructure: Siting Challenges*.

Parkhill, K. A., Pidgeon, N., Henwood, K. L., Peter, S., & Venables, D. (2010). From the familiar to the extraordinary: Local residents perceptions of risk when living with nuclear power in the UK. *Transactions of the Institute of British Geographers, 35*, 39-58.

Parkins, J. R., & MacKendrick, N. A. (2007). Assessing community vulnerability: A study of the mountain pine beetle outbreak in British Columbia, Canada. *Global Environmental Change, 17*(3-4), 460-471.

Parkins, J. R., Stedman, R. C., & Varghese, J. (2001). Moving towards local-level indicators of sustainability in forest-based communities: A mixed-method approach. *Social Indicators Research, 56*(1), 43-72.

Parson, E. A., & Keith, D. W. (1998). Fossil fuels without CO_2 emissions. *Science, 282*, 1053-1054.

Patton, M. Q. (1999). Enhancing the quality and credibility of qualitative analysis. *Health Services Research, 34*(5), 1189-1208.

Paveglio, T. B., Carroll, M. S., & Jakes, P. (2010). Alternatives to evacuation during wildland fire: Exploring adaptive capacity in one Idaho Community. *Environmental Hazards: Human and Policy Dimensions*, 9, 1-16.

Paveglio, T. B., Jakes, P. J., Carroll, M. S., & Williams, D. R. (2009). Understanding social complexity within the wildland-urban interface: A new species of human habitation? *Environmental Management, 43*, 1085-1095.

Pedderson, E., & Waye, K. (2004, March). *Wind turbines' impact on people living in the vicinity of the turbines*. Paper presented at the International Energy Agency: Acceptability in Implementation of Wind Turbines in Social Landscapes, Stokholm, Sweden.

Pellow, D. (1992). Spaces that teach: Attachment to the African compound. In I. Altman & S. Low (Eds.), *Place Attachment*. New York: Plenum Press.

Pembina. (2007). Pembina Institute on Carbon Capture and Sequestration in Canada. Retrieved March 3, 2009, from http://pubs.pembina.org/reports/ccs-fact-sheet.pdf

Perdue, R. R., & Long, P. T. (1990). Resident support for tourism development. *Annals of Tourism Research, 17*(4), 586-599.

Perrow, C. (1999). *Normal Accidents*. Princeton: Princeton University Press.

Pettigrew, A. (1988). *Longitudinal field research on change: Theory and practice*. Paper presented at the National Science Foundation Conference on Longitudinal Research Methods in Organizations.

Petts, J. (1992). Incineration risk perceptions and public concern: Experience in the U.K.

improving risk communication. *Waste Management & Research, 10*(2), 169-182.
Pidgeon, N. F. L., Irene, Poortinga, Wouter. (2008). Climate change or nuclear power—No thanks! A quantitative study of public perceptions and risk framing in Britain. *Global Environmental Change, 18*, 69-85.
Pijawka, K. D., & Mushkatel, A. H. (1991). Symposium on the development of nuclear waste policy: Siting the high-level nuclear waste repository. *Policy Studies Review, 10*(4).
Poortinga, W., & Pidgeon, N. F. (2003). Exploring the dimensionality of trust in risk regulation. *Risk Analysis, 23*(5), 961-972.
Popper, F. J. (1985). The environmentalist and the LULU. *Environment, 27*(2), 7-40.
Powell, D., & Leiss, W. (1997). A diagnostic for risk communication failure *Mad Cows and Mother's Milk: The Perils of Poor Risk Communication*. Montreal: McGill-Queens University Press.
Priddis. (2012). Priddis Alberta Welcome. Retrieved August 15, 2012, from http://www.priddis.org
Project Pioneer. (2012). Project Pioneer partners conclude front-end study; will not proceed with CCS demonstration project. Retrieved August 11, 2012, from http://www.projectpioneer.ca
PTRC. (2012). The IEAGHG Weyburn-Midale CO_2 Monitoring and Storage Project. Retrieved July 15, 2012, from http://ptrc.ca/projects/weyburn-midale
PTRC. (2012). Weyburn-Midale Research. Retrieved August 12, 2012, from http://ptrc.ca/projects/weyburn-midale/research
Rabe, B. G. (1991). Beyond the NIMBY syndrome in hazardous waste facility siting: The Albertan breakthrough and the prospects for cooperation in Canada and the United States. *Governance, 4*(2), 184-206.
Relphe, E. (2007). Spirit of place and sense of place in virtual realities. *Techne, 10*(3), 17-24.
Rhodes, J., & Keith, D. (2008). Biomass with capture: Negative emissions within social and environmental constraints: An editorial comment. *Climatic Change, 87*(3), 321-328.
Rhodes, J. S., & Keith, D. W. (2005). Engineering economic analysis of biomass IGCC with carbon capture and storage. *Biomass and Bioenergy, 29*(6), 440-450.
Rice, P. L., & Ezzy, D. (1999). *Qualitative Research Methods: A Health Focus*. Melbourne: Oxford University Press.
Riley, R. (1992). Attachment to the ordinary landscape. In I. Altman & S. Low (Eds.), *Place Attachment*. New York: Plenum Press.
Rosa, E. A., & Dunlap, R. E. (1994). Nuclear power: Three decades of public opinion. *Public Opinion Quarterly, 58*(2), 295-324.
Roseland, M. (2000). Sustainable community development: Integrating environmental, economic, and social objectives. *Progress in Planning, 54*(2), 73-132.
Rotenberg, R. (1993). Introduction. In R. Rotenberg & G. McDonogh (Eds.), *The cultural meaning of urban space* (pp. x-xix). London: Bergin & Garvey.
Rubin, E. S., Chen, C., & Rao, A. B. (2007). Cost and performance of fossil fuel power plants with CO_2 capture and storage. *Energy Policy, 35*(9), 4444-4454.
Sacuta, N. (2012). Personal Communication: Reports on Weyburn-Midale Site Assessment. Regina.
Schively, C. (2007). Understanding the NIMBY and LULU phenomena: Reassessing our knowledge base and informing future research. *Journal of Planning Literature, 21*, 255-

266.
Schively, C. (2007). Siting geologic sequestration: Problems and prospects. In E. J. Wilson & D. Gerard (Eds.), *Carbon Capture and Sequestration: Integrating Technology, Monitoring, Regulation*. Oxford: Blackwell Publishing.
Sebba, R. (1991). The landscape of childhood: The reflection of childhood environment in adult memories and children's attitudes. *Environment and Behavior, 24*(4), 395-422.
Shackley, S., McLachlan, C., & Gough, C. (2004). Public Perceptions of Carbon Capture and Storage. Tyndall Center for Climate Change Research.
Shackley, S. M., Sarah; Reiche, Alexander. (2006). Public perceptions of underground coal gasification in the United Kingdom. *Energy Policy, 34*, 3423-3433.
Shamai, S. (1991). Sense of place: an empirical measurement. *Geoforum, 22*(3), 347-358.
Sharp, J. (2005). *Public Attitudes Toward Geological Disposal of Carbon Dioxide in Canada*. Simon Fraser University.
Shortall, S. (2004). Social or economic goals, civic inclusion or exclusion? An analysis of rural development theory and practice. *Sociologia Ruralis, 44*(1), 109-123.
Siegel, J. M., Bourque, L. B., & Shoaf, K. I. (1999). Victimization after a natural disaster: Social disorganization or community cohesion? *International Journal of Mass Emergencies and Disasters, 17*(3), 265-294.
Siegrist, M., & Gutscher, H. (2005). Perception of risk: The influence of general trust, and general confidence. *Journal of Risk Research, 8*(2), 145-156.
Sierra Club. (2010). The Basics of Carbon Capture and Storage. Retrieved January 15, 2010, from http://www.sierraclub.org/energy/factsheets/basics-sequestration.pdf
Siirila, E., Navarre-Sitchler, A., Maxwell, R., & McCray, J. E. (2012). A quantitative methodology to assess the risks to human health from CO_2 leakage into groundwater. *Advances in Water Resources, 36*, 146-164.
Simmel, G. (1950). *Conflict and the Web of Group Affiliations*. Glencoe, IL: The Free Press.
Slovic, P. (1987). Perception of risk. *Science, 236*(4799), 280-285.
Slovic, P. (1993). Perceived risk, trust, and democracy. *Risk Analysis, 13*(6), 675-682.
Slovic, P. (2010). *The Feeling of Risk*. Washington, DC: Earthscan.
Slovic, P., Finucane, M. L., Peters, E. M., & MacGregor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis, 24*(2), 311-322.
Slovic, P., Fischoff, B., & Lichenstein, S. (1990). Rating the risks. In T. S. Glickman & M. Gough (Eds.), *Readings in Risk*. Washington D.C.: Resources for the Future.
Slovic, P., Flynn, J., & Layman, M. (1991). Perceived risk, trust, and the politics of nuclear waste. *Science, 254*, 1603-1607.
Smith, E. (2002). *Energy, the Environment, and Public Opinion*. Lanham, MD: Rowman & Littlefield Publishers.
Starr, C. (1969). Social benefit versus technological risk. *Science, 165*(3899), 1232-1238.
Stedman, R. C. (2003). Is it really just a social construction? The contribution of the physical environment to sense of place. *Society & Natural Resources: An International Journal, 16*(8), 671-685.
Steelman, T., & Carmin, J. (1998). Common property, collective interests, and community opposition to locally unwanted land uses. *Society and Natural Resources, 11*(6), 485-504.
Stephens, J. C., & Jiusto, S. (2010). Assessing innovation in emerging energy technologies:

Socio-technical dynamics of carbon capture and storage (CCS) and enhanced geothermal systems (EGS) in the USA. *Energy Policy, 38*(4), 2020-2031.
Stern, P. C., Kalof, L., Dietz, T., & Guagnano, G. A. (1995). Values, beliefs, and proenvironmental action: Attitude formation toward emergent attitude objects. *Journal of Applied Social Psychology, 25*(18), 1611-1636.
Strauss, A., & Corbin, J. (1990). *Basics of Qualitative Research-Grounded Theory Procedures and Techniques*. Newbury Park: Sage Publications.
Strauss, A., & Corbin, J. (1995). Qualitative evaluation and research methods. In N. K. Denzin & Y. S. Lincoln (Eds.), *Strategies of Qualitative Inquiry* (pp. 158-183).
Suncor. (2011). 2011 Report on Sustainability: Climate Change Solutions. Retrieved April 30, 2012, from http://sustainability.suncor.com/2011/en/responsible/3523.aspx
ter Mors, E., Terwel, B. W., & Daamen, D. (2012). The potential of host community compensation in facility siting. *International Journal of Greenhouse Gas Control, 11, Supplement*(November), S130-138.
Terwel, B. W., Daamen, D., & ter Mors, E. (2013). 'Not in my backyard' (NIMBY) sentiments and the structure of initial local attitudes toward CO_2 storage plans. *Energy Procedia*.
Terwel, B. W., ter Mors, E., & Daamen, D. (2012). It's not only about safety: Belief and attitudes of 811 local residents regarding a CCS project in Barendrecht. *International Journal of Greenhouse Gas Control, 9*, 41-51.
The Legislative Assembly of Alberta. (2010). Bill 24 Carbon Capture and Storage Statutes Amendment Act, 2010. Retrieved December 2010, from http://www.assembly.ab.ca/ISYS/LADDAR_files/docs/bills/bill/legislature_27/session_3/20100204_bill-024.pdf
The Wilderness Society. (1992). *Local Social Systems*.
Tietje, O., & Scholz, R. W. (2001). *Embedded Case Study Methods: Integrating Quantitative and Qualitative Knowledge*. Thousand Oaks, CA: Sage.
Tjernshaugen, A., & Langhelle, O. (2009). Technology as political glue: CCS in Norway. In J. Meadowcroft & O. Langhelle (Eds.), *Caching the Carbon*. Cheltenham, UK: Edward Elgar Publishing Ltd.
Tonnies, F. (1957). *Community and Society: Translated and Edited by C. Loomis*. East Lansing: Michigan State Press.
Town of Fairview. (2012). Business. Retrieved August 5, 2012, from http://www.fairview.ca/businesses.aspx
TransAlta. (2011). Update on Dunvegan Hydro Development. Retrieved September 10, 2012, from http://www.transalta.com/node/629
Tuan, Y.-F. (1977). *Space and Place: The Perspective of Experience*. Minneapolis, MN: University of Minnesota Press.
U.S. Energy Information Administration. (2012). Short-term Energy Outlook. Retrieved February 2, 2012, from http://www.eia.gov/forecasts/steo/
U.S. Environmental Protection Agency. (2013). Hydraulic Fracturing. Retrieved April 7, 2013, from http://www2.epa.gov/hydraulicfracturing/process-hydraulic-fracturing
U.S. Fish & Wildlife Service. (2010). *Traditional Ecological Knowledge for Application by Service Scientists*.
Unger, D. G., & Wandersman, A. (1985). The importance of neighbors: The social, cognitive, and affective components of neighboring. *American Journal of Community Psychology,*

13(2), 139-169.
United Nations Convention on Climate Chage (UNFCC). (n.d.). Full text of the Convention: Article 2. Retrieved February 23, 2009, from http://unfccc.int/esential_background/convention/items/1353.php
University of Texas. (2010). J.C. Anderson Alumni. Retrieved August 19, 2012, from http://www.engr.utexas.edu/alumni/distinction/deg/2002/anderson
Upreti, B. R. (2004). Conflict over biomass energy development in the United Kingdom: Some observations and lessons from England and Wales. *Energy Policy, 32*(6), 785-800.
Upreti, B. R., & van der Horst, D. (2004). National renewable energy policy and local opposition in the UK: The failed development of a biomass electricity plant. *Biomass and Bioenergy, 26*(1), 61-69.
van Alphen, K., Hekkert, M. P., & Turkenburg, W. C. (2009). Comparing the development and deployment of carbon capture and storage technologies in Norway, the Netherlands, Australia, Canada and the United States-An innovation system perspective. *Energy Procedia, 1*(1), 4591-4599.
van der Horst, D. (2007). NIMBY or not? Exploring the relevance of location and the politics of voiced opinions in renewable energy siting controversies. *Energy Policy, 35*(5), 2705-2714.
Venables, D., Pidgeon, N., Parkhill, K. A., Henwood, K. L., & Simmons, P. (2012). Living with nuclear power, Sense of place, proximity, and risk perceptions in local host communities. *Journal of Environmental Psychology, 32*(4), 371-383.
Wajcman, J. (2002). Addressing technological change: The challenge to social theory. *Current Sociology, 50*(3), 347-363.
Wakefield, S., & Elliott, S. J. (2000). Environmental risk perception and well-being: Effects of the landfill siting process in two southern Ontario communities. *Social Science & Medicine, 50*(7-8), 1139-1154.
Walkeden, T. (2012). Personal Communication: History of Oil in Weyburn Area.
Walker, G., Devine-Wright, P., Hunter, S., High, H., & Evans, B. (2010). Trust and community: Exploring the meanings, contexts and dynamics of community renewable energy. *Energy Policy, 38*(6), 2655-2663.
Walsh, E., Warland, R., & Smith, D. C. (1993). Backyards, NIMBYs, and incinerator sitings: Implications for social movement theory. *Social Problems, 40*(1), 25-38.
Walsh, J. C., & High, S. (1999). Rethinking the concept of community. *Social History, 32*(64).
Warren, C. R., & McFayden, M. (2010). Does community ownership affect public attitudes to wind energy? A case study from southwest Scotland. *Land Use Policy, 27*(2), 204-213.
Webber, M. (1964). Order in diversity: Community without propinquity. In L. Wingo (Ed.), *Cities and Space: The Future of Urban Land* Baltimore: Johns Hopkin University Press.
Weber, S. J., & Cook, T. D. (1972). Subject effects in laboratory research: An examination of subject roles, demand characteristics, and valid inference. *Psychological Bulletin, 77*(4), 273-295.
Wellman, B. (1979). The community question: The intimate network of East Yorkers. *American Journal of Sociology, 84*(5), 1201-1231.
West, J., Pearce, J., Bentham, M., & Maul, P. (2005). Issue profile: Environmental issues and the geological storage of CO_2. *Energy Policy and Governance, 14*(4), 250-259.
Weyburn R.M. #67. (1986). *As Far as the Eye Can See*: Weyburn R.M. #67 Book Committee.

Wiggins, S., & Proctor, S. (2002). How special are rural areas? The economic implications of location for rural development. *Development Policy Review, 19*(4), 427-436.
Wilkinson, K. (1970). Phases and roles in community action. *Rural Sociology, 35*(1), 54-68.
Wilkinson, K. (1986). In search of the community in the changing countryside. *Rural Sociology, 51*(1), 1-17.
Wilkinson, K. P. (1991). *The Community in Rural America*. New York: Greenwood Press.
Wilson, E. J. (2004). *Managing the Risks of Geologic Carbon Sequestration: A Regulatory and Legal Analysis*. Pittsburg, PA: Department of Engineering and Public Policy, Carnegie Mellon.
Winner, L. (1986). Do artifacts have politics? In D. MacKenzie & J. Wajcman (Eds.), *The Social Shaping of Technology How the Refrigerator got its Hum*. Philadelphia: Open University Press.
Wolsink, M. (2006). Invalid theory impedes our understanding: a critique on the persistence of the language of NIMBY. *Transactions of the Institute of British Geographers, 31*(1), 85-91.
Wolsink, M. (2007). Planning of renewables schemes: Deliberative and fair decision-making on landscape issues instead of reproachful accusations of non-cooperation. *Energy Policy, 35*(5), 2692-2704.
Wong-Parodi, G., & Ray, I. (2009). Community perceptions of carbon sequestration: Insights from California. *Environmental Research Letters, 4*, 8.
Wong-Parodi, G., Ray, I., & Farrell, A. E. (2008). Environmental non-government organizations' perceptions of geologic sequestration. *Environmental Research Letters, 3*, 1-8.
World Resources Institute (WRI). (2008). *CCS Guidelines*. Washington, DC: WRI.
World Wildlife Fund. (2010). Carbon capture and storage. Retrieved January 15, 2010, from http://wwf.panda.org/what_we_do/footprint/climate_carbon_energy/energy_solutions/carbon_capture_storage/
Wright, I. (2011). *CO_2 Storage at In Salah JIP Phase 1: Storage Capacity Assessment*. Paper presented at the CLSF Projects: Interactive Workshop, Al Khobar.
Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007). Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy, 35*(5), 2683-2691.
Zautra, A., Hall, J., & Murray, K. (2009). Community development and community resilience: An integrative approach. *Community Development, 39*(3), 130-147.

Appendix A: Attributes of the CCS Projects Discussed in Dissertation*

Project location or name, Country	Project type and lead developer**	Settlement type	Strong opposition experienced	Status	References
Weyburn-Midale, Canada	Commercial, Cenovus	Rural	No	Still operational	-
Priddis, Canada	Experimental, University of Calgary	Rural	Yes	Cancelled	-
In Salah, Algeria	Commercial, BP, Statoil	Rural	No	Still operational	-
Sleipner, North Sea, Norway	Commercial, Statoil	Offshore	No	Still operational	-
Otway, Warrnambool, Australia	Experimental, CO2CRC	Rural	Some	Still operational	Anderson et al., 2012; Ashworth et al., 2010
Hawaii	Experimental, DOE, NRC and NEDO	Ocean carbon sequestration	Yes	Cancelled	De Figueiredo, 2000
Greenville, USA	Experimental, Battelle, MRCSP	Rural	Yes	Cancelled	-
Ketzin, Germany***	Experimental, GFZ	Rural	No	Still operational	Oltra et al., 2012; Dutschke, 2011
Hantomin, Spain	Experimental, Ciuden	Rural	No	Injection not yet begun	Oltra et al., 2012
Barendrecht, Netherlands	Commercial, Shell	Urban	Yes	Cancelled	Oltra et al., 2012; Huijts et al., 2007; Brunsting et al., 2011; Terwel et al., 2012
Beeskow, Germany	Commercial, Vattenfall	Rural	Yes	Cancelled	Oltra et al, 2012; Dutschke, 2011

*There are other CCS projects that are operational or have been proposed or cancelled.
**CCS projects commonly have a number of developers and funders. For overview purposes the primary developer is listed.
***The overviews of the Ketzin, Hantomin, Barendrecht and Beeskow projects are derived from Oltra et al., 2012.

Appendix B: Advertisement for Focus Group[60] Participants in the Fairview Post[61]

The Fairview Post

SELECT A PUBLICATION

Careers · Obituaries · Classifieds · Autonet

SUBSCRIBER SERVICES · THURSDAY, JULY 21, 2011

News · Sports · Special Sections · Arts/Life · Contact Us

Fairview News

Dementia Test
See if a Doctor should be Consulted about Alzheimer's. Take this Test...
www.OnMemory.ca

Dental Assisting Canada
KDM Dental College. 2 Campuses In Alberta. Learn More Today!
www.kdmdental.com

AdChoices

Home / News / Fairview News / Rural Focus Group Participants Sought

Rural Focus Group Participants Sought

By Submitted to the Post
Posted 15 days ago

What types of energy sources and technology should we develop in the future? What makes a community strong? How do communities come together to solve problems?

My rural Fairview roots sparked an interest in these questions about community and energy.

During the past three years I have had the chance to explore these questions as a PhD student at the University of Calgary.

I have come back home to look for more answers and provide policy makers with a better understanding of what Peace Country residents want in their area.

As a result, I am looking to talk to residents between July 8 and July 18 in the town of Fairview. This is an opportunity to participate in a University study of communities and share your thoughts confidentially to policy makers about energy and environment in Canada. The discussion will last approximately an hour and a half and I will provide refreshments and snacks.

If you are interested in attending or would like more information about this project please contact me by phone at 780-835-4474 or by email at amaboyd@hotmail.com

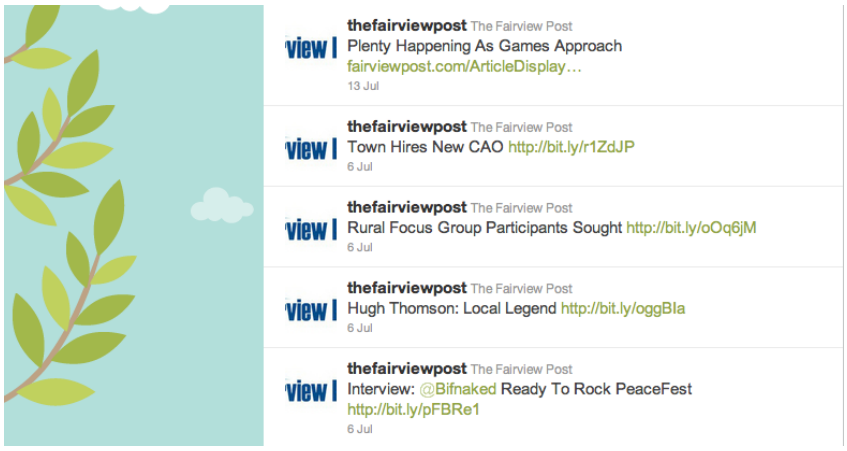
Newspaper
Archive Information
Search

AdChoices

Oil&Gas Office Assistant
Oil & Gas Admin Courses in AB. Enroll in Reeves Now. Be Job Ready!
ReevesCollege.ca/OilGasOff...

Dementia Test
Could it be Alzheimer's Disease? Take Our Test to Find Out.
www.OnMemory.ca

Fairview Post Tweet 'Rural Focus Group Participants Sought'



---

[60] As discussed in the methodology, I had originally planned on using focus groups but found group interviews were not always feasible. Residents who contacted me to attend a focus group were invited to complete an individual face-to-face interview.

[61] This advertisement appeared in the online version of the Fairview Post. The advertisement was also placed in the paper version of the local newspaper.

Appendix C: Advertisement for Research Participants in the Weyburn Review

UNIVERSITY OF CALGARY

Are You From The Weyburn Area?

University of Calgary researchers would like to invite you to discuss questions such as: **What types of energy sources and technology should we develop in the future? How do community members come together to solve problems?**

Researchers will be in the Weyburn area between October 19th and November 2nd. This is an opportunity to confidentially share your thoughts with policy makers about energy and environment in Canada. The discussion will last approximately 30 minutes to an hour.




Please contact Amanda Boyd at adboyd@ucalgary.ca for more information

The plan for this study has been reviewed for its adherence to ethical guidelines and approved by the Conjoint Faculties Research Ethics Board at the University of Calgary.

Appendix D: Interview Consent Form

UNIVERSITY OF CALGARY

Name of Researcher, Faculty, Department, Telephone & Email:

Amanda Boyd, PhD Student, Faculty of Communication & Culture, 403 404 4474, adboyd@ucalgary.ca
Supervisor:

Edna Einsiedel, Faculty of Communication and Culture
Title of Project:

Public Perceptions of Climate Change and Energy Technologies
***Sponsor*:**

Carbon Management Canada

This consent form, a copy of which has been given to you, is only part of the process of informed consent. If you want more details about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

The University of Calgary Conjoint Faculties Research Ethics Board has approved this research study.

Purpose of the Study:

The purpose of this project is to explore the issues of climate change and energy technologies. More specifically, we aim to understand the environmental and general concerns of members in your community and how they make decisions regarding the risks and benefits of different energy technologies.

What Will I Be Asked To Do?

You will be invited to discuss environmental issues and some of the technologies that have been put forth to decrease greenhouse gases. A variety of energy sources will be discussed including solar power, wind energy, nuclear power and traditional fossil fuels. Questions will be posed to better understand how you and others understand the risks and benefits of these technologies and their placement near your community. No formal debriefing is planned, however, the study will be shared in response to requests. Participation is voluntary and may be refused altogether. You may refuse to participate in parts of the study, or withdraw at any time.

What Type of Personal Information Will Be Collected?

With consent of the participants, the raw data file will include the identity (name, occupation and residence location) of the interviewee, and the information collected during the panel, including audio tapes. However, personal information on each participant will be excluded from the description of the findings. The final report will describe participant responses as a group. While participants may be quoted, they will not be identified with specific statements or points of view.

I grant permission to be audio taped: Yes:__ No: __

Are there Risks or Benefits if I Participate?

There are minimal to no risks or financial costs associated with participation in this study.

What Happens to the Information I Provide?

The information you provide will be available to both the principal investigator (Dr. Edna Einsiedel) and graduate student (Ms. Amanda Boyd) working on this project. The data collected (interview notes, questionnaire answers, audio tapes, participant identity) will be stored in a secured cabinet at the University of Calgary by the principal investigator during the research period and kept for five years after the completion of the project after which the data will be destroyed. Research findings will be presented at academic conferences and submitted to academic journals, and will be used in a PhD dissertation. Should you choose to withdraw from this study; any data collected from you up to that point will be utilized.

Signatures (written consent)

Your signature on this form indicates that you 1) understand to your satisfaction the information provided to you about your participation in this research project, and 2) agree to participate as a research subject. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from this research project at any time. You should feel free to ask for clarification or new information throughout your participation.

Participant's Name: (please print) _____

Participant's Signature _____Date: _____

Researcher's Name: (please print) _____

Researcher's Signature: _____Date: _____

Questions/Concerns

If you have any further questions or want clarification regarding this research and/or your participation, please contact:

Ms. Amanda Boyd
Faculty of Communication and Culture
Phone: 403 404 4474 Email: adboyd@ucalgary.ca
Supervisor: Dr. Edna Einsiedel, Faculty of Communication and Culture, einsiede@ucalgary.ca

If you have any concerns about the way you've been treated as a participant, please contact the Senior Ethics Resource Officer, Research Services Office, University of Calgary at (403) 220-3782; email rburrows@ucalgary.ca.

A copy of this consent form has been given to you to keep for your records and reference. The investigator has kept a copy of the consent form.

Appendix E: Meetings or Gatherings Attended During Case Studies

Meetings or Gatherings Attended during Fairview Case Study

Fairview		
Title	**Date**	**Description**
Canada Day Festivities	July 1, 2011	• Annual Canada Day Celebration for M.D. • Held at Dunvegan Park • Contacts with community
Fairview Council Meeting	July 5, 2011	• Bimonthly council meeting for town (approximately 16 in attendance) • Held at town office • Contacts with M.D. and community
Rotary Meeting	July 7, 2011	• Rotary meeting year end event (approximately 45 in attendance) • Held at Dunvegan Motor Inn • Contacts with community
Fly-In Breakfast	July 24, 2011	• Annual gathering and breakfast • Held at airport • Contacts with community
Alberta Summer Games Closing Ceremony	July 24, 2011	• Ceremonies for games, hosted by town • Held on College grounds • Contacts with community

Meetings or Gatherings Attended during Priddis Case Study

Priddis		
Title	**Date**	**Description**
Foothills Highland Games	Aug 27, 2011	• Scottish highland games • Held in Okotoks • Contacts with community
Rothney Observatory	Aug 27, 2011	• Open house for Calgary area • Held at U of C Rothney Observatory • Contacts with staff at observatory

Open House		
Priddis Community Association Meeting	Sept 25, 2011	• Monthly community association meeting (approximately 15 in attendance) • Held at Priddis Community Hall • Contacts with M.D. and community
Priddis-Millarville Farmers Market	Sept 10, 2011	• Weekly farmers market for region • Held at Millarville Racetrack • Contacts with community
Christmas Market	Nov 11, 2011	• Annual Christmas market for region • Held at Millarville Racetrack • No contacts made with community
Priddis Community Fall Dinner	Nov 11, 2011	• Yearly Priddis Community Fall Dinner • Held at Priddis Community Hall • Contacts with community

Meetings or Gatherings Attended during Weyburn Case Study

Weyburn		
Title	**Date**	**Description**
International Day	Sept 30, 2011	• Annual gathering and craft fair • Held at Weyburn Community Hall • Contacts with community
Pancake Breakfast	Sept 30, 2011	• Annual fall pancake breakfast • Held at Credit Union parking lot • Contacts with M.D. and community
Weyburn 'Communithon'	Oct 21, 2011	• Annual fundraiser for United Way • Held at Weyburn High School • Contacts with community
Weyburn Council Meeting	Oct 24, 2011	• Bimonthly council meeting for city (approximately 30 in attendance) • Held at Weyburn city office • Contacts with M.D.

Appendix F: Fairview Stakeholder Interview Protocol

Introductions, Consent Form (signed and provide copy), Provide Business Card
First, I need to go over some confidentiality points. I will be recording this interview. I need to do so because I would like to capture everything that is being said. This ensures that when I write up these results I will be using "your words" and not what I remember about what you said. I also want to clarify that in any reports or other documentation no names will be attached to comments. Do you have any questions?

Community

1. When people ask you where you live, what do you say?
   a. Tell me about the area you live in?
   b. Describe the community you live in?
   c. Why do you live here?
2. What do you:
   a. Like about where you live?
   b. Not like about where you live?
   c. Prompts: What do you think about the people who live here? What characterizes people who live in Fairview? What do you think about the surrounding land or area?
3. How much of your identity is tied to where you live? *(May require additional prompting or explanation)*
4. What are the most important outcomes or motivations of your interactions with people in this area? Who do you interact with in this area?
5. What types of groups or organizations are there in this area? Do you belong to any of them?
6. When you want information about something where do you go or who do you talk to? Where do others in the community go?
7. What kind of community events do you go to and how often? Are there other meetings within the community?
8. I would like you to look at these circle diagrams. How do you align with the perceptions and values of the community? Why?
9. How well do members of your community work together to solve problems?
   a. Can you give me an example of an issue that the community came together to solve?
   b. Can you give me an example of a conflict that has split the community? Prompts: What types of conflict occur in your community? Among government, groups, and residents?
   c. What kind of things does a community come together for?
   d. How could community involvement be improved? Who else should be included?
10. What do you think about energy source developments in the region (i.e. nuclear, hydro, oil, etc.)?
    a. What are some of the benefits of the development of energy sources in the region (i.e. nuclear, hydro, oil)?
    b. What are some of the risks or downfalls of the development of energy sources in the region (i.e. nuclear, hydro, oil)?
    c. How has energy development affected your community wellbeing, if at all?
    d. How have *community* members respond to these developments?

Energy and Environment

1. What are some of the most pressing environmental issues here in Fairview or the Peace Country?
2. When you hear the term climate change what comes to mind?
3. What energy sources should we use in Canada? Why? What should we not use? Why?

Carbon Capture and Storage Specific

1. Have you ever heard about carbon capture and storage?
   a. If no, reassure that it is normal that they wouldn't and provide explanation and diagram.
   b. If yes, what do you know about it? If they don't really know about it or know very little provide explanation and diagram.
2. What is your first reaction to hearing about CCS?
   a. If they know about it ask, tell me some of your thoughts on CCS?
3. What would be some of the benefits of having CCS in your community?
4. What would be some of the negative issues of having CCS in your community?
5. How would your community as a whole react to a CCS development nearby?

Further Participant Recruitment

1. I will want to talk to more people in the area, is there anyone you can think of who I should be talking to about these topics?
2. I will also be doing group interviews, where I will try to get groups of people together to talk about these topics. Do you know of any groups that are getting together that I can talk to? Or how might I recruit or get people to come to a meeting?

Thank you

Appendix G: Priddis Stakeholder Interview Protocol

Introductions, Consent Form (signed and provide copy), Provide Business Card

First, I need to go over some confidentiality points. I will be recording this interview. I need to do so because I would like to capture everything that is being said. This makes sure that when I write up these results I will be using "your words" and not what I remember about what you said. I also want to clarify that in any reports or other documentation no names will be attached to comments. Do you have any questions?

Community

1. When people ask you where you live, what do you say?
   a. Tell me about the area you live in?
   b. Describe the community you live in?
   c. Why do you live here?
2. What do you:
   a. Like about where you live?
   b. Not like about where you live?
   c. Prompts: What do you think about the people who live here? What characterizes people who live in Priddis? What do you think about the surrounding land or area?
3. How much of your identity is tied to where you live? *(May require additional prompting or explanation)*
4. What are the most important outcomes or motivations of your interactions with people in this area? Who do you interact with in this area?
5. What types of groups or organizations are there in this area? Do you belong to any of them?
6. When you want information about something where do you go or who do you talk to? Where do others in the community go?
7. What kind of community events do you go to and how often? Are there other meetings within the community?
8. How well do members of your community work together to solve problems?
   a. Can you give me an example of an issue that the community came together to solve?
   b. Can you give me an example of a conflict that has split the community? Prompts: What types of conflict occur in your community? Among government, groups and residents?
   c. What kind of things does a community come together for?
   d. What could community involvement be improved? Who else should be included?
9. What do you think about developments in the region (i.e. fossil fuel, housing, recreational developments, etc.)?
   a. What are some of the benefits of these developments in the area?
   b. What are some of the risks or downfalls of these developments in the area?
   c. How have developments affected your community wellbeing, if at all?
   d. How have *community* members responded to these developments?

Carbon Capture and Storage Specific

1. Have you ever heard about Carbon Capture and Storage?

   a. If no, reassure that it is normal that they wouldn't and provide explanation and diagram.
   b. If yes, what do you know about it? If they don't really know about it or know very little provide explanation and diagram.
2. What is your first reaction to hearing about CCS?
   a. If they know about it ask, tell me some of your thoughts on CCS?
3. If they have not brought up the University research project ask, have you heard of the research project that the University was doing in the area?
      a. If no, provide brief explanation of the project?
      b. If yes, ask what they thought of the project?
4. What would be some of the benefits of having the research project in your community?
5. What would be some of the negative issues of having the research project in your community?
6. How did your community as a whole react to the proposed University of Calgary research project?
7. Have you heard of any problems with injecting and storing carbon? *(Start with broad questions)* If no, end questions about allegations here.
8. Do you think there is actually a CO_2 leak or problem at the site? Did that impact your feelings about the University research project here? Prompts: Why?
9. How and when did you hear about the allegations of the CO_2 leak?

Energy and Environment

1. What are some of the most pressing environmental issues here in Priddis and the Foothills area?
2. When you hear the term climate change what comes to mind?
3. What energy sources should we use in Canada? Why? What should we not use? Why?

Further Participant Recruitment

1. I will want to talk to more people in the area, is there anyone you can think of who I should be talking to about these topics?

Thank you

Appendix H: Weyburn Stakeholder Interview Protocol

Introductions, Consent Form (signed and provide copy), Provide Business Card
First, I need to go over some confidentiality points. I will be recording this interview. I need to do so because I would like to capture everything that is being said. This makes sure that when I write up these results I will be using "your words" and not what I remember about what you said. I also want to clarify that in any reports or other documentation no names will be attached to comments. Do you have any questions?

Community

1. When people ask you where you live, what do you say?
   a. Tell me about the area you live in?
   b. Describe the community you live in?
   c. Would you consider this area rural or urban? Why?
   d. Why do you live here?
2. What do you:
   a. Like about where you live?
   b. Not like about where you live?
   c. Prompts: What do you think about the people who live here? What characterizes people who live in Priddis? What do you think about the surrounding land or area?
3. How much of your identity is tied to where you live? *(May require additional prompting or explanation)*
4. What are the most important outcomes or motivations of your interactions with people in this area? Who do you interact with in this area?
5. What types of groups or organizations are there in this area? Do you belong to any of them?
6. When you want information about something where do you go or who do you talk to? Where do others in the community go?
7. What kind of community events do you go to and how often? Are there other meetings within the community?
8. How well do members of your community work together to solve problems?
   a. Can you give me an example of an issue that the community came together to solve?
   b. Can you give me an example of a conflict that has split the community? Prompts: What types of conflict occur in your community? Among government, groups and residents?
   c. What kind of things does a community come together for?
   d. What could community involvement be improved? Who else should be included?
9. What do you think about developments in the region (i.e. oil, etc.)?
   a. What are some of the benefits of oil extraction in the area?
   b. What are some of the risks or downfalls of oil extraction in the area?
   c. How has oil development affected your community wellbeing, if at all?
   d. How have *community* members responded to these developments?

Carbon Capture and Storage Specific

1. Have you ever heard about Carbon Capture and Storage? If no ask, have you heard of carbon injection?
   a. If no, provide explanation and diagram.
   b. If yes, what do you know about it? If they don't really know about it or know very little provide explanation and diagram.
2. What is your first reaction to hearing about CCS?
   a. If they know about it, tell me some of your thoughts on CCS or (carbon injection)?
3. If they have not brought up the Weyburn Project ask, have you heard of the project in the area? Did you know there is a project here?
   a. If no, provide brief explanation of the project.
   b. If yes, ask what they think of the project?
4. What do you know about it? How did you find out about it? Have you ever been to an information meeting?
5. What are some of the benefits of CCS? What are some of the benefits in having the carbon injection project in *your community*?
6. What are some of the downfalls or risks of CCS? What are some of the negatives of having a carbon injection project in *your community*?
7. How has your community as a whole reacted to the carbon injection project here in Weyburn?
8. Have you heard of any problems with injecting and storing carbon? *(Start with broad questions)* If no, end questions about allegations here.
9. Do you think there is a CO_2 leak? Would you feel threatened if you thought there is a CO_2 leak? Prompts: Why do you think there is (or is not) a CO_2 leak?
10. How did you here about the allegations? When did you hear about the allegations of the CO_2 leak?
11. What do you think about the credibility of the family who reported it? What do you think of the company (i.e. Cenovus and Apache)?

Energy and Environment

1. What are some of the most pressing environmental issues here in the Weyburn area?
2. When you hear the term climate change what comes to mind?
3. What energy sources should we use in Canada? Why? What should we not use? Why?

Further Participant Recruitment

1. I will want to talk to more people in the area, is there anyone you can think of who I should be talking to about these topics?

Thank you

Appendix I: Timeline of Kerr Farm Testing, Press Release, Media Reporting and Final Reports

History of Kerr Farm Testing *(2003-2010)*

2003	Kerrs claim beginning of degassing and water issues on their property
October 2004	Water and surface soil samplings. Water yielded elevated PH results. Testing for dissolved hydrocarbons and extractable hydrocarbons were less than detection limits
August 2006	Pond water analyzed for general inorganic chemistry, trace inorganic compounds by McDonald and Associates
2007	Report commissioned by the Kerrs and conducted by M.R. McDonald and Associates notes that overall data and observations did not yield any significant water abnormalities
October 2009	First involvement of Eco-Justice in the Kerrs case with queries to PTRC and Saskatchewan Ministry of Energy and Resources
October 2010	Petro-Find study of soil on Kerr farm sent to Saskatchewan Ministry of Energy and Resources

Press Conference, Media Reporting and Post-Conference Testing *(2011)*

January 10	Eco-Justice releases media notification of press conference in Regina for January 11th
January 11	The Kerrs and Eco-Justice hold their press conference in Regina and initial media reports of the potential leak begin in Canada
January 13 to 15	First media reports questioning the science of Petro-Find study
January 16	IPAC-CO2 announces they are assembling a team of international experts to conduct an independent performance assessment of protocols and practices in the Weyburn CCS project
January 19	IEA GHG and PTRC response to Petro-Find report are critical of research methods and claims of leak
January 19 to 21	Second round of media reports and interviews of Petro-Find assertions
January 27	Eco-Justice press release and reply to PTRC and IEA GHG report
August	Testing on the Kerr property was delayed until August due to excessive rainfall and ground water levels

Release of the Final Reports *(2011)*

November 29	Cenovus releases report stating that there is no CO_2 leaking from the project on the Kerr property
December 12	IPAC-CO2 releases report stating that there is no CO_2 leaking from the project on the Kerr property

Derived from discussions with Cam and Jane Kerr (2011) and PTRC presentation (Sacuta, 2011)

Appendix J: Summary of Perceived Risks and Benefits of CCS by Community

	Priddis	Weyburn/ Goodwater	Fairview
Risks/Negatives			
Increase traffic	✓	✓	✓
Increase noise	✓		
Threat to drinking water	✓	✓	
Possible earthquakes	✓	✓	✓
Threat to wildlife	✓		
Possible leaks (ground or water)	✓	✓	✓
Possible 'industrial' growth & development	✓		
Decrease land values			✓
Benefits			
Increase CO_2 for plant growth			✓
Increase use of land	✓		
Increase jobs		✓	✓
Increase oil production (EOR)		✓	✓
Positive Perceptions of the Area		✓	✓
International fame and recognition		✓	
City growth		✓	✓
More money for rural municipalities		✓	
Benefits for local industry		✓	✓
Growth of surrounding communities		✓	✓
Additional income source for landowners		✓	✓