

Inroads on Backroads: Sustainable Prairie Agriculture

By

Kurt G. Dorward, B.Sc., P.Ag.

A thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

In partial fulfillment of the requirements for the degree of

MASTER OF ENVIRONMENT

Department of Environment and Geography

University of Manitoba

Winnipeg, Manitoba, Canada

Copyright © 2009 by Kurt G. Dorward

THE UNIVERSITY OF MANITOBA
FACULTY OF GRADUATE STUDIES

COPYRIGHT PERMISSION

Inroads on Backroads: Sustainable Prairie Agriculture

BY

Kurt G. Dorward

**A Thesis/Practicum submitted to the Faculty of Graduate Studies of the University
of Manitoba
In partial fulfillment of the degree**

MASTER OF ENVIRONMENT

Kurt G. Dorward © 2009

**Permission has been granted to the University of Manitoba Libraries to lend a copy of this
thesis/practicum, to Library and Archives Canada (LAC) to lend a copy of this thesis/practicum, and
to LAC's agent (UMI/ProQuest) to microfilm, sell copies and to publish an abstract of this
thesis/practicum.**

**This reproduction or copy of this thesis has been made available by authority of the copyright owner
solely for the purpose of private study and research, and may only be reproduced and copied as
permitted by copyright laws or with express written authorization from the copyright owner.**

Thesis Abstract

The goals of this project were to investigate farming methods that provided farmers and their families with a good standard of living and reasonable financial returns, in the context of a healthy environment and a durable community and to identify the organizational barriers to adoption of a system of thinking in agriculture that may be considered to be sustainable. I was seeking this knowledge in the role of an activist who believes in both the utility and quality of life offered by an agrarian lifestyle, as well as a practitioner of agriculture interested in making a quality life for my family and myself.

In the course of this research, I spoke with many people who grow food and steward the land for a variety of reasons. I discovered that most of these people are most interested in farming as a lifestyle with a wealth of personal benefits, even if they are not the most financially feasible operations. Farmers displayed a real interest in caring for the land that supports them, and for the quality of their communities.

This thesis concludes with a variety of recommendations for both producers as well as the governments who represent them.

ACKNOWLEDGEMENTS

There is good evidence that fine wines, great cheeses and the best topsoil in the world are produced over a very long time. I am truly glad that this is the case, because it makes me feel that perhaps this research will serve a greater purpose because of the time it took.

A sincere thank you must go to all the producers and industry folks who took the time to fill in the survey, answer the questions and undergo the somewhat tortuous process of being interviewed! The timing of the distribution of this survey was at least, not the greatest, starting at harvest time and proceeding into the beginning of the school year. I owe you all a debt of gratitude and hope that the end result provides you with insights and information worthy of your time invested.

There are several individuals to whom I owe a debt of gratitude. I would be remiss in not giving a great deal of credit to my maternal grandparents, Phillis and Henry Cairns, for their faith in me. Having been born and raised predominantly a city kid, my love of the outdoors and agri-culture blossomed under their tutelage. My grandpa Henry went on to that great field in the sky without ever having known the direction I would take, but I feel his presence and hear his words on a daily basis. My grandma Phillis taught me so much of what I now consider second nature and served up home-baked bread as her own style of aromatherapy. Thanks also to my uncle and aunt who have persisted on the home farm, providing encouragement and hints. 125 years of family farming lends some wisdom!

I need to thank my parents for their persistent support and encouragement. It truly inspired me to have well-educated parents who started their careers as teachers! They

Prefatory

always provided me with opportunities to further my education and never once discouraged me from my path, although it may have seemed a wee bit unreasonable at times.

To my wife Louise, my love, my life, I say this: I could not have done this without you! We started off with high ideals and ideas, made some brilliant efforts to integrate them into our community, and put those same intentions into action in our own lives once we started our own endeavours in agriculture. It was the northern lights that inspired us to start down that path, and our farm, Aurora Farm, started out as a little old house on a little old river lot. It has since grown to become a gem in the region. A diverse group of people and animals in conjunction with many unique strategies, buildings and a lot of hay has made our lives full and fulfilling. Never stop believing that we can do anything. See you in a minute...

Thanks also to all the residents, board members and friends of the St. Norbert Arts Centre (SNAC), past and present. Our organization has given me many skills and the ability to try them out in a non-judgmental environment. That first harvest so many years ago that produced a salad of 12 different greens and innumerable flowers still lingers in my mind's eye and on the tip of my tongue.

Table of Contents

THESIS ABSTRACT	i
ACKNOWLEDGEMENTS.....	ii
TABLE OF CONTENTS.....	iv
LIST OF TABLES.....	vi
LIST OF FIGURES.....	vi
CHAPTER 1: GENERAL INTRODUCTION	
1.1 PREFACE.....	2
1.2 STUDY RATIONALE.....	4
1.3 ORGANIZATION OF THESIS.....	7
CHAPTER 2: LITERATURE REVIEW	
2.1 OBJECTIVES OF LITERATURE REVIEW.....	9
2.2 WHY DO WE NEED SUSTAINABLE AGRICULTURE?.....	9
GIMME THREE STEPS.....	11
ORIGIN OF THE CONCEPT.....	12
WHAT IS SUSTAINABLE AGRICULTURE?.....	15
2.3 AGRICULTURE ON THE PRAIRIES.....	25
WHERE WERE WE? A LOOK IN THE REAR-VIEW MIRROR.....	25
WHERE WE ARE – FROM GREEN REVOLUTION TO GREEN THINKING.....	35
INTRODUCTION.....	35
AGRO-CHEMICALS.....	38
CANADIAN STATISTICS.....	47
CURRENT MANITOBA CONDITIONS.....	48
WHERE WE’RE GOING – HAND ME THAT ROAD MAP, MA.....	64
2.4 THE SUSTAINABILITY TRIPOD.....	67
INTRODUCTION.....	67
THE THREE SISTERS:	
THE ENVIRONMENT: EVERYTHING IS SO GREEN!.....	69
THE ECONOMY: THE INFAMOUS “BOTTOM LINE”.....	75
SOCIAL CONDITIONS.....	83
2.5 LITERATURE REVIEW SUMMARY.....	91
CHAPTER 3: METHODS	
STUDY AREA.....	94
STUDY DESIGN.....	95
SAMPLE POPULATION.....	97
STUDY METHODOLOGY.....	98
DATA ANALYSIS.....	100
QUESTIONNAIRE RESPONSE.....	101
CHAPTER 4: RESEARCH FINDINGS	
4.1 PRODUCER SURVEYS - DISCOVERED THEMES.....	103
4.2 CASE STUDIES.....	136

4.3 MEASUREMENT & ASSESSMENT.....	151
4.4 CONVERSION FROM INDUSTRIAL TO SUSTAINABLE PRACTICES.....	164
CHAPTER 5: RECOMMENDATIONS & SUMMARY OF KEY FINDINGS	
5.1 RESEARCH OUTCOMES.....	176
5.2 RECOMMENDATIONS FOR PRODUCERS.....	177
5.3 RECOMMENDATIONS FOR GOVERNMENT.....	186
5.4 FUTURE RESEARCH DIRECTIONS.....	194
5.5 FINAL DISCUSSION.....	200
5.6 PERSONAL REFLECTIONS & HOPES.....	203
EPILOGUE.....	206
LITERATURE CITED.....	211
APPENDIX A – SURVEY.....	225

List of Tables

Table 2-1 – Comparison of Industrial and Biological Models of Agriculture.....	69
Table 4-1 – Demographic Summary Table.....	130
Table 4-2 - Environmental questions: results summary.....	132
Table 4-3 – Economy questions: results summary.....	133
Table 4-4 – Society questions: results summary.....	134
Table 4-5 – Sustainable Practices: results summary.....	135

List of Figures

Figure 2-1 – Farmscape near Rivers, MB.....	25
Figure 2-2 – Red River Cart.....	28
Figure 2-3 – Promotional Poster.....	30
Figure 2-4 – Threshing.....	31
Figure 2-5 – Early gasoline tractor.....	34
Figure 2-6 - Cash Receipts, Net Income and Ratio.....	49
Figure 2-7 – Organic Production Trends in Manitoba.....	60
Figure 2-8 – Three Pillars of Sustainability.....	67
Figure 2-9 – Landscape near Austin, MB.....	69
Figure 2-10 – Creek near Rivers, MB.....	72
Figure 2-11 – Ryerson School, Maskawata, MB (1957).....	85
Figure 2-12 – Farm Kids (1946).....	87
Figure 3-1 – Terrestrial Ecozones of Canada.....	94
Figure 4-1 – Map of Farm Locations.....	104
Figure 4-2 – Age and gender of respondents.....	105
Figure 4-3 – Livestock Summary.....	107
Figure 4-4 – Farm Size.....	107
Figure 4-5 – Years in Organic Production.....	108
Figure 4-6 – Alternative Methods.....	109
Figure 4-7 – Conservation Methods.....	110
Figure 4-8 – Photovoltaic Panels.....	124
Figure 4-9 – Working horse team ca. 1938.....	126
Figure 4-10 – Horse drawn binder.....	126
Figure 4-11 – Norwegian Fjord team.....	127
Figure 4-12 – Pastured poultry ca. 1936.....	128
Figure 4-13 – Andy Cairns and “Charlie”.....	136
Figure 4-14 – FarmAll “M”.....	137
Figure 5-1 – Aurora Farm, 2008.....	204
Figure 5-2 – Cairns’ barn at NE30-10-23W1 ca.1921.....	205

Chapter 1

General Introduction



Rodney Cairns, Henry Cairns and Petey Pup, 1966

1.1 Preface

When I started this degree many years ago, I had no idea that I would end up researching sustainable agriculture. To tell the truth, I also had no idea that I would end up being a farmer. Agriculture always held a particular fascination for me, as I spent an inordinate amount of time on the farm, for a city kid. My undergraduate degree in environmental science laid a foundation for the technical understanding of the world around me, and with the help of my advisor Dr. Andy Lockery, I was able to include some very unusual courses in my degree that largely consisted of soil and agronomy sciences.

My work in the natural resources management field in the early days of this degree helped to solidify my desire to make a real difference on the prairies, but at the time, my thesis topic sounded more like an engineering survey than an environmental research project. In 2004, my family and I decided to embark on a rather unusual project of our own, and purchased a small farm just south of Winnipeg. By small, I mean by today's current standards for commercial farms; suddenly we owned 160 acres of prairie and needed to do something with it.

After a break from studies in 2005-06, I re-enrolled with new direction and new purpose. I knew from what we were doing that I needed to know more about how to make a real go of this project we were calling Aurora Farms. There were a million things I didn't know about all sorts of things that I really needed to know. We didn't enter into this lifestyle to make money hand-over-fist. We didn't enter into it because we thought it would be easy or that we knew all the ins-and-outs of farming. We did it because our

heritage is in farming, and in the stewardship of the land, and because we really wanted to be able to do and grow things for ourselves.

Through my circle of friends and my community, I discovered a real desire in people to be more self-sufficient and healthy. I discovered that the local farmers' market was more than just a place to sell products; it was a place to trade stories and insights and learn. I discovered that many of the people I knew desperately wanted to live a quality rural lifestyle but had become so distanced from farming that it was essentially an insurmountable barrier. I discovered that there are many people who are farming who want to cast aside the current industrial ways of doing things and live more simply, and closer to the earth.

1.2 Study Rationale

Sustainable agriculture. Sounds so simple doesn't it? It's what so many people just assume is the way things work in the growing of food and getting it to the table. Food security. Another simple concept perhaps? Aren't we secure in our system of obtaining food? Just to walk into a supermarket, you would think so. Sure we all hear about people who go hungry, but do we ever really see it? I had a little taste of being food insecure when I was 16, and I sure wouldn't ever want to go there again. Environmental degradation. Now there's something that we as Canadians don't want to think about. We have seen what various parts of the world looked like after the Cold War and the pinnacle of industrialization. Ugly. But here in the prairies? Not so obvious.

My introduction to agriculture first hand as an adult came right in the midst of the BSE crisis of 2003-05. That really made me think hard about what I was doing and about what I wanted to do. I realized that if I wanted to make a living in a profession that was also a lifestyle that I was going to have to learn a great deal about all the little details and what my neighbours were doing and about how the whole system worked. I began to see that there was a considerable amount of research that had already been done on the principles of sustainable farming systems, but really not that much that was focused on our little part of the world, and particularly not about how people really LIVE in that context. I wanted a book that I could pick up and read that would tell me all those details, how to feed horses, what to feed chickens, how to grow enough to feed our family and our animals and how to live off what we have, right there in our own backyard. I discovered that there were only a couple of publications that held this kind of information and with one notable exception; they were really not about the prairies.

So, I decided to do the research and to write something that people could look to when they needed advice on where to start or what to do. I chose to focus on the prairies because that is what I know. I could see little point in doing an in-depth study of how cassavas are grown in the tropics or how rice farming systems in India help to bring food security to small villages. Not that research of that nature isn't worthwhile; it certainly is! I just believe that those who are living in a particular place should focus on their particular place, or if they don't have the desire to do so, they should just move to where they want to focus! This really boils down to my feeling that in my own way, I am somewhat of an expert on where I live. I think that this is a fairly critical part of the solution finding process.

Because of my beliefs in personal ability and the real potential for self-sufficiency, I chose to examine not only farms that would fit into the definition of farms, but also those who are really doing things differently. Having traveled some in earlier years, I met some fascinating people who had taken a new (or perhaps quite old) approach to community and to food production. Eco-villages and Permaculture came onto my radar in the early part of this decade and, as they say, everything just fell into place. It was as if these things, these ideas had always had some little corner of my mind. It was something akin to genetic memory, those realizations that there were simpler solutions to these problems that seemed to be cropping up all over the world, as well as right here in our own backyard.

Hence, the focus of this research is to investigate practices that people are employing towards a goal of self-sufficiency, food security, environmental stewardship and a good quality of life. In researching these strategies, I hope that it will reveal the need for

change in a world dominated by an industrial paradigm of agriculture and the move towards a new enlightenment of simplification in hopes that we as humans still have time to make a change before the earth decides that we have already done too much damage.

1.3 Organization of Thesis

This thesis is organized in five main chapters that work through the problem, examine the alternatives and present and define solutions. Chapter One consists of an introduction, a statement of the problem to be examined and a background of agriculture, specifically in prairie Canada. Chapter Two is a review of the past and current literature available on the topic, and delves into the background issues that have led to the current state of affairs in agriculture today. Current and developing issues are placed in the context of how we came to arrive at them, what the issues are today and educated speculation of where we are going. A review of the tripartite arrangement of agricultural sustainability is included in terms of environmental, economic and social aspects. This section is completed with a review of methods for measuring and assessing sustainability in agriculture. An investigative section on conversion from industrial to sustainable agriculture examines the difficulties, advantages and consequences of converting. Chapter Three is a look at the methodology employed in this thesis, including the survey and data analysis. Chapter Four is a summary of the research findings, including themes identified in methods such as animal husbandry, cropping systems, resource management, environmental stewardship, self-sufficiency and marketing. The second part of this section includes a few case studies of farms around Manitoba and what they are doing towards the goal of improving their sustainability. Section 5 is comprised of recommendations, a summary of the key findings and a final discussion.

Chapter 2

Literature Review



Photo taken near Maskawata, MB – Summer 2007

“Loaded wheat today at Kirkella. Sold No. 5 wheat at 91 7/8 cents per bushel. Poor grade likely due to early frost and scorching hot dry summer.”
- Great-grandfather Laurie Johnson, November 3, 1915.

Chapter 2: Literature Review

2.1 Objective

The objective of this literature review is to present the definitions of sustainable agriculture/ agricultural sustainability; to review and summarize the events and processes that have led humanity down the path to where we are currently and to discuss the current conditions; and to identify trends and strategies that may move humankind towards a realistic future of sustainability.

2.2. Introduction - Why Do We Need a Sustainable Agriculture?

Having a sustainable agriculture seems to be a self-evident need, one would think. However, for the last several decades, agriculture has been taking a path that leads towards a finite limit and possible collapse of the system that provides food for humanity. Undeniably, there have always been periods throughout history when the supply of food in a given region has not met the requirements of the population that depended on it. Such are the vagaries of climate, weather and other uncontrollable conditions. Since the advent of the industrial age, with the introduction of technologies and tools that should have made the consistent supply of food an easier task, humanity has also been straying from its path of stewarding the land, and moving towards mastery of creating its own environment. Given, there are biblical references to the “god-given” right of humans to have mastery over the earth (if one holds to such beliefs), but our recent path is showing that the interpretation of this directive may have gone too far.

Humanity has moved from being a species of the earth, like every other species, to being a species on the earth, more like a plague. We subject our surroundings to

whatever treatment we see fit in order to make our lives more comfortable. And yes, I mean comfort. In order to provide ourselves with shelter, food and more recently, distractions, we have changed every major ecosystem on the planet to enable these “needs”. But now, in the 21st century, we are starting to realize once again, that living on earth requires a more subtle approach, a softer hand, and a more holistic view. Our population has mushroomed in the last few generations and we are starting to see that if current trends continue, we might not be able to continue.

The current industrial model of agriculture “treats the farm like a factory, with inputs and outputs, and considers fields and animals to be production units (Kirschenmann, 1991). Industrial farming systems have relied for many years on specialization and mechanization to realize physical and economic efficiency through large-scale production. These strategies have begun to raise considerable concerns for the environment and the economy. There are general concerns about the effectiveness of inputs and technologies used in these mega-systems that are producing our food. Mono-crop concentrations are resulting in increased pest problems for farms and hence increased use of pesticides. There is a demonstrated problem with rising occurrences of pesticide resistance in weeds and insects alike. Soil fertility is diminishing due to continuous cropping and loss of organic matter content. Water tables are declining in irrigated areas while water quality is impacted by runoff or leaching of agro-chemicals. Air quality has been compromised by increasing dust and particulates as well as odours from industrial animal units. Health risks for farmers as well as consumers are in the limelight in recent years and disease pressures are getting to be a major problem in food processing plants. The trend towards large and extremely specialized farm units has

resulted in diminishing numbers of farm families and an increased need for off-farm income to support those families. Not unlike other aspects of the economy, scale-dependant issues have forced expansion and growth into an exponential curve in order to “keep up with the times”. In light of this myriad of troubles, it would seem that the problem facing society today is not agriculture in general, but rather with an industrial, input-dependant agriculture that has a single goal in mind: profits for agribusiness.

Gimme Three Steps...

So, how will humanity avoid a rather ugly crash? Well, perhaps the first step is to examine what we are doing that is hurting our surroundings (see also environment). The next might be to identify how we can reverse that trend. The final step in this oversimplified list would be to DO something about it: action. There has been a lot of research on the first two of these steps, but most unfortunately, not nearly enough done about the last. It seems that humanity is really quite good about communicating and investigating, but perhaps not nearly good enough about doing.

First, as most people could likely intuit, humanity is growing in leaps and bounds in terms of population. The number of hungry people around the world is not getting any smaller. Agriculture is growing more and more crops to feed all these people. And the situation is NOT getting any better. In fact, it is really quite likely getting worse by the minute. Well, from these basic facts, it might be obvious to some that the solution lies at least in part in slowing down the number of new people on the planet. Common sense would dictate that there is eventually going to be a point when there are more people on the planet than the planet can feed. Secondly, in order to feed all these people, we need to make sure that our agriculture is able to keep producing an increasing quantity of food.

What does agriculture need to keep producing food? It relies on an environment with clean air, clean water, and soil with plenty of nutrients and a culture dedicated to stewardship. So thirdly, humanity needs to ensure, for its own selfish reasons, that all these factors are safe-guarded. How can we possibly ensure this? By making agriculture sustainable. By treating the natural environment as an ally rather than as an enemy. By remembering that there is also a future time frame and that we need to leave something for our descendants. It is that simple. The complicated part is the DOING.

Origin of the Concept

Where did the concept of sustainability in agriculture come from? Seventeenth century English philosopher John Locke wrote on the social goal of efficiency in agriculture and encouraged farmers to practice restraint in cultivation by leaving land to nature for the greater service of humankind. Thomas Jefferson, the third president of the United States, wrote extensively on the virtuous task of husbanding the earth through agriculture. The concept of conservation continued to evolve throughout the 19th and 20th centuries as concerns for the natural environment grew. In the early part of the 19th century, authors and thinkers such as those of the New England transcendentalist movement, including Bronson Alcott, Margaret Fuller, George Ripley, and perhaps most importantly Henry David Thoreau and Ralph Waldo Emerson, developed theories and perspectives on humankind's interaction with nature and its inherent importance. The latter two helped establish the view of nature as a teacher, and was later built upon by other writers of the 20th century such as John Muir. Muir, who among other accomplishments helped found the Sierra Club, stressed the importance of protection of the natural world for not only the provision of natural services, but also for the crucial

role of recreation and uplifting the human spirit (Edwards, 2005). Muir's writings inspired his contemporary, President Theodore Roosevelt to create the first of many National Parks in the United States. Following the lead of Muir, the 1940s conservationist Aldo Leopold, wrote on the need for ecosystem health directly tied to human survival. In his book, *A Sand County Almanac*, Leopold penned the famous line, "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."

At the outset of the 20th century, industrial agriculture was well underway. Mechanization and adoption of technology were major factors in agricultural development and a split occurred in thinking between farmers' groups in terms of the sources of knowledge and its dissemination. These opposing camps were the systematic agriculturists, who followed the emerging industry as their model, and the scientific agriculturists, who looked to nature as their model (Harwood, 1990). Also at the beginning of the 20th century, the debate on the differences between reductionism and wholism was heating up. The emergence of holistic thinking, that saw natural systems as a model and the role of farmers in evolving their own systems, led to what is now referred to as 'alternative agriculture' (Harwood, 1990). F.H. King published his book *Farmers of the Forty Centuries* in 1911, which recounted his investigations into the sustainable practices of agriculture in Asia. Biodynamic agriculture also arose in popularity in the early part of the century after a series of lectures by Rudolph Steiner in 1924 and included spiritual teachings and consideration of terrestrial and cosmic forces on the growth of plants and animals. Lord Northburn's book, *Look to the Land*, published in 1940, contains perhaps the first use of the word organic to refer to the entire

philosophy and practice of integrated, decentralized, chemical-free agriculture. Shortly thereafter in 1943, Sir Albert Howard's book, *An Agricultural Testament*, added considerable weight to theories on humus farming, composting and other ideas involved in organic, biological and ecological agriculture (Harwood, 1990). Howard's book also influenced such writers as J.I. Rodale, founder of Organic Gardening Magazine.

The concept of agricultural sustainability arose in conjunction with an increasing awareness of environmental concerns and issues related to rural decline that were contemporaneous with the Green Revolution of the 1950s and 60s. 'Conventional' agriculture was seen to be at the root of many of these problems, which included resource depletion, a general decline in self-sufficiency, health concerns related to agro-chemicals, dwindling rural populations, soil degradation and water pollution. In response to these problems, a new (or perhaps RE-newed) paradigm of alternatives arose and became known as 'alternative agriculture', which now is seen as being synonymous with sustainable agriculture. Rachel Carson's book *Silent Spring*, published in 1962, rang alarm bells around the world concerning the hazards of pesticides (particularly DDT) and the plight of the natural environment. The theory of agro-ecology appeared in 1970 and was discussed in detail by such authors as Altieri (1983). Agroecology is essentially the synthesis of agriculture and ecology. While the discipline of ecology views humans as only one component of the environment, agroecology implies the right of humans to shift the ecological balance in their favour (Altieri, 1983; Ikerd, 1993). Agroecologists contend that agricultural technologies must enhance and work with nature rather than replace or conquer nature. Further, this school of thought implies a systems approach to agriculture that integrates technology and natural processes to develop the most productive system

(Hecht, 1995). The works of Wendell Berry, John Ikerd and numerous other authors have contributed a great deal of insight into the challenges faced by agriculture, society and the environment.

There are other related schools of thought that have essentially the same goals and ideals and include regenerative agriculture, bio-dynamic farming (Rudolph Steiner), Permaculture (Bill Mollison), organic agriculture (J.I. Rodale), natural systems agriculture (Wes Jackson), low-input sustainable agriculture (USDA), biological farming and others. Regardless of the title used to describe the system, the general concept of these systems includes consideration of environmental and human impacts and resource conservation as well as requirements of the quantity and quality of the products of the system.

What is Sustainable Agriculture?

In order to define a term such as sustainable agriculture, it is necessary to define the individual words to begin with. To inure that something is sustainable is to imply that it is possible to continue on in the long-term, to go on into the future indefinitely. The Concise Oxford Dictionary defines sustainable as "...that which conserves an ecological balance by avoiding depletion of natural resources." Or as "... something that can be sustained.... (maintained or kept going continuously)". Manning (1986) adds that sustainability may be considered to be the flexibility to meet the broadest range of future demands. Gray (1991) adds that the term sustainable suggests limits to an activity have been recognized. The very nature of sustainability is unconstrained in time while simultaneously being dynamic and continuously evolving to deal with constant challenges (Raman, 2006). Therein lies the difficulty with definition: the requirements for

sustainability are constantly changing. Kidd (1992) states that sustainability is a term that needs to be defined by the user in the context of use when it is being used. Maynard & Nault (2005) clearly indicate that the term ‘sustainability’ is “loaded with vagueness and ripe with contradiction” and that many definitions refer to the term in an absolute context as if there were a highly specific set of practices. Sustainable practices are dependant on the conditions within the moment, must be continuously monitored for success and be able to adapt to the next iteration of circumstances in which they are presented. Changing the plan is not failing the process. What was sustainable in 1909 in terms of food production and security or conservation of the environment was very different than the reality of what the conditions are today. Exponentially growing populations, cumulative effects on the environment from practices and products, in combination with technological advances and climate change (be it naturally occurring or anthropologically –caused) have created a substantially different reality for growers of food. Hence, defining sustainability, or what is sustainable, is not a static process. Every new piece of information adds to the factors that need to be considered for definition and subsequently builds the complexity of the solution, even in the moment. Raman (2006) makes the point that it is often easier to identify non-sustainable practices than it is to define what is actually sustainable.

In the case of sustainable agriculture, it is possible to substitute “development” for “agriculture” in many instances. Agriculture in its own right is development beyond the natural state of human food subsistence. Hunting-gathering societies were the norm for humans throughout history and prehistory. Increasing populations in spatially limited areas diminished the “sustainability” of hunter-gatherer practices, thereby requiring new

strategies for the provision of food. Those new strategies took the form of what we now understand as agriculture, a practice that is only in the order of about 9,000 years in age (Madeley, 2002; Raman, 2006).

Development is a term that has numerous definitions, depending to a large degree on the specific context in which it is presented. “Development” is an increaser word, no matter the context. It almost always refers to a process whereby something is growing bigger, longer, faster, more complex, further along or just “better”. This carries with it the connotation that it will cost something more than it did previously, although the way it costs more is unclear. Oxford’s defines development as “...a stage of growth or advancement...” or “... industrialization or economic advancement of a country or an area...”

So, putting “sustainable” and “development” together in phraseology is problematic at best, and contradictory at worst. Is it even possible to continue to grow and develop anything without putting additional pressures on limited, non-renewable resources? Is a practice or set of circumstances sustainable if its requirements are ever-increasing? Perhaps. Or perhaps not. I have argued strenuously in the past that sustainable development as a concept was contradictory. The term sustainable implies that there are limits to growth in whatever sector might be in question. Development, as pointed out above, implies that something is on the rise, increasing, growing. The question of whether the two terms are compatible must be raised in order to appreciate the ramifications of continued development.

However, in terms of agriculture as the expression of that development, humanity must be ready to consider the definitions in a somewhat different light in order to assure

ourselves that it is actually even possible to continue to feed all the people on the planet without destroying the planet in the process. van Loon et al. (2005) point out that it is possible to have development without a concurrent requirement for more space or increased use of non-renewables. It is possible to consider development to be improvement, based on increases in efficiency.

Agriculture should also, at this point, have a definition. The Concise Oxford Dictionary (1995) defines agriculture as the science or practice of cultivating the soil and rearing animals. Agriculture involves the systematic management of organisms to produce food, feed and fibre for human consumption (Shaykewich et. al.,1994). Agriculture can generally be viewed as a set of human activities that enhance the biological process of plants converting nutrients, water and solar energy to produce edible food to sustain human life (Geng et al., 1990).

In 1987, the World Commission on the Environment and Development (WCED, 1987) under the direction of Gro Harlem Brundtland, published their famous report “Our Common Future”, which carefully considered at great length, all the aspects of sustainable development in terms of the environment and the future of humanity. Their definition of sustainable development is perhaps still the most succinct: “... development which meets the needs of the present without compromising the ability of future generations to meet their own needs.” Although possibly the most recognized definition of sustainable development, an earlier report produced by The International Union for Conservation of Nature and Natural Resources (IUCN) (1980) defined conservation as being “...the management of human use of the biosphere so that it may yield the greatest sustainable benefit to the present generation while maintaining the potential to meet the

needs and aspirations of future generations.” This draws an interesting parallel between sustainable development and conservation, although the main point of both groups was the concept of intergenerational equity. The world’s current inhabitants have no more of a right to its resources than did our ancestors or do our descendants. If humanity cannot make that commitment to its’ self, then there cannot be any practice that is truly sustainable. Hani (2007) went on to further refine this definition by adding more detail to the original. Hence, “*Sustainable Development allows a life in dignity for the present without compromising a life in dignity for future generations or threatening the natural environment and endangering the global ecosystem.*” A similar definition was suggested by McRae et al. (2000). The Agriculture Research Service of the USDA, in a document focused on definitions in the sustainable agriculture field, defines sustainability as it pertains to agriculture, as farming systems that are "capable of maintaining their productivity and usefulness to society indefinitely. Such systems... must be resource-conserving, socially supportive, commercially competitive, and environmentally sound” (Gold, 1999). Brklacich et al. (1991) echo this assessment in stating that a sustainable food production system is one that can over the long-term maintain and enhance environmental quality, provide adequate economic and social rewards to all individuals, and produce a sufficient and accessible food supply.

There are a number of prevalent definitions for sustainable agriculture in the literature today. The Agricultural Institute of Canada (AIC) defines sustainable agriculture as “*The application of husbandry experience and scientific knowledge of natural processes to create agriculture and agri-food systems that are economically viable and meet society’s need for safe and nutritious food and vibrant rural*

communities, while conserving or enhancing natural resources and the environment” (Maynard & Nault, 2005). Raman (2006) advanced such a definition with emphasis on environmental conservation, economic viability, social justice and equity for food producers. Hani (2007) also incorporates the same core concepts and adds that productive, competitive and efficient practices are a requirement, but not more so than social conditions with human dignity. Similarly, Geng et al. (1990) concentrate on profitability, provision of food, minimization of nonrenewable resource use and the avoidance of negative environmental impacts. However, a salient point is made by Raman (2006) in that agricultural sustainability is a “... complex, value-laden, and subjective concept...” that is required to operate in multiple time scales when it comes to needs and concerns. Maynard & Nault (2005) broke down ‘agricultural sustainability’ into five component parts for ease of understanding:

- 1) *Agronomic Sustainability: the ability of the land to maintain productivity of food and fibre output for the foreseeable future,*
- 2) *Micro-Economic Sustainability: the ability of farms to remain economically viable and as the basic economic and social production unit,*
- 3) *Social Sustainability: the ability of rural communities to retain their demographic and socio-economic functions on a relatively independent basis,*
- 4) *Macro-Economic Sustainability: the ability of national production systems to supply domestic markets and to compete in foreign markets,*
- 5) *Ecological Sustainability: the ability of life support systems to maintain the quality of the environment while contributing to other sustainability objectives.*

Further, a precise definition is not only difficult, but also impractical as it tries to relate a continuous process rather than a specific end-point goal. Whereas one could state conclusively that, for instance, under a certain set of conditions a particular cultivar of wheat will produce more than under another set of conditions, to state that a practice is

specifically sustainable is difficult to define because the goal is not specific in time; a set of practices or methods is not inherently more or less sustainable than any other.

Although the concept of sustainability has been useful for consolidating concerns and motivating change, concrete examples of its use as an operational criterion for guiding efforts to improve agricultural systems are difficult to identify (Hansen, 1996).

Sustainability depends on the nature of whole farming systems (Ikerd, 1993). MacRae et al. (1990) present a comprehensive definition of sustainable agriculture by saying that it is both a philosophy as well as a system of farming. The philosophy is based on a set of values that promote empowerment, awareness of ecological & social realities, and the ability of the individual to undertake positive action. The farming system is comprised of several facets including design and management practices that are conducive to harmony with natural processes, conservation of resources, promotion of ecosystem resilience and self-regulation while simultaneously minimizing waste and environmental degradation and the necessary improvement and maintenance of farm profitability. Horne & McDermott (2001) provide a sweet and simple definition of sustainable agriculture as "...a wedding of agriculture and ecology". Further to this definition of simplicity, those authors also point out that agricultural sustainability is about protecting the environment, helping the farmer make it financially, and about preserving natural resources and the quality of life in rural communities. In general, the trend is towards low chemical, resource efficiency, and resource and energy conservation.

Jackson & Piper (1989) expand on the trend in science to act in a reductionist manner as advocated by Francis Bacon and Rene Descartes. This reductionist thinking effectively disengages the growing of food from the environment that supports it, and in

doing so, isolates the parts from the whole. Jackson & Piper (1989) conclude that this manner of thinking is a growing part of the problem of agriculture and recommend that ecology and agriculture be studied together in a holistic manner, such that they effectively be “married”.

Perhaps the best way to define what sustainable agriculture is would be to define what it is not (Horne & McDermott, 2001). Sustainable agriculture is not a system that relies heavily on external inputs or artificial chemicals or government subsidies or on artificial market enhancement or free trade that denigrates/displaces producers or systems that line the pockets of the advantaged few or harms wildlife or harms the soil or harms the air or harms the water in the creeks/underground or reduces biodiversity. However, sustainable agriculture is NOT a way for farmers to get out of immediate debt, nor is it simply the process of removing chemical inputs from their budget (Kirschenmann, 1988).

A sustainable agriculture system is one that, ideally, can exist indefinitely. As Horne & McDermott (2001) so eloquently state, “Who can argue against this? Particularly since, that the obvious implication of an unsustainable agriculture is massive starvation and potentially the demise of the human race.” Harwood (1990) and Ikerd (1993) both concur with the assessment of indefinite perpetuation of a system and Harwood adds that continuous evolution towards better use of the environment to provide essential services, greater efficiency of the use of those resources and a favourable balance between the natural environment and humans. Hill (1992) asserts that the term sustainable agriculture implies five basic principles being:

- 1) Meeting basic needs of people and giving this priority over meeting the greed of a few;*
- 2) Keeping population densities below the carrying capacity of a region;*

- 3) *Adjusting consumption patterns and the design and management of systems to permit the renewal of renewable resources;*
- 4) *Conserving, recycling and setting priorities for use of non-renewables; and*
- 5) *Keeping environmental impacts below a level required to allow the systems to recover and continue to evolve.*

Hill (1992) goes on to point out that an environmentally sustainable agriculture is one that is compatible with and supportive of the above criteria. Horne & McDermott (2001) echo this assessment in saying that sustainable agriculture should be science based, farmer driven, and profitable and should contribute to, or at least not detract from, the environmental health of the area, be consumer friendly, delivering safe, nutritious food, and lastly, should provide the basis for strong rural communities. A sustainable agriculture system depends not only on the endowment of natural resources, but on humanity's labour and the capital society has accumulated through knowledge, institutions and human-constructed artifacts (Shaykewich et. al, 1994). Wilson & Tyrchniewicz (1995) developed an extensive list of principles that have been used to define and for use as an analytical framework of sustainable agriculture. These fall into nine general groups of principles each made up of several criteria. Gray (1991) offers a definition from an economist's point of view, although it does not differ markedly from others: "The maintenance of the net benefits agriculture provides to society for present and future generations" (p.628).

From definitions and descriptions of sustainable agriculture in the literature, it would be reasonable to state that sustainable agriculture is a term that conveys purposes of agricultural systems rather than specific activities that lead to a particular end goal. Sustainable agriculture is a continuum, with several entry points and different end points, depending on a farmer's management skills and farm resources (Kirschenmann, 1988).

This relies on a management approach that uses natural soil-building routines and crop rotation schemes, instead of synthetic inputs, as the principle means of crop and livestock production.

Further examination of these concepts reveals that there are innumerable underlying factors that support and even possibly hinder furthering the goal of making overarching agricultural practices actually sustainable. Whereas environmental conservation is an obvious requirement, in so far as the environment is the keystone in agriculture, it is not enough to simply state that conservation is required. Conservation carries many meanings to many people, from conservation for the purpose of providing a continued source of whatever product of the natural ecosystem is needed or wanted by humans, through various degrees of protectionism for a variety of reasons, many of which are inherently anthropological, until in the finest spirit of the term, conservation of the environment by humans for reasons explainable only through valuation of inherent qualities possessed by components of the environment.

2.3 Agriculture on the Prairies

Where Were We? A Look in the Rear-view Mirror

Agriculture on the Canadian prairies brings many things to mind. The archetype of the Canadian prairie farm is that of a rolling landscape, a vast blue sky with fluffy clouds, fields filled with golden crops waving gently in the wind, and pastoral scenes of rangeland dotted with cattle. I suppose that someone could easily take a picture of this scene and neatly paste it into an advertisement for agro-chemicals, or possibly a new tractor. But where did this come from? How did we get to this image, this illusion of prosperity?

Figure 2-1 – Farmscape near Rivers, MB



Agriculture in Canada's great prairies began simply with simple living. In the very earliest days, Aboriginal communities, while often nomadic, also practiced a basic form of agriculture on the prairies. Some communities grew a wider assortment of plants than others, but always because they saw a need and recognized the opportunity. In eastern North America, where many aboriginal groups practiced a more sedentary lifestyle, agriculture was more developed (Grewell et al., 2003). Fields were recognizable and were used year after year to produce an assortment of crops beginning with sunflowers, goosefoot and squash. Perhaps a note about scale is appropriate at this juncture. Fields, in the case of these groups of people, would certainly not be anything

like those that would come later with the advent of Europeans in North America. Fields, in the case of aboriginal groups would have been more appropriately measured in square meters than in hectares. Around 1000 AD, corn and beans were introduced from Mexico and the result was an increase in plantations (Grewell et al., 2003). In the prairies, aboriginal agriculture would have been more confined to short season crops that were grown in small plots, such as the “three sisters”, a planting strategy of building a small earthen mound and seeding into it seeds of corn, beans and squash tended with bison bone and stone tools. The vertical component of the corn provided a way for the bean plants to vine up, while the beans provided added nitrogen to the corn and the squash. The squash, with its rapid, prostrate growth habit provided ground cover of the mound, thereby maintaining a cooler soil temperature and conserving moisture. Plantings such as these could be left to fend for themselves through the summer while the groups moved about the plains hunting for meat. While hunting cannot really be considered to be agriculture, the result is essentially the same. These peoples had a practiced relationship with animals and harvested them in a manner that did not exhaust the supply to ensure a store of meat for protein requirements throughout the winter. Archeological evidence found in the Lockport, MB area suggests that agriculture supplemented the hunter/gatherer Aboriginal societies as far back as 2000 years ago. Food preservation in clay urns and underground storage pits have also been found. The "Little Ice Age", the climate change that occurred 500 years ago, diminished the opportunity for agriculture in the prairie region and native peoples returned to a predominantly hunter/gatherer lifestyle (MBGov, 1994).

Enter the fur trade and Europeans on the Canadian prairies. In about the year 1734 Europeans managed to get to the prairies, but not with agriculture in mind. They came for fur trading and exploration. Perhaps exploitation would have been another motivation for the push into the west. Eventually, settlements started to appear, first in the form of forts, trading posts and then the small communities surrounding them. Europeans had relied on organized agriculture for the provision of vegetables and grains for hundreds of years prior to this point in history, and proceeded to plant gardens and small fields with crops they required (Murray, 1967).

The competition between the Hudson's Bay Company and the Northwest Company in the early 1800s may well have contributed to the advent of agriculture in the Red River Valley. There were some small efforts in agriculture at the turn of the 19th century when traders planted plots of barley and oats at the mouth of the Winnipeg River. Between 1800 and 1808 large quantities of potatoes, squash, turnips, carrots, beets, parsnips, cucumbers, melons and cabbage were grown, as well as chickens and hay were produced at Pembina (Murray, 1967).

Organized, large-scale agriculture in the prairies really got started when Lord Selkirk and a group of highland settlers, along with a bull and a cow (Jackson, 1970), arrived to found the Red River Settlement in 1812, occupying lands near present-day Winnipeg granted to him by the HBC (Murchie et al., 1936; Murray, 1967). This influx of settlers between 1812 and 1815 was contemporaneous with a sharp increase in fur trade activity after 1810, which saw rapid population growth and a concomitant increase in the need for food in the Red River Valley, particularly at Fort Garry. The first crop of winter wheat was planted in the fall of 1812 in the area now known as Point Douglas

(Jackson, 1970). Between 1812 and 1820, many of the years resulted in complete or nearly complete crop failures, harassment and armed conflict with the NWC (for example, the Seven Oaks massacre of 1816), plagues of grasshoppers and the necessity of over-wintering at Pembina. Crops of peas, barley, oats, hemp, Indian corn and potatoes were tried, without great success and colonists were forced to subsist on berries, roots and fish (Murray, 1967). Lord Selkirk granted over 10,000 acres to the Catholic Church in 1817, which later became the Parish of St. Boniface and was populated by experienced farmers who followed the new priests to that area (Murray, 1967). After the great flood of 1826, the colony's fortune changed for the better (Jackson, 1970). A group of English colonists from Lincolnshire arrived in Red River in the late 1830s to set up and operate an experimental farm located in Point Douglas for the HBC (Murray, 1967). The Selkirk settlers were, by 1834, able to provide the fur trade with flour, potatoes, dairy products and fresh meat (Murray, 1967).

The HBC and the Northwest Company merged in 1821 (Whitcomb, 1982) resulting in an increase in the demand for foodstuffs in the region. The early years of the 19th century in the Red River Valley saw large organized buffalo hunts that originated from the Winnipeg area.

By 1850, the population of the Red River settlement was approximately 5000

people (Murray, 1967), resulting in a further demand for fresh food. The Métis people actively participated in the buffalo hunts, but also maintained small farms throughout the



Figure 2-2 – Red River Cart

region (Jackson, 1970). The Canadian and British governments sent survey expeditions to the prairies in 1857 to ascertain the potential for agriculture. The Canadian party led by Henry Hind and S. J. Dawson examined the Red River region while John Palliser spent three years exploring the prairies between the Red River and the Rocky Mountains for British interests (Murray, 1967). They all returned to the East with reports of the enormous potential for agricultural activities in the prairies (Jackson, 1970).

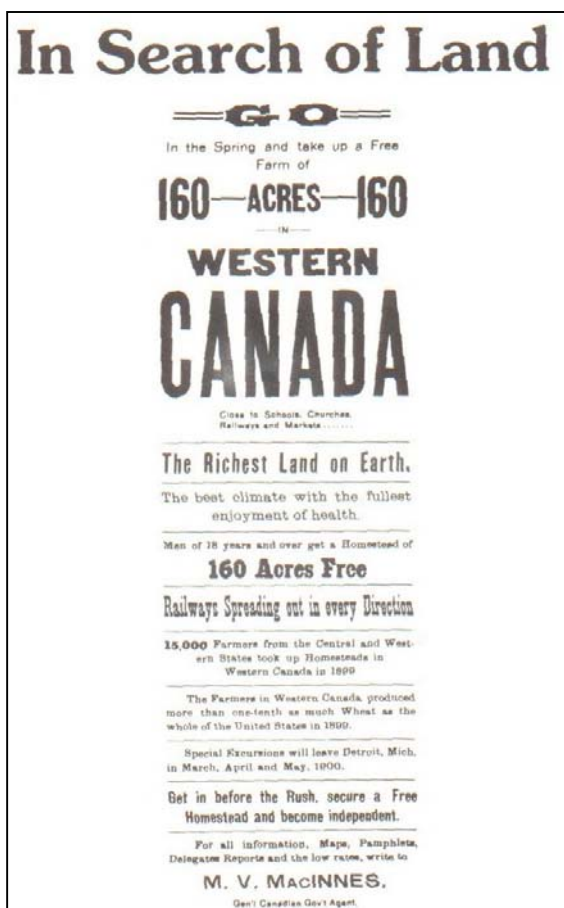
The first mass transportation into the Red River region was a steamboat running between St. Paul, Minnesota and the Red River settlement beginning in 1859 (Murray, 1967; Whitcomb, 1982), followed by a direct rail connection from St. Paul to Winnipeg in 1878. These transportation connections enabled significant increases in population and settlement in the valley that was not directly related to the fur trade. In 1848, the Committee on Economy of the Council of Assiniboia ordered Black Sea wheat seed in an attempt to overcome the problems with the comparatively short growing season experienced in Manitoba (Murray, 1967). This variety was later (mid-1860s) augmented by other varieties from northern Europe.

Canada was recognized as a Dominion of England on July 1, 1867 by Confederation (Whitcomb, 1982). Louis Riel's defiance of the Canadian Government land survey occurred in 1869 at St. Norbert (La Barriere), starting the series of events that would lead to the Red River Rebellion (Jackson, 1970). Manitoba was admitted as a province in 1870 under circumstances that would forever shape the face of the province (Whitcomb, 1982).

The first agricultural exports began in 1876, being primarily of wheat (Whitcomb, 1982). The advent of steel rolling mills that replaced the old stone mills made it possible

to utilize hard wheat, being ideally suited to the prairie climate. Manitoba Number 1 Hard quickly became an international standard in grading wheat crops (Murchie et al., 1936; Whitcomb, 1982). Red Fife wheat, with its suitably shorter growing season requirements, became the first ideally suited wheat breed for the prairies (Whitcomb, 1982) and had been developed by David Fife of Peterborough, Ontario in the 1820s (MacEwan, 1980). It was in this period that the practice of mono-cropping began, with large areas seeded to the same crop (primarily wheat) that depended on large markets and later, significant quantities of inputs, rather than on the practice of rotations (Madeley, 2002).

Figure 2-3 – Promotional Poster



The Canadian Pacific Railway connection from the East to the burgeoning community of Winnipeg was completed in 1881, and immediately settlers began to arrive in droves. Winnipeg's population grew from a few hundred in 1870, 1,869 people at the time of incorporation in 1874 to over 5000 by 1875 (Morton, 1957; Whitcomb, 1982) and later to 52,000 by 1901. Settlers from all over Europe began arriving in the late 19th century. Although the vast majority of settlers until the 1870s

had been either of British/Scottish descent or French Catholics, the connections to the outside world made possible by steamer and railway enabled Icelanders and Mennonites

to begin to arrive in the 1870s (Whitcomb, 1982). Approximately 40,000 settlers arrived in western Manitoba between 1876 and 1881, settling much of the land between the American border and Riding Mountain, from Portage la Prairie to Rapid City (Morton, 1957; Murray, 1967). Increased land use in the Red River Valley was gradually made possible by an ever-increasing network of drainage ditches and channels made possible by a drainage act in 1879, but was largely put on hold from 1888 until 1895 when the government was replaced (Murray, 1967).

It was also in this period that mechanical farming got its start in the prairies, with the arrival of seed drills, gang ploughs, self-binding reapers, steam threshers and the material that would end the open prairie forever: barbed wire (Morton, 1957; MacEwan, 1980). The first grain elevator was constructed in St. Boniface beginning in 1880 (Morton, 1957) and exports of wheat to the east were well underway, with transport at first being by steamer to the United States and then by rail. In 1876 the



first shipment of wheat left Winnipeg by rail for the East (MacEwan, 1980). The westward push of the CPR furthered settlement of the west as it quickly crossed the prairies towards the mountains. The rail line reached Rogers' pass by 1884 and carried countless settlers into the prairies as it went. Freight rates from Manitoba to Fort William

(now Thunder Bay) became the single largest expense for Manitoba farmers (Whitcomb, 1982).

In the late 1890s, immigration to the prairies increased drastically and followed on into the early years of the 20th century. Between 1873 and 1914, homestead entries totaled 536,253, although some 85% of those were filed between 1900 and 1914 (MacEwan, 1980). Agricultural production expanded rapidly during the same period, with 2.7 million bushels of wheat coming from slightly more than 10,000 farms in 1881, rising by an order of magnitude to 29 million bushels from 31,815 farms in 1891 and reaching 43 million bushels from 55,593 farms in 1901 (Murchie et al., 1936; MacEwan, 1980).

Immigration was at an all-time high and immigrants settled throughout the prairie region. The first decade of the 1900s was a period of heavy agricultural settlement and the second decade was that of agricultural development. During the 1910s, occupied land increased from 57 million acres to roughly 88 million acres; an increase of 53% (Murchie et al., 1936). During this same period, improved land increased by 100% from 22.9 million acres in 1911 to 44.8 million acres in 1921 and to over 60 million acres in 1931 (Murchie et al., 1936). Although incredible gains were made in all areas of farming and in total yields, Murchie et al (1936) point out that millions of acres of land completely unsuited to the growing of wheat were used for that purpose. Murchie et al. (1936) go on to mention that "...nearly everywhere one goes there is some untellable land... or is highly unprofitable for tillage. Such land could be helped materially by the maintenance of livestock, and this is the usual function of livestock on the prairies."

Steam-powered engines used to run thresher units began to be seen on the prairies in the late 1870s, but due to their enormous cost, were fairly rare. These machines were often used as a community tool, particularly for threshing operations, which required considerable horsepower (MacEwan, 1980). Still later, steam-powered tractors appeared to undertake draught requirements in fields. Many of these large machines were operated by a crew of workers and were effectively the equivalent of modern “custom” operators. The first decade of the 20th century also saw the implementation of the Manitoba Grain Act as well as the birth and development of the Territorial Grain Growers’ Association (later to become the Provincial Grain Growers’ Association) with W.R. Motherwell as its president (MacEwan, 1980) as well as the first of many Wheat Pools and co-operative elevator companies. The year 1905 marked the first time that the western grain crop reached 100,000,000 bushels and this put enormous pressure on the grain-handling infrastructure of the time (Jackson, 1970). The first gasoline-powered tractors made their appearance in the prairies in about 1908, and not long afterwards, steam power was in the decline (MacEwan, 1980). Marquis Wheat, a shorter growing season variety, was developed in the early 1900s through crossing Red Fife with other short season varieties and was accomplished by Dr. Charles Saunders and his sons (MacEwan, 1980).

In the first decade of the 20th century, approximately 1 million acres of cropland were being added per year concurrently with rapid construction of grain elevators and railway branch lines (Jackson, 1970).

Tractors quickly replaced the remaining few horses still in use as draft animals, and machinery in general saw drastic improvements and increase in physical size as well as capability. While the trend of replacing draft animals with tractors began in the 1920s,

as Murchie et al. (1936) point out, in 1926, only about 18% of prairie farms had tractors. This study further points out that the replacement of draft animals by tractors resulted in millions of acres of crop land being freed up for other uses (or non-use) as they were no longer required to feed draft animals. However, after the crash occurred in 1929, the result was dramatically decreased sales of tractors across the prairies, slumping from 17,000 units sold in 1928 to fewer than 1,000 in 1931 (Murchie et al., 1936).

Figure 2-5 – Early gasoline tractor



The 1930s were a tough time for prairie farmers. The stock market came apart on October 24, 1929 and was quickly followed by a decline in agricultural prices, an increase in prices of goods, a world-wide depression, and a period of exceptionally poor crop yields that were further exacerbated by a severe drought throughout much of the prairies (MacEwan, 1979). Much of the problem with western Canadian farms was that in those areas that were naturally on the verge of not having enough water received less than usual. Cropping practices were focused on the extensive rather than the intensive and large areas made up to some extent for poor productivity, but with insufficient precipitation, the consequent decline in yields changed many farmers' financial position from marginal profit to loss (MacEwan, 1979). The drought began in the fall of 1929 and the summer of 1930 saw no relief in the form of rain. Grasshoppers arrived in numbers rivaled only by the Selkirk settlers' scourges of the early 1800s and enormous quantities

of topsoil blew off the bare fields (Jackson, 1970). By 1931, Manitoba's wheat and barley crops were less than half of that produced just three years earlier. The diversification of agriculture served only to provide some measure of variety to a subsistence level of living for farm families (Jackson, 1970). The Canadian Wheat Board (CWB) was established in 1935 with the goal of providing some stability in wheat prices (Wilson & Tyrchniewicz, 1995). Several years of poor crops and poorer prices were turned around somewhat in 1938 when a good crop was realized and a sugar beet refinery was constructed. The plant was in operation by 1940 and capable of processing 2000 tons of beets per day (Jackson, 1970). The Second World War got underway in September 1939 and quickly brought economic relief to the prairies through drastically increased manufacturing and an instant market for agricultural products (Morton, 1957).

Where We Are – From Green Revolution to Green Thinking

The Green Revolution was, as one anonymous scholar put it, not really so revolutionary. The term itself was coined in 1968 by William Gaud, who was the administrator of the US Agency for International Development (USAID) at the time. After the Second World War, the first area of the world to receive the benefit of new scientific agricultural research and practice was Mexico. During the war years, Mexico was in a position of deficit in terms of corn and wheat production and requested help from the international community. The arrival of George Harrar and others in Mexico to operate the newly formed Office of Special Studies created by the Mexican Ministry of Agriculture and the Rockefeller Foundation (Conway, 1998) resulted, in fairly short order, a marked increase in the ability of farms to produce increasingly larger yields of wheat. Mexico's grain deficit decreased from fully half of its requirements in 1943 and

reached self-sufficiency by 1956 (Conway, 1998). In those post-war years, various international agricultural research centers sponsored by large private American foundations such as Ford and Rockefeller, developed high-yielding varieties (HYV) of rice, wheat, maize and soy that required considerable quantities of fertilizers and treatment products and mapped out cultivation methods on experimental stations (Mazoyer & Roudart, 2006). The basis for these programs was strict plant and animal selection, the development of treatment products, pure culture of genetically homogenous populations, new mineral and synthetic fertilizers, precise control of irrigation and some degree of mechanization (Conway, 1998; Mazoyer & Roudart, 2006). In the 1950s, then Secretary of Agriculture of the US, Ezra Taft Benson, shaped the future of farming in North America by pronouncing that farmers must "...get big or get out..." (Horne & McDermott, 2001). The Green Revolution of the 1950s and '60s was, in essence, an organized program that dramatically increased crop yields through the use of crop variety hybridization and agricultural chemicals. This hybridization came with a price however; the extreme nature of the uniformity and their engineered ability to make unusually high use of fertilizers resulted in the need for extensive protection from insects and disease (Savory, 1999). It is no secret that the goal of the Green Revolution was to produce high yielding varieties that could be grown in a myriad of conditions around the world in an effort to narrow the gap between growth in food production and growth of population (Conway, 1998).

The Green Revolution, spurred on by globalization and commoditization of food, sent high-yield hybrid seeds along with the agro-chemicals needed to support them to Third World countries *en masse*. Considerable research programs were initiated in Asia,

with the intent of developing new high yielding varieties of rice and wheat and resulted in the establishment of the International Rice Research Institute (IRRI) in the Philippines in 1961 (Conway, 1998). One of the most significant developments of this period was a new hybrid variety of rice called “IR8” released in 1966 (Conway, 1998; Cook, 2006). This resulted in record yields in countries that had been, for many years, net importers of grain from North America and consequently world grain prices fell as demand waned (Cook, 2006). Exponential growth in agricultural output has been, in some ways, necessary, as the population of the globe doubled in the last 40 years. Pretty (2008) points out that total world food production has increased by approximately 145% since 1960. Further, on a per capita basis, there is more food available today than there was in 1960, as production has outstripped population growth. However, in regional terms, certain parts of the world have not fared as well. Both Asia and Latin America have seen increases in per capita food production, while Africa has seen a 10% decrease in per capita production (Pretty, 2008). Unfortunately, it is the rural poor who have seen the least advantage in the big picture. Actual numbers of people who go hungry around the globe have increased since the advent of the Green Revolution.

Mechanization also increased exponentially during the post-war period. By 1976, approximately 88% of all farms utilized tractors for draft power, and by 2006 this figure had risen to 92.5%, often with at least 3 machines per farm (StatsCan, 2008b).

Food distribution inequities and globalization of markets has made it increasingly difficult for poorer regions to acquire the food they need to support their populations. This is often coupled with the use of lands in these countries to grow cash crops such as coffee, cocoa, bananas and tobacco for export to help prop up the economy of the

country. However, the use of lands for these cash crops eliminates their use for growing food for the country's population, leading to further dependence on imports of food staples.

The use and consequent abuse of lands for agriculture has made the environmental impact of food production increasingly harmful to the environment. Total world agricultural area has increased 11% from 4.5 to 5 billion hectares and total arable land from 1.27 to 1.4 billion hectares since 1960 (Pretty, 2008). While agricultural area has decreased somewhat in industrialized countries by 3%, it has at the same time increased in developing nations by 21% (Pretty, 2008). Livestock production has also intensified, with the number of chickens quadrupling, a doubling in the number of hogs and a 40-50% increase in ruminant livestock (Pretty, 2008). Intensity of production has increased dramatically during this period as well, with irrigated acres and machinery doubling, and a quadrupling of fertilizer use.

Agro-chemicals

Pesticides and fertilizers have been in use since ancient times (Felsot & Rache, 2007). There has also been a significant increase in the use and reliance on agro-chemicals in recent decades. Everyone seems to have some level of concern about pesticides in their food, but few really know what the issues are or how to find out about what the dangers might be. While there were some chemicals in use as pesticides and fertilizers before the Second World War, artificially manufactured agro-chemicals are really an invention of the last generation. In general, as Felsot & Rache (2007) point out, as much as 95% of cropland in the United States is treated with some form of pesticide: 64% for weeds, 22%

for insects, 6% to control diseases and nematodes and 4% with a plant growth regulator for fruit thinning, growth control or defoliation. StatsCan (2004) reports that 73.2% of Canadian farms used pesticides in 2001 and 74.5% used commercial fertilizers.

Fertilizers

In early times, a wide variety of sources of nutrients were utilized, including manure, fish, seaweed, peat moss, leaves, straw, leached ash, bone meal and guano (Huang & Uri, 1999). One of the earliest commercial agricultural nitrogen inputs was Chile saltpeter (NaNO_3), a mined mineral available in large quantities from South America and accounted for more than 60% of the world supply for much of the 19th century (Zmaczynski, 1985).

Justus von Liebig of Germany advanced a new theory in the early 1800s concerning nutrition of plants that was significantly different than other concurrent theories. He insisted that the soil contained minerals that could be assimilated by plants for growth and that chemicals could be applied to the soil and directly used by plants (Paarlberg & Paarlberg, 2000). However, von Liebig considered phosphate to be the mineral of highest importance to plant growth. He discussed the process of producing super phosphate and emphasized the importance of potassium as a fertilizer. However, he did not recognize the importance of nitrogen as essential to plant growth. Synthetic nitrogen was first produced during the First World War and then there was a significant jump in utilization of nitrogen, as well as potassium and phosphate after the Second World War (Paarlberg & Paarlberg, 2000).

In the early part of the 20th century, Fritz Haber developed a process for producing ammonia (NH₃) for military chemical use. Some years later, Karl Bosch further refined the process, enabling the production of ammonia *en masse* for use as a nitrogen fertilizer. A factory for the process, which involved high pressures and high temperatures, was built and in use in Germany by 1913 (Zmaczynski, 1985).

The advent of the Green Revolution really kicked off the use of chemical fertilizers when it was discovered that using nitrates left over from munitions manufacturing during the war could be used as nitrogen replacement fertilizers for agricultural fields. The practice of applying urea [(NH₂)₂CO] began in North America in the 1950s, and during the 1960s and 1970s saw increases of up to 10% per year (Sheldrick, 1987). The resulting increases in corn yield from 62 bushels/acre to 139 bushels/acre between 1964 and 1994, and increases in wheat yield from 26 to 38 bushels/acre during the same time period were enough to convince most farmers that the miracle had arrived (Huang & Uri, 1999). Because much of the nitrogen fertilizer production in North America is based on the use of natural gas, the price of fertilizers is closely dependant on oil and gas prices, which, in recent years, have skyrocketed. Nitrogen fertilizer use in North America has increased by approximately 400% since 1940 (Zmaczynski, 1985), while in Canada it has increased by roughly 10% per year throughout the 1970s and 1980s (Sheldrick, 1987), but has since declined in more recent years.

The use of nitrogen fertilizer has had insidious effects over the years. For example, in the USA, farmers were using 2.7 million tons of nitrogen fertilizers per year in 1960, and by 1995 this figure had grown to 11.7 million tons per year (Sheldrick,

1987; Horne & McDermott, 2001). Some farmers in the earlier days of fertilizer application developed the idea that since fertilizer was good for crop yields, more must be better. They proceeded to apply ever-increasing amounts of fertilizers onto their fields, resulting in poisonous excesses becoming part of run-off and entering into groundwater and streams (APFSAFE, 1987; Huang & Uri, 1999; Paarlberg & Paarlberg, 2000), resulting in eutrophication of water bodies and consequent effects on wildlife and water quality for human and livestock uses (APFSAFE, 1987; Racz, 1992; Huang & Uri, 1999). With increasing popularity of chemical fertilizers and the dependency that ensued, other fertilizing methods such as manure spreading and legumes included in rotation became less utilized. While both grain production and nitrogen fertilizer use have increased since the 1950s, a seldom-mentioned aspect of nitrogen fertilization is that over time, the efficacy of the fertilizer declines. Sheldrick (1987) demonstrates this fact in numerous tables and graphs showing declining grain production per ton of N-fertilizer used over the years 1950 to 2000. Huang & Uri (1999) point out that while fertilizer use increased at approximately 1.6% annually between 1948 and 1998, there was a con-committal increase in agricultural productivity (1.9% annually) and a drop in farm labour requirements (2.9% annually) during the same time period.

Pesticides

Pesticides, including herbicides, insecticides and fungicides have become a highly prevalent input in modern agriculture in the last century. While certainly providing protection of valuable crops from a host of potential destructive organisms and simultaneously allowing high yields to be maintained, pesticides have a sordid history.

Developments in the 1940s led to the introduction of such pesticides as DDT and MCPA

and in the decade following the war became widely used for control of agricultural pests (Briggs & Courtney, 1989). DDT, short for dichloro-diphenyl-trichloroethane, was first synthesized by a German chemist in 1874, but its effectiveness as a pesticide remained undiscovered until the beginning of the Second World War (Carson, 1962). Its discovery is credited to Paul Muller of Switzerland and was hailed as a highly effective killer of lice and mosquitoes in the prevention of the spread of diseases such as typhus and malaria (Pretty & Hine, 2005) and then for agricultural pests immediately after its release to the public after the war (Carson, 1962). MCPA, short for 2-methyl-4-chlorophenoxyacetic acid, was developed as an herbicide and is still in use today in a wide variety of products (Briggs & Courtney, 1989). Agricultural use of DDT expanded exponentially, with sales jumping from \$9.2 million in 1939 to \$174.6 million in 1954 (Paarlberg & Paarlberg, 2000). Also immediately after the war, a new herbicide known as 2,4-D (2,4-Dichlorophenoxyacetic acid) was released for public use. This herbicide is a plant growth regulator, based on hormone research, and is uptaken by target plants through their leaves, from which it is translocated to the meristems, causing rapid and unregulated growth resulting in death (Briggs & Courtney, 1989; Paarlberg & Paarlberg, 2000). 2,4-D has become the most widely used herbicide in the world and the third most used in North America (ITFII, 2008).

As early as 1950, the US Federal Drug Administration warned that it was extremely likely that the potential hazard of DDT had been underestimated (Carson, 1962). At the same time, it was becoming evident that insects were developing a tolerance to the poisons and its effectiveness as a pesticide was waning (Paarlberg & Paarlberg, 2000; Felsot & Racke, 2007). After Ms. Carson's book was published in 1962,

public outcry, in conjunction with further research, eventually led to the banning of DDT in the USA at the end of 1972 (Paarlberg & Paarlberg, 2000). Biological concentration of this neuro-toxic compound posed a whole range of potential harmful environmental effects (Carson, 1962; APFSAFE, 1987; Paarlberg & Paarlberg, 2000; Felsot & Racke, 2007). Generally speaking, pesticides have two main disadvantages: evolution of pest resistance and the blanket effect that broad-spectrum sprays have on natural enemies of insects (Felsot & Racke, 2007). Following DDT and MCPA, a wide range of other pesticides were invented and made available for agricultural use around the world. These included herbicides such as mecoprop, dicamba and dichlorprop and insecticides such as aldrin, dieldrin and heptachlor. Within a few years, the potentially harmful effects of these compounds were identified and alternatives were sought after (Briggs & Courtney, 1989). This led to research and development of organophosphate pesticides, which are generally less persistent, more toxic and more specific to the pest targeted (Briggs & Courtney, 1989; Pretty & Hines, 2005). Soon after their development, organophosphates and organochlorines were in widespread use around the world on almost every major crop. At the same time, the development of Integrated Pest Management (IPM) strategies was on the move. These strategies use a combination of chemical controls along with biological control (natural enemies) and cultural practices (Felsot & Racke, 2007).

Human health is another factor that has led to disparaging opinions about pesticides. Chronic effects such as respiratory illness, neurological disorders and cancers have been identified as associated with long-term exposure in workers regularly working with the chemicals (APFSAFE, 1987; Kishi, 2005; Felsot & Racke, 2007). Unfortunately, it is usually only reports of acute pesticide poisoning that are reported, and it is estimated

that, if all levels of severity are included, approximately 3% of all agricultural workers suffer from some degree of pesticide poisoning; amounting to roughly 25 million people annually (Kishi, 2005). Recent estimates range from 10,000 to 20,000 deaths from pesticide poisoning each year worldwide (Horne & McDermott, 2001). Pesticides present a hazard to human health: 107 active ingredients in pesticides have been found to cause cancer in animals and humans. Despite this, 83 of these 107 are still in use today (Horne & McDermott, 2001).

In the last 50 years the use of pesticides for agricultural purposes has risen dramatically and now amounts to approximately 2.5 billion kg per year around the globe (Pretty & Hine, 2005). During the advent of the Green Revolution, growth in use of these products reached as much as 12% per year, but then fell back to a moderate growth rate of less than 2% annually (Pretty & Hine, 2005). 2001 data indicates that approximately 29 million kg of pesticides are used in Canada (Pretty & Hines, 2005; StatsCan, 2008c) and that in the order of 45% of all Canadian farms use herbicides on a regular basis (StatsCan, 2008c).

Glyphosate (Roundup) was introduced in 1974 and has since become one of the most important and widely used herbicides in the world. Glyphosate is a broad-spectrum, non-selective herbicide that utilizes a surfactant system to enable it to adhere to plant leaves. Today, Glyphosate herbicides are the world's most widely used herbicides, registered for use in 130 countries and approved for use on more than 100 different crops (Monsanto, 2005).

Linked to genetically modified crop varieties programmed to be resistant to the herbicide, the use of this chemical has presented both advantages as well as

disadvantages. Roundup Ready varieties have been developed through a vigorous research program by the international agricultural giant Monsanto since the late 1990s. These crops represent a completely new paradigm in crop protection and agronomic programming. Because the varieties are copyrighted, the distributor is able to demand that producers who wish to use the varieties sign contracts in production that require producers to return the yield to the company. Producers are not allowed to retain seed for subsequent seeding in future years. The crops grown are usually of very high quality because of the ability to withstand the effects of the herbicide to which they are modified to work in conjunction with. Innumerable studies have been undertaken to assess the potential for crop improvement, as well as possible negative ramifications of this cropping system. There is a distinct climate of intolerance to genetically modified organisms (GMOs) throughout the world, as evidenced by European countries' refusal to allow imports of GMO products. The perceived negative aspects of GMO crops and their accompanying chemicals include unknown impacts to non-GMO crop varieties, human and animal health, increased reliance on crop-specific chemicals, and corporate control of seed (Madeley, 2002). This is especially evident in developing nations such as India where the use of Roundup Ready crops require considerable investment on the part of farmers to equip themselves in order to use the system. The promotion of these varieties has also been blamed for a narrowing of the genetic resources in agricultural crops and the abandonment of older varieties. Other research has begun to show that certain weed species are developing resistance to glyphosate, which could lead to a widespread problem with crop failures due to weed pressure. Finally, Monsanto's control of whole segments of agriculture has made immense quantities of revenue for the company, but

has really not provided the average farmer with a particular advantage, except that weed pressures are reduced. The glut in the market of Roundup Ready produced crops has resulted in generally falling crop prices, which carries a consequent decline in farm income. Three large agribusinesses (Syngenta, DuPont and Monsanto) currently control in excess of two-thirds of the world pesticide market (Madeley, 2002).

Pollution

Pollution of the environment becomes a significant factor working against sustainability when residual effects compound to create conditions unfavourable for plant growth or human and animal health. Early examples of environmental pollution having an effect on agriculture include the decline of the Fertile Crescent between 4000 and 2000 BC (Raman, 2006). New technology and techniques in irrigation utilized water from sources that were naturally contaminated by salinity. In ordinary terms, saline groundwater or surface water does not present a serious issue. However, when large volumes of these saline waters are applied to otherwise fertile ground to provide moisture requirements for crops, the water evaporates and transpires and leaves behind precipitated salts that remain in the topsoil where plants are acquiring the water required for growth. Plants that are not suited to growth in saline conditions generally do not survive for long, as the moisture balance between plant tissues and soil salts pulls water from the plant into the soil, subsequently desiccating the plants. Large-scale agricultural endeavors cannot help but fail in such conditions.

Other examples of non-point agricultural pollution include the resulting effects of overuse of chemical farm inputs. Pesticides and fertilizers have turned up in ecosystem analyses all over the world, and in increasing concentrations. The results of excess

pesticides in the environment is invariably the poisoning of a wide variety of species, either acutely or chronically and background levels found in food products or water bodies. Excess fertilizers in the environment lead to eutrophication of water bodies that upsets the natural balance of oxygenation and algal growth, leading to imbalances in natural ecosystem productivity. There is a wealth of information and research in the literature concerning these issues, but as the focus lies elsewhere, those details will not be dealt with in this document.

Canadian Statistics –

Not everything that can be counted counts, and not everything that counts can be counted

In the Canadian prairies, things have gotten bigger at the same time they have shrunk. Farmers made up 31.7% of the Canadian population in 1931, while as of the 2006 census, farmers now account for a mere 2.2% of the total population (Maynard & Nault, 2005; StatsCan, 2008a). During the same period, the size of the average farm in Canada has grown from 224 acres in 1931 to over 700 acres in 2006 (StatsCan, 2008b). In 1931, there were 728,623 farms across the country and this number has shrunk to 229,373 in 2006 (StatsCan, 2008b). This dichotomy in farms has created two very different types of farms: those that make money and those that spend it (hobby farms). Farming is increasingly becoming less of a lifestyle and more of a business, and it is undeniably a big business. In recent years, 30% of farms produced approximately 70% of the food in Canada and approximately 2% of farms in Canada produce more than 35% of all the food grown in this country and the numbers are continuing to widen (Maynard & Nault, 2005). It is estimated that every 5 years there will be 10% fewer farmers, which leads to the conclusion that in 20 years there will be 35% fewer farmers than today (Maynard &

Nault, 2005). Interestingly enough, although farm sizes are increasing and numbers of farms and farmers are decreasing, even today, 98% of all farms are family owned and operated (Maynard & Nault, 2005).

According to the 2001 Census, the job of running the farm in Canada is increasingly falling to fewer and older farmers. Farm operators have a median age much higher than the comparable labour force population of self-employed workers. Although reductions in the total number of farmers may reflect increased productivity in the sector, a lack of younger workers entering the field may cause labour shortages in the future (Maynard & Nault, 2005).

Current Manitoba Conditions

As a result of events of the period between the Second World War and today, the face of agriculture in the prairies has had a drastic, and to some extent, unflattering make-over. Certainly, there have been some incredible advances in technology and the ability of farms to produce increasingly large yields. However, rural decline and vertical structuring in agribusiness have also led to diminishing incomes, profits at the expense of the environment, and a landscape of empty farmyards.

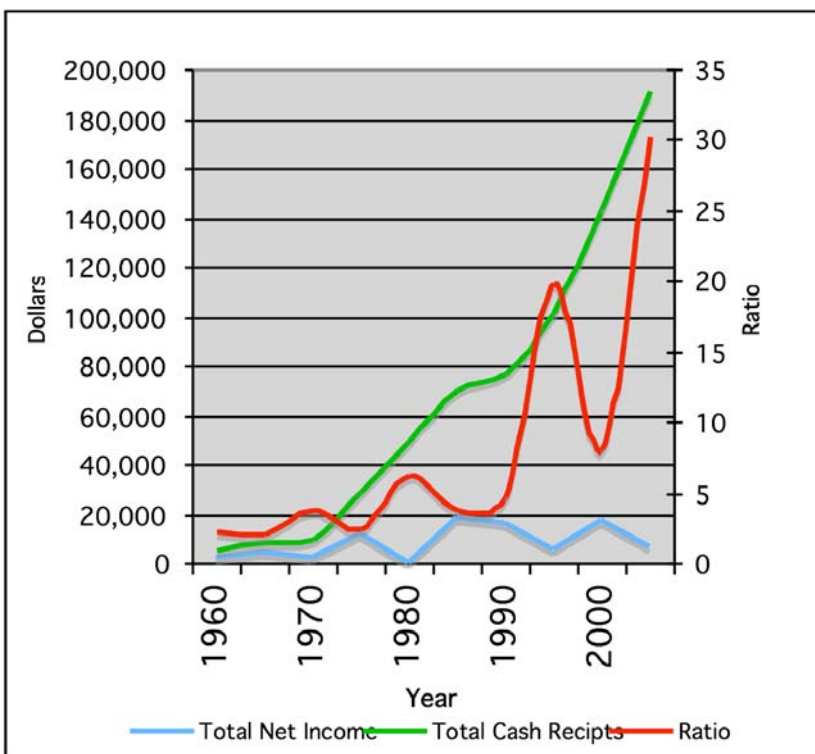
Farm Income

Canadian farmers today have really ramped up production. In the agricultural sector, producers are making seven times the gross income that they were in 1970, but net incomes have stayed much the same (Neufeld, 2004). Where is the money going? By and large, the extra money produced in the agriculture sector is going into the pockets of processors, transportation companies, and corporations producing farm inputs. The trend certainly looks good on paper in terms of the GDP, but reflects poorly on the society's

treatment of farmers. In 1960, the average Manitoban farm produced \$5,200 in cash receipts and saw \$2,300 in net income. By 1970, this relationship had changed to \$9,500 in receipts and the same net income. Disturbingly, in 1980, this ratio was considerably worse, with receipts at \$49,800 and net income at only \$500, for a ratio of nearly 10:1. This improved by 1990, when receipts are listed as being \$76,400 and net income at \$16,200, although by the year 2000, the balance had swayed away from being in farmers' favour, with \$143,300 in receipts and only \$17,500 in net income, for a ratio of 8:1 (MBGov, 2007a).

Statistics Canada has monitored farm income carefully for decades and figures that have emerged from the 2006 Census of Agriculture reveal that farm income is declining drastically. Even in the last five years, the average farm income in Manitoba

Figure 2-6. Cash Receipts, Net Income and Ratio, per Farm: 1960-2006 (Data from MBGov, 2007c)



has declined; moving from \$21,505 in 2001 to \$17,938 in 2005, while off-farm income as a percentage of total income during the same time frame has increased from 66.6% to 73.8% (StatsCan, 2008g). While the Federal Government's

Capital Cost Allowance (Starky, 2006) has managed to turn this figure around somewhat, total average incomes rose only marginally from \$51, 201 to \$54, 634 over the same period when the CCA was accounted for in the calculations. The average off-farm income as a percentage of total income adjusted for CCA made the figures for off-farm income even more important to the typical farm household, being 92.7% in 2005 (StatsCan, 2008g).

Hogs

With the loss of the Crow Rate transportation subsidy to grain producers, the use of grains for feed in local areas has become a reality for producers in order to maintain profit margins. This has also led to the need for value-added processing in rural areas and has further resulted in the promotion of hog production as an avenue to use feed grains close to their sources. Processors, consulting firms, governments, marketing cooperatives and economic development specialists have all, at various times and to varying degrees, promoted an industrial model of hog production that involve large specialized barns (Gertler, 1999). In Manitoba, the hog industry grew from 1,287,196 animals produced in 1991 to 2,680,000 animals produced in 2008 (StatsCan, 2008f; StatsCan, 2009). Between 1994 and 2002, the inventory change of hogs in Manitoba increased by more than 100,000 animals per year with the exception of 1998, which saw an increase of 85,000 (MBGov, 2007a). With the opening of the Maple Leaf slaughter plant in Brandon in 1999, Manitoba hog processing jumped from a steady million and a half that had been maintained for many years to four million in a matter of less than ten years

Unfortunately, this specialization into an industrial model of hog production has had a consequent effect on rural communities as well as the environment. These large

barns are frequently owned by, or controlled by agri-business firms that use formulaic methods to maximize production. Whereas the initial stage of a barn unit is accompanied by large local input in the form of construction and set-up, and benefits to the community include an increased tax base, the standard operating mode is typified by minimal staffing, extreme conditions for animals involved and concomitant concentrations of wastes that require disposal. While the physical scale of the production unit requires little in the way of a land base, the feed requirements and land base for manure disposal are significant. However, feed is not usually purchased directly from grain producers, but rather from feed companies that purchase and process raw grains into specialized and medicated formulated feeds for the animals.

The wastes produced by industrial model barns are considerable. For a standard 2000 sow farrow-to-finish unit, approximately 28,600 tonnes of manure are produced annually (MBGov, 2007b). Government regulations concerning land application of manures to crop land as fertilizer are stringent in their own right, but fall short of the mark for appropriate concentrations, timing and runoff potential which all ultimately contribute to nutrient pollution of water-bodies and detract from principles of sustainability. Farmers who in the past raised small numbers of hogs using practices that could be considered to be more sustainable are now incapable of competing in a glutted market and are exiting from the practice (Gertler, 1999). In Manitoba, as of September 24, 2008, a moratorium has been placed on the development of new production units or the expansion of existing units. However, there are limits to the application of this legislation and only a narrow part of the province is actually affected. While the intent of this moratorium is to limit or curtail the environmental consequences of the wastes

generated by these barns, the unfortunate result has also been to put unusual pressures on the owners of the barns in terms of their economic freedom to conduct business. At the same time, in light of recently enacted Country of Origin Labeling (COOL) regulations in the United States, demand and hence value of pork products has fallen to levels that make pork production near uneconomic.

Cattle

Cattle in the Prairie Provinces have seen extreme swings in recent years. While production overall has increased in the last 3 decades with the introduction of feed lots and custom feeding operations, the BSE crisis that emerged following the discovery of BSE on May 16, 2003 in a cow in Wanham, Alberta, resulted in dramatic losses industry-wide due to international border restrictions on export cattle (Wooding, 2006; Stozek, 2008). Almost immediately, 60% of the country's beef export market was frozen and the cattle industry in Canada suffered an approximate loss of \$5 billion in the 18 months following the discovery of the first case (Wooding, 2006). The US border re-opened to Canadian beef exports of animals under 30 months of age on July 18, 2005 (StatsCan, 2006), although some restrictions are still in place.

Production of beef cattle in Manitoba has increased steadily, yet slowly over the years. While hog production exploded in the 1990s, cattle saw comparatively slow growth during the same time period, increasing from 1,108,780 head in 1991 to 1,573,097 head in 2006 (MBGov, 2007a; StatsCan, 2009). The profile of the industry has changed somewhat due to the loss of local beef slaughter capacity (which reduced local slaughter from 22,000 head in 1960 to 3,000 in 2006(MBGov, 2007a)) and the concentration of this capacity in large plants, mainly located in Alberta. Manitoba beef

production has been less focused on feedlot production than elsewhere in the country.

Industry concentration and control by large packing companies such as Cargill and Tyson has led to diminished returns for producers, reflected in prices received at auction. Prices for slaughter cattle have fluctuated widely since 1990, with price spikes in 1994 and 2002 and a severe drop in 2003-04 following the BSE crisis (MBGov, 2007a). Before the BSE crisis, Canada exported 60% of all its beef production, much of this to the United States, substantially more than the 5.6% exported in 1987. Only 40% of Canadian beef is consumed in Canada (Wooding, 2006).

Dairy cattle in Manitoba have seen a distinct drop in numbers over the last 45 years. In 1960, Manitoba's dairy herd was 198, 000 animals and this has since declined to 39, 000 (MBGov, 2007).

Crops

The production of crops in Manitoba is a constantly changing scenario. Prices have been affected by numerous factors over the last few decades, including commoditization of agricultural products, globalization, vertical integration, loss of single desk selling agencies and variable costs of inputs such as seed, fertilizer and pesticides. Whereas farmers were seeing prices for crops in the 1960s that enabled a reasonable income, prices in today's market have not responded to the increased costs of production. While the quantity of inputs and their prices have increased over the last five decades, equalized prices received for crops have remained flat. Harvested acres of wheat have remained much the same since 1960 except for a peak during the early 1980s to early 1990s, although yields have slowly increased over the same time period. Oats (for grain) acres have declined since 1960, particularly since 1980, although yields have nearly

doubled on a per acre basis. Barley acres have remained essentially flat through the years and this like other crops has seen a notable increase in yields. Grain corn in Manitoba has never been a strong player in the market, largely due to a short growing season. Yields for grain corn have increased three-fold since 1960 (MBGov, 2007a).

Oilseeds have seen a steady increase in the number of harvested acres since 1960. The introduction of canola as a replacement for rapeseed increased acres steadily from 33,000 acres in 1960 to over 2.4 million acres in 2006, although yield increases have only doubled during that time frame. Overall acres of flax have declined somewhat and yields similarly doubled. Soybeans are a relatively new crop to Manitoba, only having been introduced to the province as a commercial crop in 1998 (MBGov, 2007a). Acreage has increased by a factor of twenty since the crop's introduction. Another new crop to the Manitoba scene is industrial hemp, which was first produced in 1998 for both fibre as well as an oil seed. Sugar beets were discontinued as a crop in Manitoba with the loss of the Rogers Sugar Ltd. refinery in Winnipeg after the 1996 season (MBGov, 2007a).

Potatoes have seen a huge increase in the province since the early 1990s. Yield increases have been considerable, although this is largely due to the implementation of irrigated production as a replacement for dry-land production. Potato processors implemented contract requirements that mandated irrigation in the early 2000s. By 2003, Manitoba surpassed Prince Edward Island as the largest potato-producing province for the first time.

Crow Rate

In 1897, the Federal government enacted a program to pay to the Canadian Pacific Railway a subsidy to balance the cost of shipping grains to export terminals, so that

producers located in the prairies would not be disadvantaged by the distance to markets. This subsidy, known as the Crow's Nest Freight Rate that would later become known as the "Crow Rate" or "Crow Benefit" was introduced in part because of the competitive advantage that the Americans had with the ability to ship grain via the Mississippi River to ports. For Canadian farmers to remain competitive, they needed a way to reduce costs, and the Crow Rate was the way. This agreement was signed between the government and the CPR in exchange for monetary payments amounting to \$3.3 million and title to railway lands and was intended to reduce shipping rates for unprocessed agricultural products "forever" (Cruikshank, 1991).

This subsidy was challenged at various times by the railways because it did not provide sufficient resources for the company to update their rolling stock and the costs of continued growth in rail traffic. The agreement was suspended during the First World War in response to wartime inflation, but reinstated in 1925 with the addition of the requirement that all railways must also follow the rates, with further modifications in 1927 (Regehr & Norrie, 2009). Farmers saw the Crow Rate as a highly important method of reducing costs so as to attract and maintain export markets. Decades of discussion and argument eventually led to the Western Grain Transportation Act of 1983 which allowed shipping costs to increase marginally, but never by more than 10% of the world price for grain (Regehr & Norrie, 2009). The 1990s saw a new perspective on the rates, due to their specificity concerning unprocessed products. Primary producers were well taken care of by the agreement, but secondary processors within the region did not share the advantage. Many companies established processing facilities outside the prairies so that they would not be required to pay the additional charges for freight on processed

products. The introduction of the North American Free Trade Agreement in 1994 also raised red flags about the legality of the subsidy. Also at the time, Canada was facing a huge national deficit that the government was attempting to reduce, and eliminating outdated subsidy policies seemed to be an ideal way to help with this reduction.

After the 1993 federal election, the new government moved to eliminate the rates. The Western Grain Transition Program was introduced in an attempt to assist farmers in moving away from artificially low shipping rates. This program consisted of a one-time payment of \$18/acre to farmland owners that cost the government, and taxpayers, \$1.6 billion (Sheremata, 1995). This change in prices paid for shipping has had the effect of increased interest in the prairies of feeding grain locally, rather than shipping at all. Simultaneously, the railway companies proceeded to abandon extensive networks of expensive to operate, low volume branch lines, further encouraging local use of grains and the demise of many prairie grain elevators in small towns off the mainline. The trickle-down effect of these actions has been to increase opportunities for trucking firms hauling grain, but also to cost provinces and municipalities enormously in infrastructure costs for maintaining roads with redoubled heavy traffic (McCrorie, 1995). Fortunately, at the time when the Crow Rate was removed, world grain prices were relatively high, thereby cushioning the blow somewhat (Regehr & Norrie, 2009). However, as the NFU (1998) points out, the loss of the Crow Benefit resulted in freight rates for grain producers increasing from \$13 per tonne to \$33 per tonne, representing the largest single cost increase in the previous decade.

Infrastructure

One of the most visible indicators of the loss of prairie infrastructure is the decline in numbers of grain elevators. In 1960, Manitoba had 700 grain elevators with a total capacity of approximately 50 million bushels. At that time, the average elevator had an individual capacity of about 70,000 bushels. Throughout the years, the number of elevators has been declining steadily, to 405 elevators in 1980, 196 elevators in 2000 and finally down to 72 elevators in 2006 (MBGov, 2007). The capacity of elevators has been growing steadily, from 106,000 bushels average in 1980, to 234,000 bushels in 2000, and finally 468,000 bushels in 2006. However, at the same time, the overall storage capacity of prairie elevators has been reduced by 36% (NFU, 1998). While many communities were experiencing the loss of their small elevators, many communities who are located on branch railway lines lost the rail line as well. In the last 40 years, there have been many miles of railway branchlines that have been decommissioned or removed in Manitoba, with the bulk of this abandonment occurring after the passage of the Canada Transportation Act (CTA) in 1996 (NFU, 1998). Branchline abandonment has been allowed to continue despite evidence that this results in increased costs to farmers through increased trucking and storage, and the loss of rural services and rural communities (NFU, 1998).

It was at this time, along with the elimination of the Crow Benefit, that the Federal government allowed railway companies to discontinue (rationalize) service on many high-cost, low-volume, grain-dependent branch lines (Beingessner, 2004). Concurrently with the loss of small town elevators and the branch lines that serviced them is the degradation of rural roads and highways. Much of the product that was once

trucked short distances to local elevators must now travel considerably farther distances to the large inland terminals located on railway mainlines. Small grain trucks as were once seen trundling about country roads have been replaced by B-train tractor-trailers that carry considerably larger weights and have a considerable impact on lower grade roads. The Federal government has had to increase infrastructure assistance to many rural areas by means of the Prairie Grain Roads Program, which provides special funding for road re-building in areas with greatly increased heavy traffic and poor-quality roads. This \$175 million program ran from 2001 until 2006 (AAFC, 2009). The loss of branch lines has also encouraged rail-dependant businesses to leave communities that have lost their branch lines. The necessity of trucking product to remote inland terminals has cost farmers another portion of their already limited profit margin along with deregulation of railway pricing structures has made freight costs the single largest expense on many farms (Qualman & Wiebe, 2002).

Organic Farming

Organic farming got its start in the prairies in the post-war period, although acceptance and even recognition of the concept was shaky at best. The dominance of intensive, export oriented farm policies during and after the Second World War resulted in organic farming being marginalized until the 1960s and 1970s when it suddenly became a position of anti-establishment movements (Hetherington, 2005). Although this adoption by radical movements may have secured a future for organic farming, the reaction to the concept by mainstream farmers at the time was certainly not favourable. Organic philosophy was readily equated with “hippies”, who were not exactly popular with farmers, largely due to the perceived work ethic. For instance, I have a memory of a

long-haired young man showing up at my grandparents' farm in the mid-1970s looking for work and my grandfather politely but firmly turning him away.

The year 1972 saw the birth of the International Federation of Organic Agriculture Movements (IFOAM) through which producers interested in this mode of farming could acquire information and have a voice. In 1975, the Canadian Organic Growers was incorporated (Dwwyor, 2005) to represent growers on a national level. In 1988, a handful of individuals organized to create the Organic Producers Association of Manitoba (OPAM), initially registering as a co-operative and later receiving redesignation in 1993 to become an incorporated non-profit organization (OPAM, 2009b). Canada has had organic standards since 1999 although these have been voluntary. These standards included a statement of principles that indicated that organic agriculture is:

“ a holistic farming system whose primary goal is to optimize the health and productivity of interdependent communities of soil life, plants, animals and people. This system of farm design and management practices seeks to create ecosystems which achieve sustainable productivity.”
(CGSB, 2006).

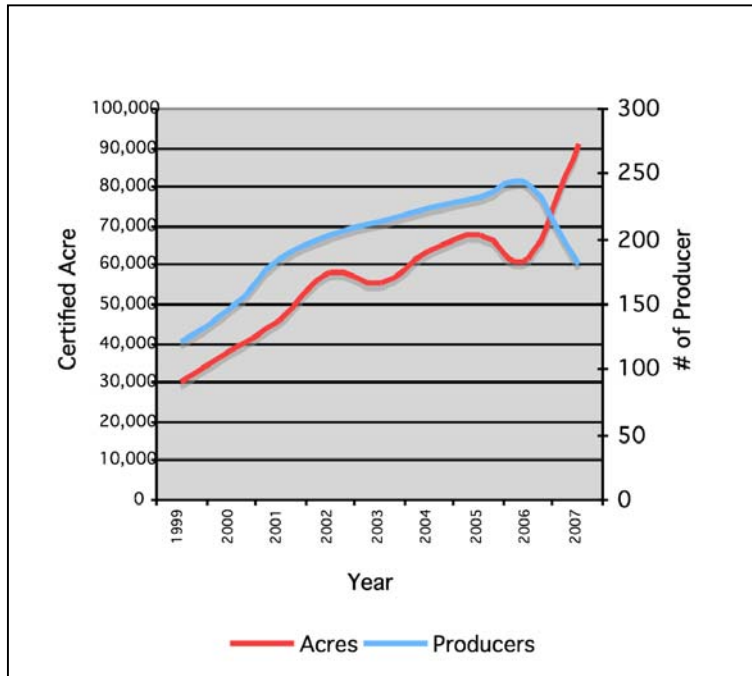
On December 14, 2008, the new Organic Products Regulations were announced and will come into effect in June 2009. After this date, organic products must be certified by a certification body accredited by the Canadian Food Inspection Agency (Kendrick, 2008).

In 2006, 4.2% of all Manitoba's farms reported organic production. 61.8% of

Manitoba's 809 organic farms produced hay and field crops. Although farms often have more than one organic status depending on their commodity mix, 24.2% produced certified organic products, 6.8% were in transition to becoming certified and 74.2% were

not certified (MBGov, 2007c;

**Figure 2-7 – Organic Production Trends in MB.
(data from Holmes & Macey, 2008.)**



Macey, 2008). The number of farms reporting certified organic production more than doubled between 2001 and 2006, moving from 90 to 196; a 217% increase (MBGov, 2007c; Holmes & Macey, 2008). The value of Canadian organic crop products sold

continues to climb, with estimates for 2006 at approximately \$1 billion (Holmes & Macey, 2008). Figures for organic production values in Manitoba are available only as total organic foods in grocery supermarkets and are estimated as being \$15 million in 2005-06 (Macey, 2007).

Agribusiness

Agribusiness really got its start when the Second World War commenced. There was suddenly a global demand for agricultural products that could not be supplied in those areas where the war was interrupting production. The post-war period served to further accelerate the trend as various nations attempted to rebuild and found drastic

shortages of food for their populations. It was during this period that the term agribusiness was born, coined by Ray Goldberg working at Harvard University to describe the all-encompassing system of food production from basic farm inputs all the way up to the end product served on the kitchen table (Warnock, 2003).

This phenomenon is now increasingly controlled by fewer and fewer companies that control more and more aspects of agriculture, including seed companies, fertilizers, pesticides, food processing, food transportation and distribution, industrial animal facilities and international trade in all of these areas. Corporations tend to pursue vertical integration structures, self-sufficiency and self-supply while urging farmers toward disintegration, dependency, and maximum consumption of corporate-supplied inputs (NFU, 2005b). This trend is known as concentration and Filson (2004) sees this as a disadvantage to smaller agribusinesses and farmers, not to mention consumers.

Vertical integration is a style of management control that utilizes a hierarchical structure to produce different products or services that relate to an end product, in this case in the food industry. This corporate structure, in the example of the agri-food industry, has established systems that closely control all aspects of the primary production, collection, manufacturing and distribution of food products around the world. A great deal of money is made by this process that results from the sale of crops and animals from farmers to large corporations. These corporations use a number of strategies to obtain and retain power in the industry to their best advantage.

A review of corporate profits in the agri-food industry by the NFU (2005b), describes strategies utilized by corporations to maximize their profits and maintain a high degree of control of the agri-food industry. These strategies include:

- Captive supplies: Holding inventory of animals in company owned finishing yards to buffer price increases: if prices increase, processors withdraw from buying market and utilize inventoried animals; when process drop, they re-enter the market.
- Cost externalization: rationalizing of services to force additional costs on a third party (the farmer),
- Pricing power: control of prices according to what the market will bear,
- Fostering farmer dependence: inputs designed for farms to imitate natural sources, such as fertilizers and seeds,
- Pursuing corporate independence: corporations have no vested interest in provision of services or exchanges with farmers in any given local area,
- Destroying non-corporate competitors
- Merging with corporate “competitors”
- Profit expansion
- Integration and disintegration

Non-Government Organizations and Initiatives

While there are many negative trends to report in terms of the direction agriculture has taken in recent decades, there are also some outstanding examples of progress. Local groups such as the Harvest Moon Society, the Organic Food Council of Manitoba, the Turtle Mountain Community Development Corporation and a variety of local co-operatives, such as the Organic Producers Association of Manitoba, have strengthened our communities in terms of support for rural entrepreneurship and societal values in agriculture.

Initiatives such as programs offered by Heifer International, Farm Start and various Farm Mentorship programs have been able to provide financial aid and general advice to farms and farming communities. Events such as the Growing Local Conference, the 100-Mile Diet and numerous local Farmers' Markets, and others have increased the awareness of rural issues and helped to promote healthy lifestyles.

Conclusion

The history of agricultural development on the prairies therefore provides a proper introduction to the historical meaning of sustainable agriculture in the prairie region. The sustainability of agriculture was the essential objective in the development of the region. However, as it happened, governments laid out a land and transportation system geared towards production of wheat *en masse* that were economically and environmentally unsustainable. As Fairbairn (2003) concludes, we have been living with the ongoing adjustments of that poorly conceived system ever since. Variability of climate, the lack of infrastructure and the need for new technology all had to be overcome. Current forms of agriculture reflect development in the past that have been modified by the policies of the present. The current emphasis on sustainability therefore represents only one position along a development course that started in the 19th century. It is nonetheless recognized that the present concept of sustainability in agriculture is much more comprehensive than was originally the case.

Where We're Going – Hand me that roadmap Ma

International organizations such as the UN Food & Agriculture Organization (FAO, 1995), the International Food Policy Research Institute (IFPRI, 1997) and the World Bank (1997) have developed their own predictive models of agriculture over the next few decades. All these models envisage that a steadily improving world economy and intensification of methods for production and productivity growth currently pursued will provide a reasonably comfortable food security situation with an increase in food availability over that time period. Other publications such as *Limits to Growth* (1972) published by the Club of Rome, have taken a dimmer view of the direction that humanity is headed.

The models expected to steer the world toward agricultural sustainability need to be carefully assessed because they raise a number of questions to which the answers are not clear. Conway (1998) points out that many of the models used are exclusively econometric and are based on the potential purchasing power of individuals. In reality, not everyone is included in these numbers, particularly the poorest. Further, it is commonly assumed that developing countries will be able to pay for food imported from developed countries and that the demand itself will stimulate those economies sufficiently to ensure a consistent supply of food. Conway (1998) and Raman (2006) further examined the situation with respect to predictive modeling by economic organizations and concluded that it cannot be assumed that countries with a food surplus will continue to bridge the demand-supply gap of the developing countries to the extent required. A difficult position for economic-based modeling is that there is an increasing negative attitude towards the role of agriculture in environmental pollution in these

countries; efforts are underway in many countries to restrict the use of fertilizers and pesticides (Conway, 1998). It is quite possible that the increasing emphasis on sustainable production will lead to a decrease in cereal production and/or a shift to other commodities or to habitat conservation or ecotourism for additional income. Very few countries have experienced rapid economic growth without preceding or accompanying growth in agriculture (Raman, 2006). In the least developed countries, the agriculture sector typically accounts for over 80% of the labour force and 50% of the GDP and even modest rates of growth have a considerable multiplier effect (Conway, 1998). Raman (2006) puts forth the following major challenges for agricultural sustainability in the future. The first of these is continuing population growth and demographic changes.

Unrestrained population growth that is not expected to stabilize for another century will lead to an expected population in 2030 of approximately 8.1 billion people, an increase of almost 30% (Raman, 2006). Much of this increase will occur in developing nations who are already facing dire food shortages. In order to accommodate this population growth, urban centers will grow substantially as well and may well lead to a 1% annual loss of crop lands near current urban centers. There will likely be a 60% increase in demand for grain production in the next twenty years and this will require per capita grain availability to grow at a rate higher than population growth in those countries. The other major challenge of the future as predicted by Raman (2006), will be natural resource restraints that will include global warming, loss of productive lands to urbanization, desertification and increasing pressure from pollution of lands, water, and air. Altieri et al. (1983) describe the developing problem as a limit to the potential productivity of agro-ecosystems. There is certainly a finite limit to the amount of food

that can be grown on a particular parcel of land, if not by virtue of the physiological limits of crops, then certainly by virtue of the carrying capacity of the habitat and external costs incurred in the process of expanding production.

What does this mean for prairie farmers? The potential for large-scale and broad-reaching recession is quite pronounced. Canada and the world have recently entered into a period of financial difficulty of which scale has not been seen in decades. With the control of much of the agricultural sphere of the economy squarely in the hands of multinational interests, it is clear that the short end of the stick will be handed to farmers. The trend that these companies have attempted to maintain for many years is to increase the efficiency and size of farming operations and to ensure that those few operations that persist are completely dependant on the companies for seed, fertilizer, pesticides, production contracts, processing and transportation, as was discussed earlier. Where can this possibly lead? Complete dependency in any situation is detrimental to the players, but particularly so for the one who is dependant on the other.

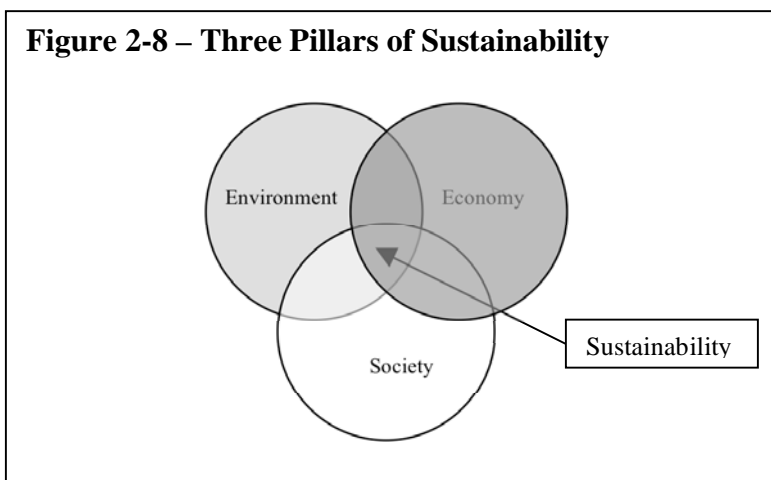
There is no reason that programs could not or should not be used to encourage sustainability. In fact, failure to utilize programs of incentive and support, without necessarily injecting capital in the form of subsidies that distort the price of products, will over the long-term result in perceived and actual hardship and declining ability to produce sufficient quantities of food to feed an ever-increasing human population. This not being a study of the subjective value of agro-inputs, shall not pass value judgments on specific products. However, as research has revealed, certain products and techniques are eventually ineffective, create logistical difficulties with other spin-off problems, have the potential to disrupt natural environmental cycles, or create inequities in social dynamics

in terms of devaluation, distribution and accessibility. If agricultural programs with social consequences have the ability to effect change to increase production or to provide maximum capitalization on investment, then so too should they be able to direct trends and techniques towards a state of increasing balance between the 3 legs of the sustainability tripod.

2.4 Sustainability Tripod: Where to put your sustainable camera?

Introduction

So, it would seem that there are some key concepts that define what we could label as “necessary” for valuing agricultural systems as “sustainable”. These are the three pillars of SA, the so-called sustainability tripod: environmental, economic and social health. While all three of these “pillars” have their individual spheres of requirements and impacts, that area in which they meet and operate harmoniously is the “zone” in which sustainable agriculture exists. Figure 2-3 depicts the overlap between the 3 areas,



simultaneously showing that this area of overlap and symbiosis is comparably narrow.

Many activities relating to agri-culture operate well outside the

zone that defines a sustainable system. Raman (2006) points out that there is a fourth component of sustainable agriculture: it is necessary for there to be sufficient plant and

animal productivity to meet the needs of the growing global population. A Venn diagram could represent this with four circles intersecting. Blum (1998) contends that in order to have sustainable agriculture in terms of land use, all other forms of land use in a given region are sustainable as well.

If we think of the food chain as being comprised of economic, social and environmental links, there is enough evidence to suggest that the economic links are strong. Unfortunately, the same cannot currently be said about the social and environmental links. Witness the declining rural infrastructure and environmental quality in many parts of the country and the world. (D'Souza et al., 1998). Sustainable agriculture does not mandate a specific set of farming practices. There are myriad approaches to farming that may be sustainable. Because sustainable agriculture will continue to be defined farm by farm and individual by individual, it diverges sharply from industrial agriculture, which claims to be appropriate everywhere. Sustainable agriculture, on the other hand, holds that sustainable approaches will vary from site to site. (Horne & McDermott, 2001).

“While ecologists have retreated to study their bogs and alpine meadows, agriculturists have been forced to include the social, political, economic, and even religious realms within their boundary of considerations. Just as a plant species bred in monoculture may behave unpredictably when grown in polyculture, sustainable agroecosystems cannot be isolated from their cultural contexts.”

(Jackson & Piper, 1989)

Table 2-1 Comparison of the Industrial and Biological Models of Agriculture	
Industrial Model	Biological Model
Energy Intensive	Information Intensive
Linear process	Cyclical process
Farm as factory	Farm as ecosystem
Enterprise separation	Enterprise integration
Single enterprise	Multiple enterprises
Monoculture	Diversity of plants & animals
Low-value products	Higher value products
Single-use equipment	Multiple-use equipment
Passive marketing	Active marketing

Adapted from: Sullivan (2003)

The Three Sisters – The Environment, the Economy, and Society

The Environment: Everything is So Green!

The global environment or biosphere is that part of our planet that supports all life within it. The unique combination of the presence of an atmosphere and related

Figure 2-9 – Landscape near Austin, MB



components in conjunction with a mantle of living medium (soil) suited to the development and growth of plants and animals makes all life possible. If a system is not ecologically sound, it cannot persist in the long term and therefore cannot be productive and profitable, and ultimately

sustainable (Raman, 2006). Blum (1998) points out that there are three main ecological functions to land use, namely: production of biomass; filtering, buffering, and

transformation capacity; and biological habitat and gene reserve. If any of these functions is compromised, then it follows that there will be consequences in terms of the ability of the system to provide required components for continued growth and productivity. The short version of that long story is that if the system is abused and depleted, there may not be enough to support the enormous and growing population of the planet.

The concept of ecological services has become very popular in recent times and has quantified in monetary terms, the value that the environment provides. Such things as insect pollinators of crops, water purification in wetlands, and air purification in forests, climate regulation, erosion control, carbon sequestration, flood control, soil formation, biological control and runoff control all have at least an intrinsic value, and in ecological services reckoning, a dollar value as well (Wilson, 2008). One estimate of the value that is provided to humankind by ecosystem services is in the order of double of the global GNP (Patriquin, 2001).

Population growth (and the inherent consequence of over-population) is the most significant challenge facing humanity in terms of maintaining a sustainable agri-culture. Short of the discovery of a way to produce food synthetically (see “replicator” technology, with apologies to Gene Roddenberry), the trend of increasing population is putting an incredible strain on agriculture to produce sufficient food to keep up with the growth in population. Unfortunately, population is growing exponentially, while agricultural production is growing arithmetically. On occasion, there are revolutionary breakthroughs in technology, or in the past, the opening up of new areas for production. However, with the settlement of North America and the Green Revolution behind us, there are fewer opportunities for this kind of dramatic increase in the ability of humans to

produce more food per unit area. As Raman (2006) points out, the maintenance of the ecological viability of an agricultural system is considerably more difficult than maintaining that of a natural system because the agricultural system is one that depends on human intervention and carries with it mandatory goals of minimum production. This being said, the idea that preserving the environment in its “natural” state will allow for unchecked human population growth is absolutely unrealistic.

Ecosystem services

Ecosystem services are the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life (Kramer, 2007). This is a succinct definition, although I find it to be rather anthropocentric. Relating functions of the ecosystem in terms of what it can do for humans is a narrow way of looking at the value of the ecosystem, but at the same time, the aspect of services was developed in light of an economic model; purely a construct of humans. No other species on Earth would find the need to compartmentalize the value of its habitat unless it had become so dreadfully aware of the damage it was doing to its surroundings!

In these economic terms, ecosystem services can be calculated as an aggregate of four separate components according to Kramer (2007). These are: *use value*, the benefit people receive from direct use of the environment; *indirect use value*, services that users receive from a distance (such as air purification by forests); *option value*, users’ willingness to pay (WTP) to preserve a resource for possible future use and; *nonuse value*, what people are willing to pay for the protection of resources that they will never use (for instance, conservation for inherent values). As with any aggregate measure, some

components are easier to measure than others, and the complete measure is usually a rough estimate of the real picture.

On any farm, there are four major ecosystem processes at work. When these processes are functioning appropriately, the result will be the conservation of soil and water resources and a consequent

reduction of overall operating costs. As Sullivan (2003) explains, these four major processes are as follows: **energy flow** in the form of sunlight that is used throughout the biological system. Management decisions affect the quantities in which

Figure 2-10 – Creek near Rivers. MB



solar energy is captured and used for the purposes needed on the farm (Savory & Butterfield, 1999). The next ecosystem process or service is that of an **effective water cycle**. This is typified by a lack of erosion, rapid infiltration of water into the soil column and large water holding capacity. These functions contribute to an increasingly perennial flow regime in streams resulting from the slow release of water from the soil profile (Briggs & Courtney, 1989; Sullivan, 2003). Soils with a high water holding capacity that drain slowly are typically less prone to moisture deficit situations, and ultimately the permanent wilting point, which can lead to crop failure (Briggs & Courtney, 1989). The third ecosystem process is a well-functioning **mineral cycle**. The mineral cycle is the movement of nutrients from the soil through the crops and animals and back to the soil,

which ultimately means reduced requirements for fertilizers and feeds from off the farm. Ultimately, to be sustainable, we need to find ways to use the natural cycle to minimize our off-farm purchase of minerals. Conditions and practices that tend to inhibit the natural mineral cycle such as erosion, leaching, OM depletion and selling products off the farm, tend to reduce the farm's sustainability. The fourth ecosystem process is that of an effective **ecosystem dynamic**. This is indicated by a high diversity in species, genetics and age in the populations. Greater diversity produces greater stability and minimizes pest problems (Krebs, 1994; Sullivan, 2003). The Alternative Land Use Services (ALUS) program, which ran from 2005-08 in the RM of Blanshard (MB), provided incentives to producers to protect wetlands, improve wildlife habitat, conserve riverbank areas and enhance water quality. This program offered eligible landowners between \$5 and \$25 per acre for land areas managed for specific attributes or taken out of production to protect sensitive areas. The program was initiated in light of growing recognition that environmental improvements produce a societal benefit for which society should make a contribution towards (Maynard & Nault, 2005).

Sustainable agriculture also has implications for wildlife in agricultural areas. In keeping the natural environment healthy, balanced and diverse, there should therefore be a wide variety of naturally occurring wildlife on and around farms. As Sullivan (2003) points out, abundant wildlife and prolific fish in agricultural areas are part of the definition of a sustainable agricultural system. In contrast, industrial farming operations continue to make farmland increasingly sterile through land-leveling operations, forest

clearing, draining wetlands and even reclamation of road allowances that once provided wildlife corridors throughout rural areas.

Some farmers are attempting to change this trend by integrating wildlife-friendly aspects into their land base. Kirschenmann (2002) makes the example of a system that is gaining popularity in Japan that involves the integration of ducks and fish into rice paddy systems. These systems then have natural weed control and fertilization and yields have been shown to increase by as much as 50 per cent. Lovins (2005) mentions that Management Intensive Rotational Grazing (MIRG) contributes, among other things, to the improvement of wildlife habitat. Altieri et al. (1983) indicate that the restoration of plant diversity through crop rotations, interplantings, agroforestry systems and cover crops can correct problems associated with the loss of diversity resulting from the expansion of monocultures. Papendick et al. (1986) point to no-till farming practices as a method to minimize disturbance of wild bird nesting sites. Also, organic farming, with its typically smaller fields and higher diversity, can have beneficial effects on wild bird populations. In addition to these techniques, regional diversification of crop-field boundaries with windbreaks, shelterbelts and living fences can improve habitat conditions for wildlife as well as many other beneficial aspects.

Biodiversity is a component of the natural environment that has received increasing attention in the last generation. It has come to be recognized that diversity is a critical part of the health of ecosystems because of the stability that is afforded in having a wide range of plant and animal species present within a given locality or region. Sustainable agriculture practices foster the maintenance and enhancement of local biodiversity through a variety of measures. Biodiversity can be defined as the variability

among living organisms and the ecological complexes of which they are part (Wilson & Tyrchniewicz, 1995). p38.

The Economy – The infamous “Bottom Line”

Economics as a discipline was developed in the late 18th century when the prevailing activity was agriculture, the dominant focus was on the individual, and the assumed motive was self-interest. Then followed the industrial revolution of the 19th century and the agricultural revolution of the 20th century, modifying the setting for the discipline. Institutional economics, which admits ethics, law, politics and social subjects into the decision theatre, struggled to gain acceptance during the 20th century and may achieve recognition in the 21st century (Paarlberg & Paarlberg, 2000). An early insight comes from Murchie et al. (1936): successful settlement of the prairies can only be achieved if an adequate income through farming is possible – adequate in providing a reasonable standard of living, and adequate in comparison with alternate incomes.

Farm Size

All farms have some impact on the environment and the local community of which they are part. The type of impact (positive or negative) and the intensity (high, medium, low) are likely to be different for different sizes of farms. There is some evidence that the continuing trend towards fewer and larger farms that rely on increasing amounts of chemical inputs and mechanization with the accompanying specialization and globalization is contributing to the strength of the *economic* (emphasis mine) link in the food chain (D’Souza et al., 1998). Conversely, it is also reasonable to point out that these trends coincide with a decrease in the sustainability of agriculture evidenced by a decline in social and environmental components. The post-industrial sustainability paradigm has

emerged as a possible solution to problems associated with the industrial model of agriculture such as resource base degradation and the decline of quality of rural lifestyles.

A common characteristic of sustainable farms is that they tend to be smaller in size, or at the very least, family farms (Corselius et al., 2001). The relationship between farm size and sustainability has rarely been examined in the past, although more studies (Sell et al., 1995; D'Souza et al., 1998; Maynard & Nault, 2005) are now examining this linkage in detail in light of the dearth of so many small farms on the Prairies. The examination of size of farms in relation to their potential sustainability may be able to provide some insight into whether characteristics associated with farm size are observed more or less in one end of the spectrum or the other. As with the multitude of definitions of sustainability itself, the definition of small or large farms varies widely, although D'Souza et al. (1998) and Maynard & Nault (2005) have similar criteria based on acreage and income. D'Souza et al. (1998) provide an excellent summary of the hypothetical trade-offs among size, economic efficiency, rural quality of life and environmental quality. These relationships are summarized as follows: with increasing size comes increased economic efficiency; with increased size come decreased environmental quality; and with increasing size comes declining rural quality of life. These general trends in trade-offs present a particularly difficult problem: how can agriculture be structured so that all three components have an increasing trend while still maintaining production levels sufficient to provide food at the volume required to feed the population? The most obvious answer to this question is that the size of farms needs to be limited, somehow. It might have been reasoned that if a small farm or homestead size farm were worthwhile, a bigger farm would be proportionately more rewarding. This does not

necessarily follow, but the theory has been tested again and again (MacEwan, 1980).

There are some critical components of small and sustainable farms that need to be examined here. For instance, in a small farm setting, equipment and transportation requirements are greatly reduced, thus making profitability more possible (D'Souza et al., 1998). Similarly, the use of manure and composting are quite common, supporting the nutrient cycle ecosystem process (Sullivan, 2003), again with the possible result of reducing costs and increasing profits. Conversely, industrialized agriculture relies heavily on a transportation and retailing infrastructure that is energy and capital intensive, that potentially contributes to environmental degradation and that requires constant investment in infrastructure, including new technologies (D'Souza et al., 1998). However, in light of recent developments in agribusiness and the trend towards concentration and vertical integration, the requirements for equipment and transportation are likely on the rise, as well as the impetus for these farmers to utilize chemical fertilizers. Smaller-sized, family farms are often touted as the route to sustainability and, if only government policies, markets and regulations were more favourable, these farms would be viable (Maynard & Nault, 2005). The reality of the situation is thus: a great percentage of remaining farms in Canada are increasing in size because under current economic parameters, it is the only way to stay in business. While large farms are usually portrayed as pushing small farms out, it can also be seen as inevitability: large farms buying up land after farmers operating smaller units decide to quit. The reasons are quite clear – small-scale farmers grow tired of hard, physical labour that pays so little that they must hold at least a part-time job off the farm in order to earn a decent living. The benefits

of operating a small family farm are quite clearly related to family heritage, lifestyle and other social factors, but outside of particular niche markets, they are not economical in the current market. Maynard & Nault (2005) conclude that strategies for sustainable agriculture must include both small and large farms, although there needs to be differentiated treatment of the two principal types of agricultural operations because neither is going to disappear overnight.

Micro-economics: the little bottom line

As Maynard & Nault (2005) outlined, farms today have to consider two levels of economics: both macro- and micro-scale. Micro-economic sustainability in farming is the ability of farms to remain economically viable as the basic production unit. Regardless of the size of a farm, the ability to make enough money (gross) to cover costs such as inputs, fuel, taxes and still have enough left over (net) to enjoy a reasonable standard of living with aspects such as good food, appropriate clothing, sufficient shelter and recreational activities, is the basis of the farming business. It is evident from recent statistics that many Prairie farms are not making enough gross income to have any net income worth mentioning. Disturbing reports of negative incomes (losses) are replete in the literature and in farm newspapers. Small Canadian farms are (in a general sense and in the current context) not economically viable, spending as much as \$1.68 in operating expenses in order to take in one dollar of receipts (Maynard & Nault, 2005). Canadian farmers are generating 7 times the *gross* income they were in 1970. But the *net* farm income has remained the same (Neufeld, 2004). This results in the necessity of farmers

having to obtain operating loans from year to year, and to hold off-farm employment to make ends meet. Neither of these strategies lends itself well to the concept of sustainability. An unintended result of this problem with income is that producers facing bankruptcy or dislocation have no incentives to maintain the land resource (Gray, 1991) and ultimately may have to leave the community, thereby having a diminished social commitment. An example of a system that is both small-scale and community oriented is the Community Supported Agriculture (CSA) concept that is becoming increasingly popular (Gregson, 2004). Consumers purchase a 'share' in an agricultural endeavor in exchange for a portion of the products throughout the season. By marketing directly, farms are able to cut costs and increase profit margins. This is an example of a system that can meet the needs of the local community in a manner that potentially is economically, socially, and environmentally sustainable (D'Souza et al., 1998; Sullivan, 2003). Sullivan (2003) further proposes that there are five general trends that will be observed in the economics of a farm moving towards sustainability: Farm family saving or net worth increase over time; debt decreases over time; farm enterprises are consistently profitable from one year to the next; the purchase of off-farm inputs are reduced; and reliance on government income programs decreases.

Macro-economics: the **BIG** bottom line.

Trends in today's agricultural marketplace point clearly towards continuing decreases in farm gate prices, continued increases in productivity due to the application of new technologies, and the continued expansion of world markets and global trade in food. All of these factors are working against the small family farm and are having the effect of continued increases in farm size. Sustainability in the framework of

macroeconomics reflects the ability of a national production system to supply both domestic markets as well as be able to compete in foreign markets (Maynard & Nault, 2005).

Multi-national corporations (MNC) have in recent years, restructured to decentralize operations to locations where labour is less costly and regulations are minimal. As a result of this decentralization, many MNCs can no longer be identified with any particular country – they have become trans-national corporations (TNC). Hence, individual countries have become increasingly unable to regulate the new TNCs that operate within their jurisdiction. The regulatory power of a country is subverted as it becomes unable to regulate the economy and protect the interests of society (such as labour and the environment (Peters, 2002). TNCs have created an ‘hourglass’ economic structure, where a few TNCs have positioned themselves at the processing phase between thousands of farmers and millions of food consumers. Being in control of this bottleneck, TNCs exert a disproportionate influence on the price, quality and type of agricultural commodities bought from producers and sold to consumers (Peters, 2002). Hence, extremely high prices would represent severe scarcity of food. Similarly, very low prices would indicate an abundance of food. High prices threaten security and low prices threaten farm incomes. If one were comparing two agricultural structures that had the same expected mean prices, the system that had more stable prices would be more sustainable (Gray, 1991). This is the balancing act that governments must attempt to reconcile. There are obvious advantages to both ends of the spectrum in the equation: maintaining higher prices is good for the national economy and for appeasing the corporate interests in the food commodities market, and maintaining lower prices is good

for appeasing the consumer market although the effect of a price decline is to disrupt, dislocate and impoverish farm families.

Gray (1991) further indicates that because of its nature, the elasticity of demand for food is small, limiting the ability of consumers to reduce demand in times of high prices. The elasticity of supply may therefore be a more relevant indicator of the sustainability of an agricultural system. Farmers interviewed by Maynard & Nault (2005) all said that there is no room for them to maneuver with current farm gate prices and their ability to engage in development activities that do not result in immediate financial returns is very limited. This is hardly surprising when income statistics about income are considered. The NFU (2005b) reviewed income trends on Canadian farms and determined that the Market Net Income, which is a measure that subtracts out government payments, fell to a new all-time low of *negative* \$10,000 per year. This income level is comparable to that of the 1930s, which was compounded by a severe drought situation. Unfortunately, this is not a new occurrence; this is a twenty-year trend. If income levels such as this are occurring in the current economic situation under relatively normal climatic conditions, what would happen if Prairie Canada was to experience another severe drought?

The current farm crisis is often explained away as a result of market imbalances due to US and European agricultural subsidies. Admittedly, the EU spent approximately \$90 billion in 1999 to protect its farmers from chronic market failure. The U.S. spent approximately \$24.5 billion to protect its farmers. In Canada, federal and provincial governments have chosen not to protect farm families from this market failure. Federal agricultural spending has fallen to half the levels of ten years ago. The result is

widespread bankruptcy, the rapid loss of family farms, decimated rural communities, and damaged regional economies (Qualman, 2001). While this seems to be a likely rationale for the decline in prices of agricultural products, it is only part of the bigger picture. Even the use of supply management programs, which have provided dairy and poultry farmers in Canada with the most stable and consistent returns in the farming sector, have not prevented the mass exodus of farmers nor prevented farm consolidation and production intensification (Maynard & Nault, 2005).

Summary

In order for a farm to be sustainable, it must be economically viable. Farms (and society) can accomplish all the environmental conservation and social re-structuring we can think of, but without being able to make enough money to continue operations and to continue living, the other aspects become somewhat of a moot point. Making a farm sustainable doesn't happen for nothing either. Sustainable agriculture must be, at least in part, a maintenance of the flow of income from agricultural production (Gray, 1991). Farmers must be able to retrieve from the marketplace better levels of income if they are to be able to participate in sustainable agriculture practices. Gray (1991) further recommends that the ability to deal with unanticipated shocks, rather than being on the periphery of the issue of sustainability, is central to the whole concept. In the meantime, while Canadian Prairie agriculture is finding a new way of doing things, farm income support programs will continue to be necessary. This means that the government and the public need to recognize the problem and provide support so that farms of all sizes remain economically viable. The NFU (2005b) insists that the current farm crisis is caused, in no small way, by the fact that an imbalance in market power has created a

parallel imbalance in the allocation of profits within the agri-food chain; farmers are making too little because powerful corporations are taking too much.

Social Conditions – Not the price of drinks at the “Social”

The third equal pillar of a sustainable agriculture is that of society and social conditions. There are a number of components to society that make it an essential part of a sustainable system of food production, as well as global sustainability. Sustainable agriculture is viewed here as an appropriate set of resource-conserving farming practices but also as an orientation or approach that seeks to protect environmental values while pursuing broader social objectives related to health, emancipation, and democratic control (Gertler, 1999). While people in general usually operate within the framework of their daily lives driven by self-interests, it is indeed a rare occurrence when a person can operate independent of some form of society around them. As Ikerd (2001) points out, it is entirely possible for people to rise above selfishness and greed to pursue a higher concept of self-interest: one that values relationships and stewardship as critical components of their own well-being. Hence, a society that provides healthy relationships and fundamental right to the production and acquisition of food, fibre and shelter becomes an indisputable requirement to a society that is able to perpetuate into the future. Shared values that focus on relationships, community and social values as well as altruistic values that focus on interests that people pursue out of a sense of stewardship, ethics or morality, ultimately contribute to a person’s well-being and quality of life.

Health is a concept that has many connotations and definitions. There is the physical well-being of an individual; the health of a family dynamic; the health of a

community (at whatever scale is specified); the health of the soil; the health of the food that is grown; and the health of the environment that supports all the biotic components that rely on it. Likely, most humans have some concept of health, at least on a personal level. Also, it is likely that most have an idea of what the health of external factors has to do with their own health. Somehow, in recent generations, a disconnect has occurred in this link. Humans are now increasingly likely to pollute their environment to their own detriment. Communities as well as people show signs of depression and disease.

How can we define a healthy community? Sustainable rural development depends on a sustaining social ecology, that is, appropriate relations “between people, and people and nature” (Gertler, 2003). A sustainable social ecology implies a dynamic, synergistic relationship between resource-based economic activities, social and institutional arrangements, and communities of interest and place. It is local communities that have a joint interest in making a living and in managing resources to ensure long-term viability of the economy. Maynard & Nault (2005) point out that farm operation by local ownership, regardless of farm structure, would help to ensure greater socio-economic commitment to the local community by larger farms, as well as more extensive engagement in environmental conservation. The trouble is, many of the largest and most concentrated farm operations are no longer owned by people living in the area in which it is operated. In days gone by, a requirement of acquiring farmland was that the person who applied for homesteading rights had to make improvements to the land and to live on it for at least part of the year.

Community dynamics and the practical realities of living in small towns have a great effect on social well-being. As the statistics in Section 2.3.2 display, the recent

trend across the prairies continues to be toward larger farms and fewer farmers.

This trend has been driven by technological developments, economic efficiency and government policy.

Concentration in agribusinesses has had the result of removing the diversity of operations and the local capacity for

processing from small communities. This has decreased employment opportunities in these communities and has led to a decline in rural services (Pretty, 1998). As a result, people are continuing to move away from the smaller communities, local businesses become uneconomic and the business operators move to larger centers, if they can survive at all. As communities' populations decline, the local infrastructure also declines and producers must travel longer distances to acquire their basics. Businesses are not the only component that suffers; with a decline in rural populations, so too do the number of hospitals, community centers, Legion Halls, and schools decline. All of these institutions are mandatory for "normal" healthy operation of a community. It has been argued that the migration of people from the land could be stopped or reversed by programs designed to retain more people in agriculture (Wilson & Tyrchniewicz, 1995), but there is little initiative in this regard. Numerous studies have demonstrated that more small farms can make an overall greater contribution to rural community vitality than fewer large farms; this only stands to reason as there would be more people present in the particular location (Maynard & Nault, 2005). Sullivan (2003) lists several aspects of sustainable

Figure 2-11 – Ryerson School, Maskawata, MB: 1957



rural communities that include interdependency between farms, businesses and community functions resulting in a local economy that is not insular, but rather self-supporting. Other aspects include a general trend of increasing numbers of farm families, continued family farm succession, the return of college and university graduates to the community and full family participation in farm planning.

Much of the blame for rural decline is usually directed at the trend towards larger farms fueled by industrial practices and commoditization of agricultural products. While there is undeniably some truth to this, it is also apparent that the shift away from manual labour on farms has contributed to this as well. Maynard & Nault (2005) make the point that the most rapid period of rural population decline occurred in the 1950s, which was when most farms first received the benefits of electricity and obtained tractors for draft requirements. It would seem that the emptying of rural areas had something to do with so-called improvements in farming techniques; certainly something that almost every farmer strove for in those days. Who, in that era, would have wanted to continue to farm with horses and undertake considerable manual labour when relatively affordable options were available? This was certainly something that occurred right on schedule on my grandparents' farm. While my great-grandfather farmed with horses right up until he retired, my grandfather was apparently all too happy to get on with field-work with the help of tractors. My grandmother milked cows as a young girl, but insisted that once my mother came along, that she not even be allowed to learn how to milk, for the desire to save her the drudgery of that type of work. Two of the three children on that farm left farm life permanently, the third only came back after several years in the city. Which leads into the next topic, succession.

Farm Succession

As we have seen in the above section on Canadian statistics, the number of farmers is declining, due both to older farmers dying off as well as those who just see an exit as the most prudent strategy. Those who are remaining on the land to practice agriculture are becoming increasingly older: the median age is climbing. Once the mass emigrations to rural Canada ceased in the early part of the 20th century, so the decline in farm

Figure 2-12 – Farm Kids: 1946



numbers began (Maynard & Nault, 2005). This is a sector of the Canadian economy where new practitioners are becoming less and less frequent.

Pretty (1998) indicates that the decline of family farms does not only hurt the farmers, it also hurts the quality of life in the whole of society. Similarly, Dwwyor et al. (2005) state that viable family farms affect the sustainability of the entire rural community – assets, families, and revenue stay in the local community. If

these opinions can be accepted, then it becomes clear that the health of rural communities is closely tied to that of society in general. The question is then, how can we ensure that there is actually a next generation of farmers?

Farm succession planning is a very popular topic for presenters at farming conferences in the last few years. It has been identified that there will have to be some concerted efforts to make sure that there are actually enough people on the landscape who know how to farm in order to ensure that the land can actually be farmed. In some ways, the success of succession depends on whether people in general will still consider

farming an attractive way of life in the future. As Maynard & Nault (2005) explain, the rate of success of encouraging non-farmers to become farmers has been mixed, particularly because starting down the path to farming as a living with little experience is a good recipe for disaster. These authors go on to say that the possibility of immigration providing the necessary numbers of people to bolster the ranks of farmers in Canada is reasonable. Neufeld (2008) relates, “[We] get a steady stream of mostly urban young people through our place. Many would love to grow and process food as a profession. But as a prairie society we’re not providing adequate on-ramps and so almost every one of these wannabes gets drawn away from the dream” (p. 3). A similar situation is occurring on our own farm with young people who come through on the WWOOF (World Wide Opportunities on Organic Farms) program. There is a great deal of interest in the practice, but little hope of ever getting a chance to start it. My wife and I also had a related experience; the only thing making the entry into farming possible being a good sized nest egg with which to purchase land and equipment. I hear a great deal about dreams that these young people have about being a small-holder, raising a few goats and chickens and having a big garden. But when I ask them about their education and their life skills, almost without exception, none of them would really be prepared to actually run an agricultural operation, of any size. There is entirely too much focus on income, in monetary terms, and the conveniences of life. I think of my own aspirations of an agrarian life and wonder if I could make ends meet if I had to rely solely on money I brought in from selling eggs and vegetables. I also wonder if my children will really be interested in carrying on the way of life I grew to be so fond of as a child and actuated as an adult. Again, there is just too much focus on making money and having things. When

the hard work starts, or when there has to be some concession in acquisitions, the interest quickly fades.

Succession remains the primary mode in which farms are re-populated from generation to generation. Because it is primarily a family enterprise, even in this era with so much corporate control, sons and daughters of farmers are those most likely to carry on the tradition, precisely because it is the tradition; not because it is a great way to make a living. Undeniably, there are easier ways to make a living that do not involve so many hours a week of hard work or so little opportunity for recreation. There are now very few people lining up to become farmers, and most of those who could inherit a farm are choosing not to do so as is evident from the continuing exit rate from the farm sector (Maynard & Nault, 2005).

There are certainly other strategies that could be utilized to help turn the trend towards increasing numbers of farmers on the landscape. Among these is the possibility of fiscal incentives that could be offered by governments, including tax breaks for new farmers and young farmers interested in taking over the family farm (Maynard & Nault, 2005). I see this as a crucial step towards stabilizing the numbers of farm families in Canada. With the current conditions of decline and difficulty, it is essentially impossible for 'new' farmers to get into the business without help. In order to have an operation that is financially viable at this time, it is unavoidable that its size be sufficiently large to provide an income that would reasonably replace what a family could make in some other sector. Without secure financial backing (and some faith on the part of bankers) or the ability to inherit or have a transfer financed by family, the necessary capital required to obtain an operation of this scale is essentially impossible. At the same time, a smaller

operation that was more easily obtainable in financial terms might not meet current criteria by lending institutions for that same financial viability. Gertler (1999) indicates that removing barriers to entry into farming will also require experimentation with new organizational arrangements under which more people can participate in farming, such as multi-operator or multi-family cooperatives, partnerships and other joint ventures. He adds that cooperation and collective entrepreneurship will be important features of the most enduring sustainable agriculture arrangements.

Improving the health and well-being of farmers and the land that they farm, in conjunction with assuring them of a reasonable standard of living will make the task of replacement of farmers more feasible. In utilizing techniques and methods that are of benefit to the environment, such as organic farming, it may be possible to encourage more people to be involved in farming as a way to make a living and as a lifestyle. Dwwyor et al. (2005) have found that the children of organic farmers often stay to farm, carrying on the tradition to the next generation.

Conclusion

The sustainable development of agriculture and rural communities will require the mobilization of many allied forces: farmers, non-farm rural residents, researchers, public servants, food industry workers, consumers and environmentalists (Gertler, 1999). If we consider the stabilization of Prairie rural communities as a requirement to a sustainable agriculture then this sense of community will require new connections to informed and engaged urban communities. Rural communities cannot possibly exist in isolation from the urban areas that consume the products coming from farms. Urban communities likewise cannot exist indefinitely without support from farms. Resilient and productive

agricultural economies, healthy ecological systems, and vibrant rural communities are closely interconnected. We must find ways to simultaneously address the cultural-agricultural and ecological-economic dimensions of sustainability. A good quality of life for both groups stems from mutually supportive systems of understanding, trust, communication and cooperation. The concept of community in sustainable agriculture systems enters the equation both as a required condition as well as a worthy goal.

2.5 Literature Review Summary

This review of the literature examined as many aspects of agricultural sustainability as was feasible for this project. A review of the history of agriculture on the prairies from pre-history to settlement to expansion and into the war years displays the path that our society has taken with agriculture at the forefront.

A look at the recent history of agriculture from the Green Revolution to the present helped to set the stage for the examination of how our current paradigm came about, the consequences of that development and finally what the suite of problems, advantages and concerns have become. From the development of fertilizers and pesticides, to high yielding crop varieties, disturbing statistics about the state of Canadian agricultural communities and individuals, the recurring economic crisis in agriculture and the slow, yet inevitable decline of the petroleum era, agriculture has always had to be out in front and to bear the worst of consequences of failure.

A brief and speculative exploration into the future of agriculture on the prairies will help to put the concerns into context and to prepare society for the changes that are pending.

A review of the current thinking on agricultural sustainability provided a look at the three pillars of sustainability: the environment, the economy, and society. These three pillars are inseparable and mutually supportive; the failure of one component means the eventual failure of the others. The environment provides the fundamental building blocks for all activities undertaken by living things; nutrients, water, minerals, and mutualism. The economy contains the underpinnings of how humans interact with one another for the provision of goods and services that they may not be able to provide for themselves. Humans moved from being generalists to being specialists only because some were better able to provide certain components of food or shelter than others. Also in this way, a structure has emerged in society that requires healthy interaction, peace and emotional well-being for our species to thrive.

Chapter 3

Methods



Photo taken on Henry Cairns' farm – NE29-10-23W1, 1938.

Chapter 3 – Methods – What did you see?

Study Area

The study area is primarily located in the province of Manitoba, Canada. The southern-most, agricultural region of Manitoba consists of parts of three major Ecozones: the Prairie Ecozone, the Boreal Plains Ecozone, and the Boreal Shield Ecozone. The majority of the agricultural activity within the province is conducted within the first two of these Ecozones. Manitoba comprises 649, 950 km² of which 548, 360 km² is land. As of 1996, the agricultural land in Manitoba was 7 729 495 hectares, representing approximately 14% of the province’s land base (MBGov, 2009; StatsCan, 2009). Prairie agriculture is largely dominated by crops, such as cereal grains, oilseeds, pulses and leguminous and grass forages, whereas livestock production largely consists of beef, dairy, pork, poultry, bison, elk and goats, including meats and eggs. Although some operations are characterized as “mixed farms”, most farm production systems have

Figure 3-1: Terrestrial Ecozones of Canada. (EnvCan, 2009)



adopted a more intensive approach

and specialize in either grain or livestock (Shaykewich *et al.* 1994).

The climate of the southern portion of Manitoba is characterized by extreme continentality. Typical summer season mean temperatures are in

the range of 10 to 20°C and the coldest month mean is 2°C while the average frost-free period is 121 days (Shaykewich et al., 1994). The seasonal range of temperature may be greater than 48 degrees C. Precipitation is, on average, less than 50mm in the wettest month and ranges from 400mm annually in the southwest to 700mm in the southeast portions of the province (EnvCan, 2009).

Approximately 8.3 % of all farms in Canada are located in the province of Manitoba. StatsCan (2008a) indicates that there was a 9.5 % decline in the actual number of farms in Manitoba during the period from 2001 to 2006, and a 45.5% decline between 1971 and 2006. During the same periods, the average area in crops per farm has increased from 283 acres (1971) to 697 acres (2006).

Study Design

The study design was approved under the Joint-Faculty Human Subject Research Ethics Board Protocol at the University of Manitoba (No. J2007:162). In an effort to keep the grassroots-level involvement of the study consistent, respondents were generally contacted personally, rather than in mass mail-outs, either by means of phone calls, emails or letter mail. Five personal interviews were conducted on-site with respondents.

A mixed methods approach (Creswell, 2003) was used to explore the components of sustainable agriculture. Both quantitative and qualitative data were collected in order to ascertain trends as well as to garner anecdotal input from agriculturalists throughout the region. In this way, using a grounded theory approach, I attempted to derive a theoretical framework for the transformation of agriculture away from the current industrial, chemical-based paradigm. The intention is that this approach might lead towards a rational re-construction of methods that would result in an improvement of

long-term sustainability. As Creswell (2003) points out, this process may use many stages of data collection and subsequent refinement and relating of categories of information. As I also determined that close examination of a few specific individual agricultural enterprises would provide valuable insights into methods that “work”, I embarked on the acquisition of a handful of case studies.

A thirteen-page survey was constructed following in-depth background research into themes and issues surrounding sustainability in agriculture, with an attempt to incorporate as many facets as possible without making the survey excessively time-consuming for the respondents. The survey consisted of both Likert-scaled questions as well as check box answers and open-ended questions. Topic areas included current practices, environmental issues, economic issues and social aspects, as well as demographic components. The survey acquired quantitative data concerning numbers of animals, area farmed, time invested on an annual basis, and proportion of energy acquired by means of alternative energy sources. The instrument also provided qualitative data in the form of opinions of subjects on a variety of topics, by means of open-ended questions. In this way, I hoped to build a cross-sectional profile of the community of agriculturalists practicing alternative methods so that the product of the research could serve the larger purpose of transformative change and advocacy (Creswell, 2003) for a group that is generally under-funded and increasingly marginalized. Glaser (1992) indicates that by undertaking an iterative process of identifying a chief concern or problem for a population and discovering the category that the incidents indicate will ultimately lead to an emergence of a theory and possibly a solution.

Sample Population

The population that this study is concerned with is persons living in the prairie region of Manitoba who are practicing agriculture in a manner that does not follow the current paradigm involving reliance on agro-chemical inputs and heavy consumption of petroleum products. These factors have been identified as being part of a shift in paradigm that will further the aim of increasing the sustainability of agriculture in the modern world. One of the most recognizable and easily identifiable groups that fit these criteria is those who practice “organic agriculture”. In order to be certified as an “organic” farm in Manitoba, it is necessary to eliminate the use of artificial fertilizers and pesticides and to find alternatives to these inputs. Land transition requirements include 36 months with no prohibited inputs and requires an inspection in year two of transition. Livestock transition requires that animals transitioned are not eligible for organic slaughter, but that their off-spring are eligible. Dairy requires one full year before milk produced is eligible for certification and poultry must be under organic management by day two of their lives (OPAM, 2009a).

The sample size that was determined to be required was not exhaustive, but rather representative. While there is an organization in the province that undertakes to certify farmers to organic standards (Organic Producers Association of Manitoba: OPAM), there are numerous other producers who are undertaking practices similar, if not identical to those used by certified producers. Hence, a small-scale, personal approach was used to identify those persons attempting to adhere to practices that could be termed as “alternative” or “sustainable”. There are many different monikers for these strategies that have been discussed in the Literature Review. Not all of these producers have or will self-

identify their operations in these terms, so it was necessary to employ a “snowball” method to elucidate potential survey respondents. The membership of the OPAM is currently 189 members who are scattered across Manitoba and some that are located in the provinces Saskatchewan and Alberta.

Study Methodology

The survey was pre-tested with 6 respondents in Manitoba during August of 2008 in order to fill gaps in the questions. An initial version was distributed to five respondents with a request for input on content and wording. Subsequently, the final version was prepared and circulated to the full list of respondents. Initial distribution was accomplished by means of personal visits to a variety of farms throughout the southern part of Manitoba. Potential respondents were identified in advance and contacted by telephone in small nodules based on geographic proximity. I arrived at the farms identified as being willing to participate and that had time to meet for a short introduction to the survey. I also visited the Carman Farmers’ Market, the Winkler Farmers’ Market and attended the Holistic Management Conference held in Brandon, MB on October 22 to 25, 2008, as well as the Organic Producers Association of Manitoba Annual General Meeting held on November 15, 2008. Additional surveys were distributed at these events as well as further contacts established. A total of 43 surveys were delivered in person. Personalization of the distribution of the surveys was undertaken to increase response rates in the form of short personal meetings to distribute the surveys, signed cover letters, hand-addressed envelopes with postage included.

A total of 48 producers were emailed after the initial group of surveys were delivered or distributed in person. These recipients were encouraged to email or fax surveys back so as to avoid postage costs, or to call the researcher to arrange for pickup.

Surveys were later emailed to a wide group of farm operators. These persons were identified by means of the Organic Food Council of Manitoba publication “Down to Earth” (OFCM, 2007) and the membership list of the Organic Producers Association of Manitoba (OPAM). As my home farm is also a registered member of this association, a request was sent to the Director of OPAM asking that the producer survey be distributed to the membership via email. A total of 87 farms were emailed the survey through the OPAM office. In addition to those identified through these means, other farmers were selected through personal network connections, word of mouth and “snowballing”. One of the questions included in the survey was if the respondent knew of anyone who practiced some form of sustainable agriculture and that might be interested in participating in the research. This was undertaken in an effort to keep the focus of the selection process on the grassroots agriculture community. As the primary interest of the study was focused on community and sustainability, it was determined that an “organic” method of participant selection would be most appropriate for the situation.

Additional survey respondents categorized as “experts” on the basis of their professional affiliations and positions were identified in a manner similar to that used to identify producers. A shorter, open-ended question survey consisting of seven questions was emailed to these respondents. Additional participants were also identified by means of a request contained in the survey that asked for the names and contact information of persons thought to be potentially interested in the study and/or the subject matter. A total

of 62 persons in this category were emailed the short survey. All those selected to receive surveys were contacted approximately 6 weeks after the emailing for follow-up in the case of non-response.

An informed group of farms were selected for personal interviews that would be used as case studies. These farms were selected based on general geographic region throughout the province and were to some extent informed based on reputation and innovativeness in the field of alternative agriculture practices. The areas identified were: Southwest, Interlake, Red River Valley, South-central, and Westman. It was determined that these farms located in those basic geographic areas would provide sufficient locational differences in soil types, agricultural focus and ethnic history.

Results were received immediately from the outset of distribution until as late as the first week of February 2009. Numerous participants required several reminders, either by means of email or by telephone in order to get the survey completed and sent in to the researcher.

Data Analysis

The qualitative data received in the survey instruments were transcribed as necessary. Transcription was only required on the open-ended questions, while all other data were tabulated to form a summary. Due to the small total number of respondents, emerging themes and trends were identified manually, using a table to record recurrences of particular themes. In order to summarize demographical and numerical data, descriptive analysis was undertaken and produced graphic outputs of the data. Due to the lower than expected number of survey respondents, the answers in the Likert-scale questions were grouped into categories that indicate a positive answer, neutral answers,

and negative answers, rather than the six possible degrees offered as responses. I continued to use this aggregate data system throughout the analysis for all the Likert-scale questions.

I used a matrix system to analyze the results of the professional surveys. In this system, key words or phrases for each of the six questions were identified and entered into the matrix as coding. Dominant themes were identified and categorized according to their relevance to the topics.

Questionnaire Response

In total, 135 producer questionnaires were distributed and 36 were returned. This represents an absolute response rate of 26.6%. Of the total of 62 short surveys sent to “experts”, a total of 17 were returned representing a response rate of 27.4%. I considered these response rates to be surprisingly good, considering that a survey administered by the Organic Agriculture Centre of Canada in early 2008 sent out 358 surveys to organic producers and received 55 questionnaires back for a response rate of only 15.4% (OACC, 2008). Similar results (15% absolute response) were experienced by a study conducted by Stozek (2008), although adjusted response rates were somewhat higher, at 33.1%. These response rates are typical of large-scale mail surveys conducted in rural areas and reflect a trend of declining mail survey response rates in natural resource-based sectors (Connelly *et al.* 2003).

Chapter 4

Research Findings



Henry Cairns, Buddee, Harold Cairns: 1942

4. Research Findings

4.1 Producer Surveys - Discovered Themes

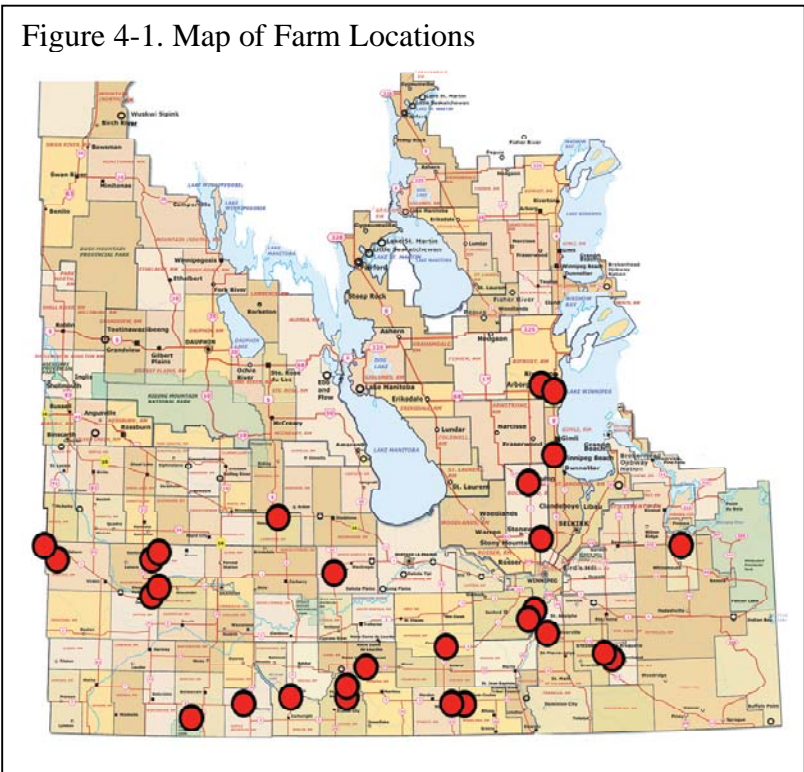
The analysis of the results of the surveys produced some enlightening and encouraging trends in what practitioners of sustainable forms of agriculture are really doing on the landscape. Many of the respondents displayed a practical recognition of the importance of the three basic pillars of sustainability through their answers and several had enlightening perspectives on methods that could be utilized to enhance their sustainability. I found most of the respondents' replies to be thorough and well thought out: people obviously spent much more time answering the questions than they really needed to in order to complete the survey in a perfunctory manner. Although some of the answers to the Likert-scale questions were at times conflicting, the open-ended questions provided a great deal of in-depth knowledge that these farmers held and were willing to share.

A copy of the entire survey is available in Appendix "A". Due to the lower than expected number of survey respondents, the answers were grouped into categories that indicate a positive answer, neutral answers, and negative answers, rather than the six possible degrees offered as responses. I continued to use this aggregate data system throughout the analysis for all the Likert-scale questions. Some questions unfortunately did not provide much insight, due in part to unexpected types of responses as well as no observable trends or correlations. These questions have largely been omitted from the discussion.

Demographics of the Producer Participants – The W5

The 35 producer farms that responded to the surveys consisted of a wide variety of people undertaking many different operations of all range of size and many different backgrounds. Respondents hailed from all over the province, ranging from the RM of Hanover in the Southeast, to the RM of Morton in the Southwest and as far Northwest as the RM of Swan River.

Respondents sent in surveys from deep in the South in the RM of Stanley to high in the Interlake in the RM of Bifrost, although 55% of respondents farmed in the Southwest region of the Province. 26% of respondents were



between the ages of 18 and 39, 57% between 40 and 59, and 17% over 60 years of age.

There was an obvious bulge to the curve in the middle age group, which was representative of the median age of farmers in Canada of 51 (StatsCan, 2008d). A similar demographic was found in a related research topic by Stozek (2008) as well as the findings by Yestrau (2008). Both of these studies utilized a similar research instrument in the form of a producer survey. A study conducted by the OACC (2008) similarly found that the majority (68%) of survey respondents fell into the 40-59 years of age category.

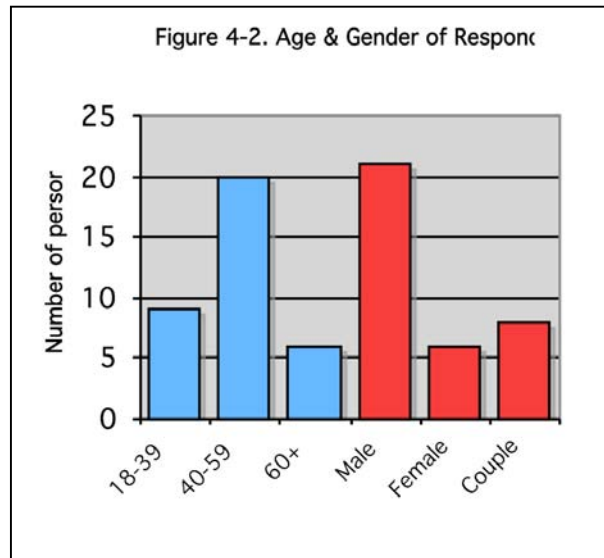
A total of 21 respondents (60%) were male, 6 (17%) were female and 8 (23%) answered as a couple (see Figure 4-2). Respondents were asked to indicate “couple” if the farming duties were relatively well shared. These numbers are still exemplary in terms of Canadian demographics for gender-based division of labour on farms.

Most producer respondents were well experienced with farming as a way of life and income-producing occupation. Fully 83% of respondents had been farming or ranching for between 5 and 39 years. In the categories of less than 5 years or more than 40 years, only 8.5% of each were identified. While these figures speak volumes about the experience that these farm

operators possess, many of them also indicated that their families were multi-generational on the farm. Most (54%) of respondents indicated that they were the third generation farming, while 31% indicated that they were second-generation farmers. In an era of

diminishing farm populations and dismal prospects for farm income, it was surprising and encouraging to discover that of this group, 14% identified as being first generation on the farm.

From this group of respondents, most (59%) indicated that their on-farm family (or situation) included between 3 and 6 people. There was one respondent who indicated that there were more than 7 people living on the farm. In the past, this demographic



would have been more concentrated on the larger end of the scale, with rural households having on average 4.7 people per household in 1921 which has since declined to less than 3.5 people per farm in 2006 (StatsCan, 2008e).

The work and income situations of the respondents were also queried to ascertain the presence of demographic concentrations. A total of 31 of the 35 respondents answered this question and the results indicated that 58% of those who responded were on the farm as their full-time occupation. The next category was “mostly farming with some non-farm work” and 23% of the respondents were found to be in this category. The “neutral” category, in which respondents indicated that they were about equal in their time spent on on-farm and off-farm work yielded 16%, while those indicating that most of their work was off-farm consisted of only 2 respondents (6%).

In terms of the education level of the respondent producers, 58% identified as having a university degree, 15% indicated that they had attended a technical or trade school, and 26% had completed high school as their highest level of education. The potential answer of “less than high school” was omitted from the survey as it was felt during the pre-test that respondents would decline to indicate this answer. A summary table of demographic components is included at the end of this section (Table 4-1).

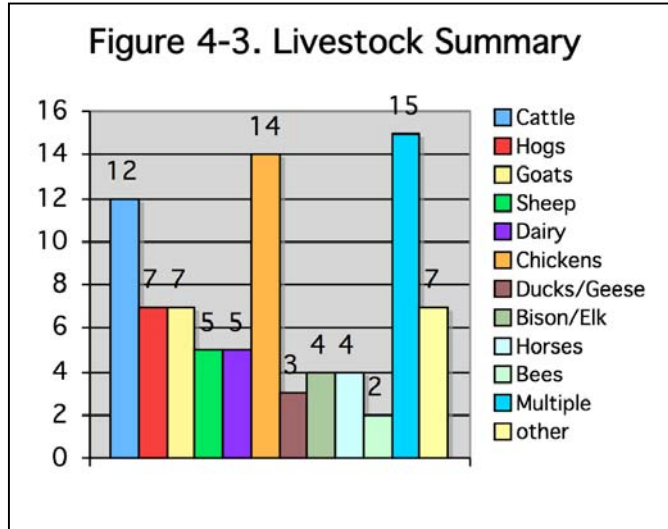
Operations – Nuts and Bolts and other material to Tinker with...

The thirty-five producers who responded to the survey represent a wide variety of operations. Many of these farms are very diverse, and in fact, only 17% of the respondents indicated that they did not keep some form of livestock. The most common form of livestock was cattle, with 54% of respondents reporting owning these animals. However, several respondents (51%) also indicated that they raised more than one form

of livestock, including sheep, goats, dairy cattle/goats, alpacas, chickens, geese, bison, elk, horses, swine and bees (see

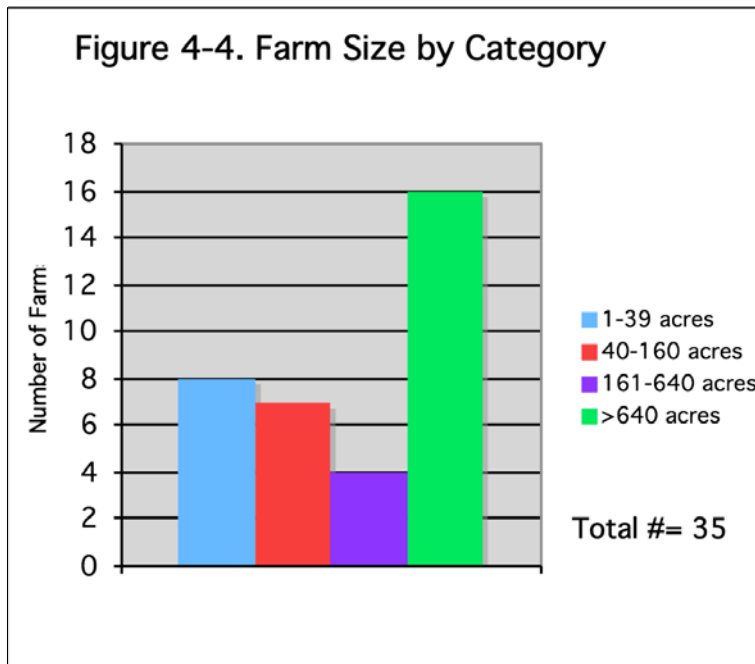
Figure 4-3).

Land holdings of the respondents varied widely, from as little as 2 acres to as many as 3000 acres, with the majority (46%) of respondents indicating that they owned/ rented more than 640 acres.



As many of the producers to

whom the surveys were sent were identified by means of the publication “Down to Earth: Guide to Organics in Manitoba” or through the mailing list of the Organic Producers

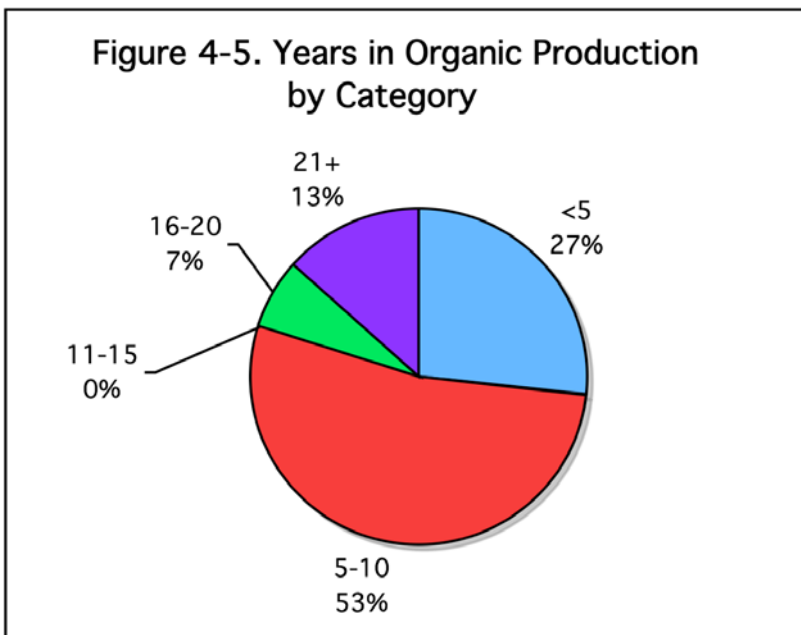


Association of Manitoba, the majority of producers indicated that they were either certified organic (28%) or that they were non-certified, but practicing organic techniques and principles (34%). An additional 11% indicated that they were moving

towards organic techniques or certification as a goal, and only 17% indicated that they

were not practicing organic techniques. The duration of organic and certified organic operations varied, but many of these indicated a considerable number of years dedicated to those principles, ranging from 3 to 25 years, with the majority (31%) being more than 5 years (see Figure 4-5).

Some of the respondents indicated that they were formerly certified but have since dropped the certification because of its expense. It was mentioned by one organic

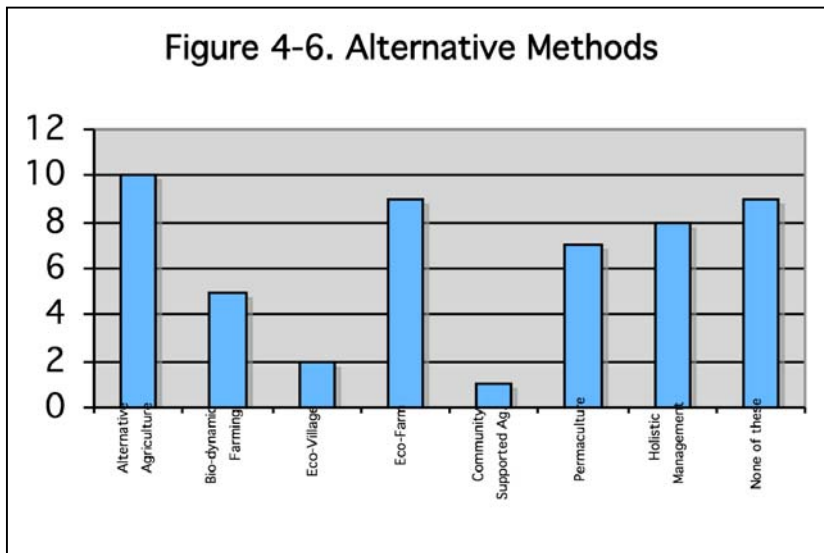


producer that there is a trend towards larger organic farms, much the same way conventional farm size is increasing. This is evident on examination of Figure 2-2 in the literature review, which shows

the trends in the numbers of acres farmed organically and the number of certified organic producers. My own experience is that the biggest point to certification is that you must have a considerable crop to sell to make it worth paying for the certification. With the introduction of the new national organic standards, small-scale operations that follow organic practices may not label their product as organic unless they are certified. This is fair enough, and long awaited in terms of a national standard that takes the guesswork out of purchasing organic products. However, it removes much of the advantage that small

producers may realize in higher prices for their products if they have to pay to certify a small number of acres.

It is interesting to note that many producers self-identified as using a variety of “alternative” strategies. Some producers indicated more than one category, so

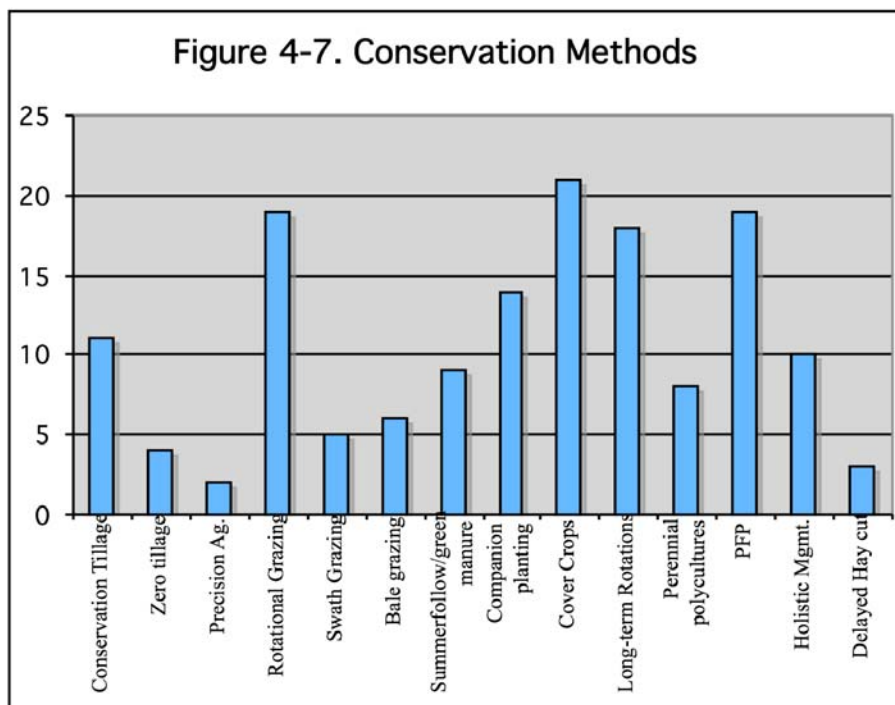


percentages are not revealing in this instance. Ten respondents indicated that they considered themselves to be using some form of alternative

agriculture, nine considered themselves to be an “eco-farm”, eight are using principles of Holistic Management, and seven are utilizing Permaculture techniques in their operations. Unfortunately, there was only one respondent who indicated that they were operating as a Community Shared Agriculture (CSA). It would have been highly interesting and informative to have had more input in this area, as CSAs have been identified as being an excellent way to connect farms with city dwellers in the pursuit of community education and awareness towards sustainable practices (Sullivan, 2003; Gregson, 2004; Dwwyor et al., 2005).

Producers spent significant amounts of time working on their farms according to responses received. The average employed person who works a 40-hour week with 2 weeks of holiday time per year works 2000 hours per year. Responses indicated that

many producers surveyed put in twice this number of hours per year, or more. Sixteen of thirty-five respondents indicated that they worked more than 3000 hours per year on-farm, and seven respondents indicated that they work more than 5000 hours per year. Twenty of the thirty-five respondents also indicated that they use non-family members to provide labour on the farm at some point through the year, although most (91%) indicated that this outside labour component was less than 400 hours per year. Four farms surveyed indicated that their outside labour was greater than 500 hours per year, although there was no direct correlation between labour requirements and the number of acres farmed. A correlation did emerge in a subtler manner: three of these four farms are primarily engaged in growing vegetables (or seedlings) for sale and operated greenhouses for this purpose, which tends to be a very labour-intensive occupation. The producers



who indicated the greatest number of hours worked per year also generally had two or more people working full-time on the farm.

I was also interested in finding out what common (and a few not-so-common) conservation strategies farmers are using. I provided a table in which fourteen strategies were listed and asked respondents to indicate all of those that applied to their operation. There were some strategies that I expected to be commonplace that turned out to be less than common, and *vice versa*. I was surprised with the lack of practice in the areas of zero-till and precision technologies, but then I thought about it and realized that both of these require a level of machinery technology that many of these people were trying to avoid because of cost and impact. Management strategies were the most popular, as they often require no actual costs, just more time to manage. Using techniques such as bale and swath grazing, cover crops, perennial polycultures and companion planting do not require any new purchases, or new fencing, or anything else costly. They just require the forethought to undertake them and some time to think about the best way to get it done.

Environment – Think Green, or maybe Golden?

Responses in Section 3 concerning the environment displayed the commitment that the surveyed producers have to environmental health for a variety of reasons. The content of the questions covered several aspects of the natural environment and its relation to agricultural operations. Table 4.1 displays the questions and the responses.

In all the questions that dealt directly with environmental concerns, the majority of the respondents affirmed that they are greatly concerned with and make their best efforts to minimize and mitigate the effects of agriculture on the environment. The only exception to this trend was question 3 which asked producers to what degree they agreed with the statement: “Some farm-source pollution in the name of continued operation is acceptable”. The answers received for this question were somewhat surprising,

considering the answers to the rest of the questions. Somewhat more than 45% of respondents agreed with the statement, 11% were neutral and 43% disagreed. It could be surmised from these results that roughly half the people feel that a continued operation is paramount, even if some environmental degradation is the result. This is an unfortunate position that many farmers are put into; the realization that their actions may have a negative impact on the environment and that they have no choice in the matter if they wish to continue with farming.

The number of producers who have completed the Environmental Farm Plan program offered by Agriculture and Agri-Food Canada is evenly split in this sample. However, the majority have not applied for assistance under the program for farm-based environmental protection improvements, although some producers indicated that they had utilized the services of the Farm Stewardship Association of Manitoba (FSAM). FSAM is an independent producer organization that was formed in 2004 to assist producers in obtaining and managing projects under the EFP program.

Question 3-2 dealt with strategies that producers may use to help protect the environment from the negative effects of agricultural activities. Several common strategies were listed and respondents were asked to add others that they may be practicing. Of the five strategies listed (riparian setbacks, grassed runways, contour planting, permanent cover, and shelterbelts) the most commonly used strategy was permanent cover, with 14 of 35 respondents indicating this method. Shelterbelts (11) and grassed runways (9) were the next most common. These results are not surprising as these strategies are relatively inexpensive to implement and require very little maintenance over the long-term. Other strategies mentioned were off-site livestock

watering, run-off filtration catchment basins, and rotational grazing. All of these initiatives have been identified as contributing to the maintenance of on-farm environmental components.

Version 2 of the survey asked respondents to identify other components of environmental protection aspects that are in use on their farms. Four respondents indicated that they owned and maintained woodlots, and six indicated that they participated in Conservation District programs that included tree planting, saline area grass seeding, water retention dams, riparian fencing, armoured crossings, abandoned well capping, drainage modifications and riparian setbacks. The Conservation Districts program in Manitoba offers several different programs, depending on the District itself and the needs identified within any given District. Many of the programs consist of producer-initiated projects, usually in relation to water resources (MBGov, 2009).

Economics – Dollars and Sense

Section 4 of the survey focused on the economics of farming operations. The first part of this section looked at the economic situations of the producers in general. Table 4.2 gives the overview of the question and the answers received. Most producers (87%) indicated within the question that if severe adverse economic conditions occurred that they would be able to persist in their operations. However, when asked if they had sufficient savings to cover costs in the event of a completely failed year of production, the answers varied widely. Only 43% indicated that they would have sufficient savings, 6% replied neutrally, and 47% indicated that they would not be able to cover their expenses. Similarly, when asked if failed production would require a shift to a different agricultural sector without a large capital outlay, 45% indicated that they would be able

to make the shift, 9% indicated a neutral position, and 45% indicated that they would not be able to make the shift. Most (81%) of respondents indicated that their income from the farm varied considerably from year to year, which provided insight into the tenuous position that most farm families feel in terms of their economic stability. However, even with that in mind, most (81%) also felt that their operation was financially stable.

In today's volatile market, in conjunction with the ever-increasing costs of inputs and supplies, there is a growing problem for farmers to afford to continue with current production practices. A question in this section asked producers how they felt they would be able to deal with a sudden increase in price or drastic decrease in availability of inputs. 58% thought that they would be able to transition to a different mode of production in the event of price increases or shortages while 32% did not think that they would have the ability to continue.

Income support and crop insurance programs have long been a method that prairie farmers have used to keep their operations viable in times of economic hardship. In asking respondents if they have received crop insurance payouts or income support payments, the results were mixed: 50% identified in each category. Programs that were utilized for these supports included AgriInsurance (6), Canadian Agricultural Income Stabilization (6), Net Income Stabilization Account (3), Canadian Agricultural Skill Services (3), Environmental Farm Plan (2), Grain and Oilseed Payment Program and a variety of PFRA programs. The NISA program has since been replaced by the CAIS program, and most recently by AgriStability and AgriRecovery under the Growing Forward Initiative announced in late 2008. Although there are several more programs

offered by the Federal government to agricultural producers, very few of those who participated in the survey utilized these services.

The second section looked at the marketing strategies for selling agricultural products. Respondents were asked if they had a specific marketing plan and the results indicated that 58% had such plan while 42% did not. A follow up question asked the respondents to indicate how they marketed their products and offered 10 specific categories and asked for input if none of the above applied. As some of the respondents indicated more than one strategy, statistics cannot be applied in this case. The two most popular strategies indicated were Farm Gate Sales (21) and Direct Marketing (21). The next most common strategies were through a Farmers' Market (13), followed equally by Co-ops (5), and Internet Marketing (5). Several other strategies were mentioned and included the Canadian Wheat Board, Marketing Boards, elevator sales, production contracts, auction sales, specialty stores and specific grain buyers.

A separate written response to the question "What is your marketing plan?" was requested. Several respondents indicated that they market through Farmers' Markets, direct from the farm gate or by means of marketing co-ops. A local focus was present in many (68%) of the responses.

Section 4-2 focused on direct marketing as a strategy. See Table 4-2 for a summary of the questions and responses. When producers were asked if they utilized some form of direct marketing, 93% indicated that they used this strategy, although those who used Farmers' Markets only consisted of 35%. At least one producer indicated that the reason they did not participate in Farmers' Markets was that the markets are too limited to make a sufficient living, while another indicated that they:

“...used Farmers’ Markets in the past but found that the CSA model suited us better, guaranteed customers and money, provided a steady pace throughout the summer; required no ‘hustle’ in terms of presentation etc.”

However, 87% of respondents felt that direct marketing was an effective method for selling their products. As one producer indicated,

“We started with a direct marketing strategy due to uncertainty in conventional markets. We have been at it for three years and it has grown every year!”

and another:

“Direct marketing has been an integral part of the success of our farm for 27 years but it can be quite dependent on WEATHER.”

And another very enthusiastic respondent:

“We just started delivering our products to individual families. By word of mouth we became known for the quality of our products. It became too time consuming so we started selling to food groups, bakeries, stores in Winnipeg, Brandon, Morden and Winkler. We have a lot of customers and are still having new customers everyday. The customers keep asking us for new kinds of grains. All the new crops such as millet, lentils, quinoa, red fife and hull-less barley

are now in our vocabulary as new products for us. We are still learning new aspects of farming.”

Other producers indicated similar thoughts on the matter. Many of these respondents felt that the opportunities for small farms to effectively market their products were limited by commercialism and regulatory constraints. Many also pointed out that their profit margins were severely compromised by high costs, competition and distance to markets.

Society – My Home Town

As was discussed in Section 2.4.2, a healthy, vibrant society is an integral part of a sustainable culture and a sustainable agri-culture. Question 5-1 asked for producers’ thoughts on their own communities, and the greater community around them in terms of priorities and aspects that support those communities. Table 4-3 provides the questions and responses. Not surprisingly, 100% of respondents felt that a healthy community was essential. However, when asked if they thought that they lived in a healthy rural community, 71% felt that they did, while the remaining 29% believed that they did not.

Positive social interactions, local action and support networks are recurring themes in sustainable community literature (Honadle & VanSant, 1985; Gertler, 2003; Sullivan, 2003). When asked a set of questions relating to support and assistance between friends and neighbours, 100% of respondents indicated that they rely on community members for support of one kind or another, and 90% indicated that they had provided or received help with farming in the last few years. One producer related:

“Co-operation and help from neighbors and mentors has directly enabled the success of my farm. I think co-operation is the key for

future small-scale farms and healthy farming communities.”

Other respondents indicated that strong community organizations and volunteerism may be the key to keeping communities together and productive. As this respondent indicated:

“Our community has a core group of citizens who are good at volunteering their time and resources so we have the benefits of a rink, community hall, ball park and beach, two churches, a Legion and a Lion’s Club. There is still a K-5 school and a newly-opened daycare in the school. Many businesses have stayed open whereas in other small towns they have closed.”

Honadle & VanSant (1985) make a very valid point in saying that even in an imperfect world, local action is the key to sustainability. With both economic and social development initiatives some changes in behaviour on the part of the rural people will be required for success.

Sustainability – How Long Can it Last?

Section 6 focused on aspects of sustainability relating to government involvement, extension programs, decision-making and personal choices relating to lasting sustainable farming. Questions 6-2 and 6-4 were framed in a Likert-scale style (see Tables 4-4 & 4-5 for questions and responses). Questions 6-3 & 6-5 were open-ended questions.

The first three questions focused on the level of involvement that government representatives have had with producers. Overwhelmingly (93%, 81% and 62.5% respectively) respondents indicated that government representatives had not contacted

them to ascertain their needs, to ask for input into community issues, or to advise them of potential problems in their region. In an era of instant information and rapid communication systems, for producers to not be contacted by agencies apparently charged with improving agriculture and rural affairs is a travesty. From my own experience, I can say that the only time I have ever heard from someone in government about agriculture as I practice it on my farm, is when Statistics Canada called to ask me dozens of questions about what vegetables we grow. From anecdotal reports from friends and neighbours in my community, it would seem that the pro-active nature of our agriculture departments has declined as quickly as the number of farms and farmers on the prairies.

The next three questions dealt with how well government programs were assisting farmers with various components of their operation and community. When asked about the success of government programs providing solutions to specific problems, the results were more evenly distributed: 36% indicated that they had received solutions while 57% indicated that they had not. The following question dealt with government programming as it related to economic stability for farms. Approximately 37% indicated that this type of programming had shown a positive result for their operation, while 53% indicated that it had not. The last question addressing government programming asked producers to rate the success that programs had on the viability and resilience of their community in times of crisis. Fully one half of respondents felt that these programs had not helped their communities, 31% felt that these programs had positive effects and 19% indicated a neutral answer or did not know.

An ever-present issue in agriculture in recent times has been that of crop insurance and income support. 58% of respondents felt that these support programs were important in times of farm crises, while 32% did not agree. However, upon re-examining results from the Economics section, approximately the same number of producers that answered in the positive in this question, also had indicated that they had in the past or were receiving money from these types of programs. One respondent added a comment in the margin about this question:

“I do not believe government programs are going to contribute in any meaningfully positive way to the crisis in agriculture. Governments have spent the last 30 years regulating against small family farms through the restrictions on milk sales, chicken numbers and where and how wheat can be sold. If conventional farming needs ‘income assistance’, how is that sustainable?”

I attempted to delve into reasons that farmers change practices. As the current paradigm of the majority of farmers is entwined with chemically supported, mono-crop practices, change towards sustainability has either already occurred for some producers, or they are contemplating it. Buttel et al. (1990) found in a survey of farmers in New York State that many farmers reported that even though they used a particular production practice, they would prefer to get along without the practice. The use of certain chemicals for insect and weed control were prime examples.

The first of these questions, inquiring about the likelihood of change if obvious problems with production techniques were identified found overwhelmingly (94%) that producers would make the shift to more sustainable techniques. The balance indicated a neutral position. However, only 56% felt that changes would be necessary within their

lifetime in order to ensure sustainability. 97% of respondents felt that change was a positive force in the betterment of their operation and way of life. Producers also indicated strongly (97%) that they felt that adaptability was important and that they had incorporated this into their management plans.

The final question in this section concerned succession planning. Several authors (Gertler, 2003; Neufeld, 2008) have indicated the importance of farm families having a sound plan for how and when the older generation will discontinue farming and the next generation will take increased or full responsibility. Fully 90% of respondents felt that a succession plan was a crucial part of their farm management plan. This result exemplifies the importance of family and heritage to many farmers.

Question 6-3 asked producers to provide open-ended answers about what they saw as being the three practices that contributed to their sustainability the most. What I was expecting to find in this question was lists of crop rotations, machinery and general descriptions of techniques that people utilized. What I found was surprising: most answers were general in nature, but focused on lifestyle choices and ideologies.

One of the top answers was to have in place an effective marketing plan that circumvented reliance on vertical structures in commodity sales. Most of the producers who indicated this as a top practice stressed the importance of having control over their own marketing as a way of ensuring good returns on their investment in growing crops and animals for sale. The next most popular answer was to produce in an organic or natural paradigm. While certainly not all the respondents were certified organic, many of them saw the utility of operating in this way. The focus was not on the premium prices that might be received for “organically” produced products, but rather on the

environmental and economic benefits that could readily be perceived in this practice. This became evident when looking at the next most popular theme in these answers: improvement and maintenance of the soil and land base. Of the respondents who answered this question, 79% indicated that the maintenance and improvement of soil and land was among their top three strategies. This included green manures, animals manures, composting, crop rotations, use of organic amendments, nitrogen fixation, cover crops, mulches, vermicomposting, and grazing management strategies that were used to improve soil and land health. Other common themes that emerged throughout the analysis of the data from this question were self-reliance, diversity, adaptability, and community support.

Question 6-4 consisted of a Likert-scale group that was aimed at getting producers' opinions on techniques that may or may not have improved the sustainability situation for their farm. When asked if their choices in techniques improved a) the sustainability, and b) the profitability of the operation, the answers were almost completely positive. For each question, there were a few respondents who indicated a neutral or "don't know" answer. For a) 94% indicated a positive response and for b) 78%. The next four questions tried to elucidate the motivations for choices on farm operations by asking if choices had been influenced by a desire to be more a) environmentally sensitive, b) more socially responsible, c) as a reaction to market influences, or d) by a desire to be more profitable. Interestingly, the responses for all four questions were very similar (93%, 80%, 77%, and 90% respectively). Perhaps this set of questions should have been arranged as a rating system, with order of importance to individual producers. This likely would have produced a more tangible group of results.

Practical – Recipes for Life’s Cookies

“The hardest part about transition is that there is no recipe. Every farm is different, so talking to a number of farmers, and particularly good farmers in your own area, even if they’re not organic, is a great idea. Take your time. Start paying attention to the needs of your soil and your animals and then the move to organic is easier”.

(Dwwyor et al., 2005, p.viii)

Section 7 was a look at some of the practical strategies that producers are using in their quest for sustainability. Included in the section were questions focused on technology, alternative energy, animal power, manure management, self-sufficiency, recycling, composting and small practical machines used in day-to-day operations. The final question was open-ended and asked for strategies that producers used in the past, currently or intended to use in the future that help with the goal of long-term sustainability. Table 4-6 displays the questions and the responses received.

The majority (70%) of respondents indicated that they believed that their operation had been improved by technological solutions, but also indicated that they believed that technology had made their decision-making more complex (63%). Numerous producers (53%) also indicated that they would discontinue use of technological items if a better or simpler option were available to them, although 30% indicated a neutral response on the matter. Most (65%) producers did not believe that their operation would be classified as “high-tech”.

The next group of three questions dealt with the influences on producers’ choices in adopting technological solutions. The options were extension programs, advertising and sales people. By and large, none of these categories were favoured, with 60%, 77%,

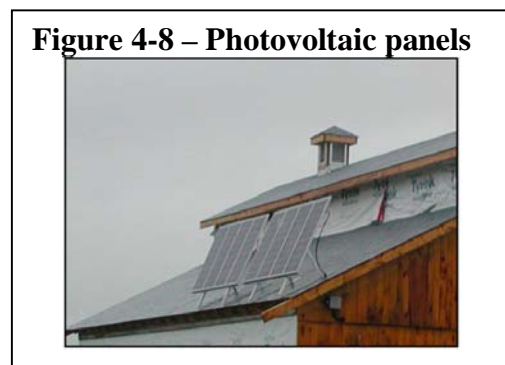
and 79% of respondents indicating that these were not the influences that affected their technology choices.

Global Positioning System (GPS) technology has made huge inroads in agricultural systems in the last ten years. As this is an essentially benign technology that provides data and spatial analysis, it could be considered to be an “appropriate” technology. I decided to investigate the adoption of this technology within the study population and found that 53% of respondents agreed that GPS had improved the efficiency of their operation. However, 20% responded neutrally and the remainder did not agree, which likely points to the technology not having been adopted.

Machinery efficiency and capabilities were addressed in the next two questions. Choices of new equipment based on efficiency or emission ratings produced a mixed result, while improvements in implement capabilities garnered a minimal positive result of 50%.

Alternative energy sources (those that do not utilize natural gas or grid-supplied electricity) revealed that photo-voltaics and wind power had a surprising popularity.

Households that had organized their heating system to include passive solar energy for heating also ranked high in the responses. Many (>50%) utilized wood fired appliances in their heating system. Of those respondents who did not use any alternative energy



sources, the reasons for this included cost, reliability issues, low requirements, fire risks and the economical cost of Hydro. Photovoltaics have become increasingly popular in

recent years for those seeking to reduce the cost of grid-supplied energy and for remote locations. Since 1992, when statistics concerning this technology were first collected, the cumulative photovoltaic power installed in Canada has risen from 958 Kilo-watts to over 25 Mega-watts in 2007 and the industry has seen steady growth of up to 27% annually (Ayoub & Dignard-Bailey, 2008). Personally, our investment in photovoltaics and wind power has paid off handsomely. During the warm months of the year, our production from the alternative sources often surpasses our consumption and the result is a net credit from Manitoba Hydro as the electricity meter runs backwards! During the winter months, with requirements considerably higher, our production is less than our use, but the benefit of the production of up to 15 kWh per day certainly helps to offset the costs associated with the provision of power on-farm. The initial setup costs were considerable, but when the production over the year is calculated and compared to our use, the system will likely pay for itself in less than ten years. We also utilize a specifically designed passive solar system in our home that collects the heat of the sun and warms a large heat sink on the south side of the house. This warmth is then released over the course of the night and helps to heat our home. The greenhouse attached to the south side of the house is the primary recipient of this heat and with nearly no supplemental energy, the greenhouse is maintained in a temperature range suitable for growing plants about ten months of the year.

Question 7-3 dealt with animal power on the farm. Of the 29 respondents who answered the questions, only seven indicated that they used animal power for various tasks. Of these, draft horses, goats and dogs provided draft power and pigs and geese were used for seed bed preparation and maintenance respectively. One clever fellow

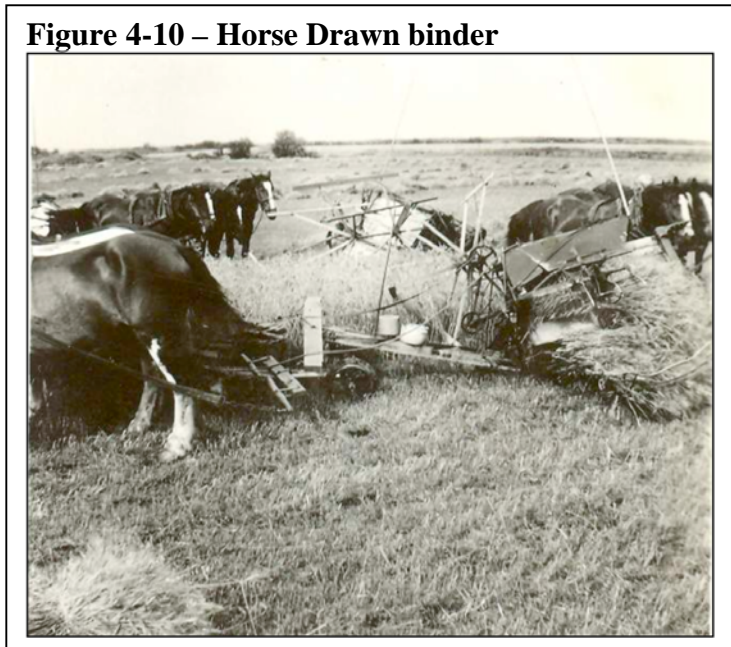
indicated that his draught requirements were met by himself! When respondents were asked if they would consider animal power for some on-farm tasks in light of extreme petroleum prices, 13 of 31 respondents indicated that they would consider this as an



option. Whereas animal power was very commonplace even 60 years ago, the number of farms utilizing animal power for

draught requirements today is minimal. Admittedly, the provision of feed for draught animals requires several acres

of land per animal every year that could be used for growing other crops. Murchie et al. (1936) give a detailed account of the trade-offs between animals and tractors for draught requirements, both in terms of areas of land required for feed as well as



efficiencies of operation. However, with the current trends in process of petroleum

products, the replacement of diesel-powered machines with horses for certain tasks is particularly appealing. Tasks undertaken by the few respondents who indicated that they

Figure 4-11 – Norwegian Fjord team



used horses were generally simple in nature, usually for hauling wood or bales, simple cultivation, or for transportation. On our farm, we have one matched team that we are training for use as chore power. While undertaking tasks that

require power-take-off, horse power is not as feasible, yet it is certainly possible. There are several companies around North America that produce light-weight machinery with ground-driven or small gas engine-driven PTO capabilities for use with draught teams. It is apparently possible to even utilize these implement adapters with standard PTO-driven machinery, as long as the PTO-horsepower requirements are limited.

Question 7-4 asked for open-ended answers concerning the management of manure on the farm. Several respondents indicated that they first composted the manure and then applied to crop fields or pastures. Several others indicated that they managed their herds so that manure was spread on pastures by the animals themselves, through various techniques such as rotational grazing, bale grazing, bale placement or swath grazing.

Question 7-5 was an exploratory question looking at how farm households manage their materials, food and other requirements. According to the results, 94% of

households grow their own vegetables and fruits, and 74% raise their own animals for meat and related products. Eggs and milk supplies were less, with only 53% undertaking

Figure 4-12 – Pastured Poultry ca. 1936



this activity. Fibre animals raised for direct use were negligible, with only 15% indicating this activity. Minimizing grocery requirements was a very popular strategy, with 73% suggesting that this was part of their regular activities. Fewer households (31%) indicated that

they made their own clothes. In terms of material recycling, 88% indicated that they did this regularly. When asked for examples of recycling strategies, there were several answers and some very creative ones, including making crafts with items that would otherwise be garbage or recycled, printer's tin for roofing, and old clothing for rags. Composting was another common activity, with 82% of respondents indicating that they composted. The most common use for finished compost was in gardens or on pastures. Some people indicated that household organic waste was fed to pigs or chickens, thereby returning it to the soil after one more processing step.

Practical household tools that people owned that contributed to their self-sufficiency included many households with sewing machines, several with food dehydrators, sergers, flour mills, solar hot water heaters or ovens, looms and butter churns.

Conclusion

The participants in the survey responded with a wealth of information and tips for all sorts of aspects of agriculture. They displayed a wide range of knowledge and experience, and it made for fascinating reading. There is obviously a huge commitment on the part of these new agrarians to the land, the environment in which we live, the practice of agriculture, a realistic way of making a living and to society as a whole. It is through people such as these that there is hope for humanity and for the world that supports us all.

Table 4-1 Demographic Summary

	Location	Products	Land base	Annual Hours	Hours Paid Labour	Age	Number of People on Farm	Level of Education
1	Teulon	Fruit, Vegetables, Poultry, Hay	40	4340	250	58 61	Couple	Gr. 9 1yr Master's
2	Carman	Vegetables	30 owned 15 rented	10000- 15000	10000	50 56	Couple	1yr U.
3	Ste. Agathe	Fruit, vegetables, herbs	40	1500	40	51	Couple	Gr.12 Bach.
4	Boissevain	Bedding plants, honey, maple syrup, herbs, fruit, vegetables, horses	160	3000	1500	52	Family	2 yrs. Univ.
5	Arborg	Cereals, cattle, pulses, sheep, oilseeds, leafcutter bees, forage seed, hay and pasture	1400 owned 640 rented	3600	500	52		Ag. Dip
6	Arborg	Poultry	2 rented 900	210	3	19	1	1 yr. U
7	Winkler	Cereals, fruit, pulses, vegetables, oilseeds	owned 800 rented	?		47	Corp.	Univer sity
8	Plum Coulee	Fruit	40 acres	300	0	51	1	Gr. 7
9	Oak Lake	Cereals, Oilseeds	320 owned 375 rented	1120	100	63	1	Gr. 12 Diplo ma
10	Pilot Mound	Cattle, swine, herbs, goats, poultry	680	5000	0	34	Family	Gr.12
11	River Hills	Herbs, fruit, vegetables, honey, poultry	80	6000	400	29	Team	Bach. Degree
12	Pansy	Cattle, herbs, fruit, vegetables, poultry, eggs	3	500	50	61	1	2yrU
13	Nesbitt	Cereals, cattle, swine, goats, vegetables, sheep, oilseeds, own use: milk, eggs, fruits, etc.	495 owned 110 rented	5000	0	33	2	Gr12
14	Pansy	Fruit, vegetables, herbs		1100	0	50	1	2yrU
15	Moosomin	Cattle, swine, chicken, hay, pasture	1856	?	0	52		
16	Killarney	Cattle, dairy cows, horses, swine, sheep, dairy goats, chickens, wheat, barley, oats, flax, vegetables, hay	74	3500	15	33	Couple	B.A.
17	Stonewall	Elk products, forages, feed-grains	750	4500	1000	70	2 Couples	
18	Notre Dame des Lourdes	Rye, wheat, spelt, oats, buckwheat flours and flakes, forage peas, oil sunflowers, flax, cattle	500 cult. 300 bush	3650	0	69	Couple	Gr. 8
19	Oak Lake	Cattle, Bison, Elk, Barley, oats, hay and pasture	2000 owned 236 rented	7488	0	32	Family	Gr. 12

Chapter 4: Results

20	Kenton	Cattle, chickens, wheat, barley, oats, hay and pasture	400 owned 145 rented	3120	100	58	1	B. Ed.
21	Elkhorn	Bison, wheat, barley, oats, flax, hay, pasture	1000 owned 300 rented	2500	?	53		Gr. 12 1 yr U.
22	Neepawa	Cattle, swine, goats, chickens, hay	1500 owned 480 rented 160 rented out	8000	0	31		College
23	St. Norbert	Goats, chickens, fruits, hay, vegetables	11	?	?	49	2	Master's
24	Kenton	Bison, wheat, oats, canola, flax, pulses, hay, pasture	2140	?	?	59		Ag. Dip.
25	Clearwater	Swine, goats, chickens, turkeys, horse, vegetables	160 rented	1464	20	21	1	Ag. Dip.
26	Winnipeg Beach	Vegetables, fruit, cattle, dairy cows, horses, swine, chickens, hay, pasture, greenhouse	7 owned 73 rented	2880	0	42	Couple	B.A
27	St. Norbert	Hay, dairy goats, chickens, alpacas, vegetables, horses, sheep, bees, cattle	160	2400	100	39	Family	Master's
28	Gladstone	Cattle, wheat, barley, oats, pulses, hay	1000	4500	0	42	Couple	Gr. 12
29	Roblin	Vegetables, fruits, herbs	6	750	0	68	Couple	Gr.12 +
30	Swan River	Cattle, horses, chickens, hay	320 owned 80 rented	2080	150	41	Couple	Master's
31	Clearwater	Cattle, horses, forages/hay	600	?	20	51	Couple	Trade
32	Grandview	Cattle, chicken, wheat, sweet clover, hay/forages	320 owned 160 rented	2000	0	50		B.Sc.
33	Clearwater	Cattle, wheat, barley oats, canola, forages, other	960	3500-4000	200	57	Couple	Ag. Dip.
34	Carman	Cattle, horses, wheat, barley, oats, flax, forages/hay	2000 owned 1000 rented	3000	100	35	1	Gr.12
35	Notre Dame des Lourdes	Cattle, chicken, barley, oats, rye, forages, vegetables, hay, sunflower, spelt, millet, green manure	320 owned 640 rented	7000	360	45	Couple	Trade
36	Austin	Cattle, buckwheat, rye, pasture, geese	640 owned 160 rented	1000	0			

Chapter 4: Results

Table 4-2 Environment	Strongly Agree/ Yes	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree/ No	Don't Know/ Not applicable	Total
I/we consider a healthy environment to be of utmost importance.	28	4	-	-	-	-	-	-	32
Climate change is a concern for our operation.	12	13	3	1	-	1	-	-	30
Some farm-source pollution in the name of continued operation is acceptable.	1	5	10	4	4	6	5	-	35
I/we minimize the use chemicals that have been shown to be harmful to aspects of the environment.	23	3	4	-	-	1	-	-	31
I/we practice methods that minimize the use of petroleum and petrochemicals because of the damage that the by-products may do to the environment.	15	11	2	1	1	1	-	-	31
I/we are aware of environmental damage to our farmland due to pollution over our lifetime.	8	12	-	4	-	1	2	-	27
I/we have completed the Environmental Farm Plan (EFP) process. (Y/N)	14	1	1	-	-	-	16	-	32
I/we have submitted application for / received assistance under the EFP grant program.	11	1	-	-	-	1	16	2	31
I/we employ methods that minimize the impact of livestock on the environment.	13	12	1	1	-	-	-	1	28
I/we have in place, practices that protect water resources.	13	13	1	-	-	-	1	1	29

Chapter 4: Results

Table 4-3 Economics	Strongly Agree/ Yes	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree/ NO	Don't Know or N/A	Total
If severe adverse conditions occurred for more than one year, our operation would likely be able to persist.	11	13	3	1	-	3	-	-	31
I/we have sufficient savings to cover costs of a completely failed year.	5	6	4	2	3	6	6	-	32
If prices of the products from our farm fell drastically, I/we would be able to shift production to another sector without a large capital outlay.	7	6	1	3	3	4	3	4	31
Our income varies considerably from year to year. (v.2)	3	3	7	-	-	2	1	-	16
I/we have a financially stable operation.	5	10	11	1	3	1	1	-	32
If a sudden increase in price, or drop in availability of petroleum based products (fuel, lubricants, fertilizers, pesticides) occurred, our operation would be able to transition to a different operating strategy in a timely manner.	5	9	4	1	3	2	5	2	31
I/we are receiving or have received money from production insurance or income support programs. (subsidies)	8	5	-	1	-	-	13	1	28
I/we practice direct marketing as a method of maximizing profits.	18	8	3	1	-	1	-	-	31
I am involved in a farmers' market on a regular basis.	9	1	1	1	-	2	16	1	31
I/we practice direct marketing by means of a marketing co-op.	2	7	-	-	-	-	18	1	28
I/we find that direct marketing is an effective practice.	15	8	4	3	1	-	-	-	31
I/we started in direct marketing because of poor performance from sales (elevator/CWB/single desk marketing boards etc.).	5	1	1	3	-	3	14	1	28

Chapter 4: Results

Table 4-4 Society	Strongly Agree/ Yes	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree/ No	Don't Know/ Not applicable	total
I/we consider a healthy community to be essential.	28	4	-	-	-	-	-	-	32
I/we believe that we live in a healthy rural community.	12	4	6	-	5	3	1	-	31
I/we rely on other members of our community for support of one kind or another.	14	8	8	2	-	-	-	-	32
Friends or neighbours have helped us or received help from us in farming in recent years.	17	6	5	1	-	-	2	1	32
Social justice is important to me/us.	19	10	1	-	-	-	-	-	30
The population of our community has declined over the last two generations.	17	8	2	2	1	-	1	1	32
Healthy rural communities are an essential for continued success of family farms.	21	7	3	-	-	-	1	-	32

Chapter 4: Results

Table 4-5 Sustainable Practices	Strongly Agree/ Yes	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree/ No	Don't Know/ Not applicable	Total
A government representative has proactively contacted you to ascertain your needs.	-	1	1	-	1	7	22	-	32
A government representative has asked for your input into solutions in your community.	-	3	2	1	2	4	20	-	32
A government representative has contacted you to advise you of potential problems in your region (or in general).	1	4	2	2	3	7	13	-	32
Government programs have given you solutions to specific problems.	2	5	5	2	4	3	12	-	33
Government programs have made your farm more stable in terms of economics.	2	6	4	3	2	2	13	-	32
Government programs have made your community more viable and better equipped to deal with crises.	2	4	4	5	3	6	7	1	32
Agricultural assistance/ income support/ insurance programs are important solutions to farm crisis issues.	2	3	13	1	2	4	4	2	31
Extension programs have provided you with realistic solutions.	1	8	4	6	3	1	8	1	32
Upon encountering an agricultural problem, I/we would contact a private agronomist. (v.2)	-	4	4	1	2	2	5	1	19
I/we would change practices if it were pointed out that current methods were un-sustainable for our operation.	12	14	4	2	-	-	-	-	32
Changes are not necessary for maintaining sustainability within my/our working lifetime.	3	3	3	3	2	3	12	1	30
I/we consider change to be a positive force in the betterment of our operation and quality of life.	16	10	3	2	-	-	1	-	32
Adaptability is a key component of our farm management plan.	17	14	1	1	-	-	-	-	33
I/we have diversified our operation to ensure its stability.	11	15	2	1	-	-	3	-	32
A succession plan is a crucial part of farm management.	8	9	6	5	-	-	1	2	31

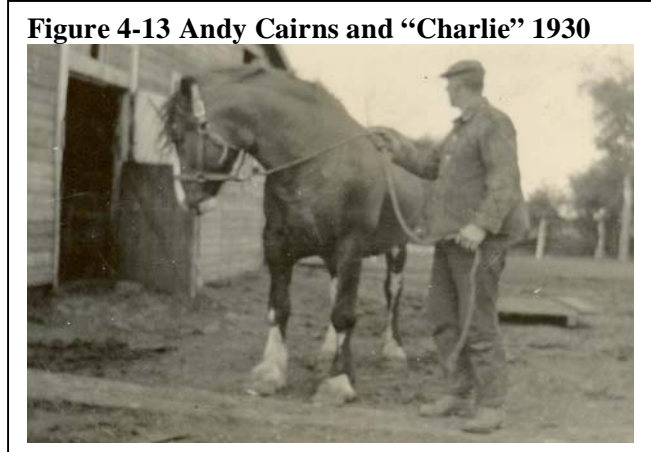
4.2 Case Studies

Case Study 1: Aurora Farm, St. Norbert, MB

My own family farming background has deeply influenced me. I spent most holidays throughout my childhood and adolescence helping grandpa with fieldwork, tractor mechanics and errands, and helping grandma with her 2 acre garden which fed the family for over 50 years. Most importantly, I understood, even as a young person, that family farming as a lifestyle was facing extinction.

In 1882, my great-great-great grandfather John Bell settled near Oak Lake, Manitoba in a sod hut and with a team of oxen. John Bell's daughter Eleanor Cairns was my mother's great grandmother. Eleanor's son, my great-grandpa Andy, farmed with 4 and 8 horse teams of Clydesdales until the 1930s. Amongst these was a stallion named Charlie who was his pride and joy.

In my grandmother's own handwriting recollecting Andy: "He deplored the passing of the flesh and blood horse power era. He worried that total mechanization would be too expensive and that farmers



would soon find themselves in bankruptcy." Great-grandpa Andy did have a Garr-Scott steam tractor around the turn of the century, and a Sawyer Massey thresher machine to do contract threshing.

My grandpa Henry farmed with horses until the end of the Second World War. He got his first tractor at that time with steel lugs on the wheels. Grandpa got his first

new tractor, a Farm-all Model M in 1947. Into the 50's, a threshing gang was hired usually from the nearby reserve and the horses were still used to bring the sheaves in to the stationary threshing machine. Cattle were always part of the farm, with grandpa keeping as many as 50 cow-calf pairs from time to time. My mother recalls that they always kept a few milking cows and would get a few pigs and/or sheep. They always had chickens and turkeys for eggs and meat. My mother remembers that they were quite self-sufficient in terms of their family

Figure 4-14 Farm-All "M"



food. They did buy flour, sugar, salt, and fresh fruit from BC. The cows were sold in 1976 when grandpa Henry retired and the farm became a predominantly wheat farm. My grandma Phillis was famous for her big garden which she kept up until 1997. She still maintained a garden much bigger than she needed at age 82 years old.

My mother's brother Rodney took over the farming operation as a young adult in 1979 and built a home half a mile away from the original homestead. He still farms the land but is nearing retirement age. My cousin Wendy and I are the only members of the next generation and we have both chosen professions in agriculture and have settled on farms other than the family farm.

My wife Louise has been a life-long animal-lover and grew up caring for some pets and learned how to ride and care for horses at a nearby farm. She got her green thumb and love of gardening from her grandpa Jack. Both her parents had small-town farming community roots. Both sides had lived in towns but produced much of their

food in their yards. Her father tells of a few dairy cows that had to be walked out of the town to pasture everyday. Most yards had hen houses and all available sunny land was used for growing vegetables. Her grandpa Jack was the operator at the Ogilvie Flour Mill in Elkhorn all his life and had a strong connection and value for farmers. Louise's mother presented a less-than romantic picture of farming in Saskatchewan. Her father came from Switzerland with his two brothers to farm. They found some of the most barren land in Canada, in a drought and the family endured much hardship before they moved to town when her mother was a young girl. In the generation prior to her grandparents however, all were agrarian people.

Louise and I met six years ago at the St. Norbert Arts Centre (SNAC), where Louise had worked and volunteered for many years. At the time, she was hosting a summer program featuring projects that taught natural-building skills to women. SNAC was in a transformative process in their gardens and site in an exciting experiment that combined the social, cultural, spiritual and ecological. We visited in their beautiful gardens, canoed down the LaSalle River along the pristine river-bottom forest and shared our values about ecology and community.

The site of the St. Norbert Arts Centre is a former Trappist Monastery, itself an historical model ecological agricultural community. When the Cistercian Monks from La Trappe, France decided to accept the offer of St. Norbert parish priest Pere Joseph Noel-Ritchot to establish a Monastery in St. Norbert, Manitoba, they brought an agricultural revolution to the area. Within the first 30 years of arriving, the Monks, known for their hard manual labour as much as their spirituality, had built an impressive industry including a renowned cheese factory, a metal forge, a lumber mill, an apiary, several

distinctive barns. They farmed the land in 20-acre sections, each section named after a Saint. They worked the land with large teams of horses and were among the first in the area to have steam tractors. Their numbers grew to 80 Monks and many families and individuals in the town of St. Norbert were employed by the Monks. The Trappist Monks are vegetarians and live a simple life. Their abundance in St. Norbert was found in the infrastructure that they built with their own hands, an industry of sustainability.

Within a year, we were making a big decision to move on our deep desire to take our place in the family-farming movement and began looking for a farm to buy. Because of her roots in St. Norbert, Louise felt that we needed to be close so we began searching in earnest in the surrounding area.

The farm that we purchased was one of the few remaining Seignorial-style lots remaining in St. Norbert. It is 660 ft. wide and 2 miles long. It belonged to a local farming family who have been in this community for over 100 years. We have had the good fortune to meet the man who grew up on this farm, who built our house for his family of eight and who farmed the land for all of his adult working life.

When we purchased the farm, we immediately needed to renovate the farmhouse. We built a greenhouse (and passive solar heat collector) on the south side of the house. We used as much recycled and natural building materials as we could and tried to keep the cost as low as we could. We hired many friends to help us with the work but kept it a “hand-made” home. We painted all the walls with clay paint. Although Louise and I were still both working full-time, we began planning for ways to reduce our economic dependencies and be able to be at home more.

We studied permaculture design through a year-long online course offered through the Barking Frog Permaculture Institute which gave us the opportunity to consider many different options for our farming activities. Guided by the principles of ecological symbiosis with nature, homesteading the land, community and creative inventiveness, we pursued, on paper at least, many different ideas. To fulfill the requirements of the Barking Frog Institute, we completed a significant study of our potentials and did many diagram drawings of these ideas. We settled on a few that represented long-held desires for each of us and began planning those in more detail.

In our first year we planted a twenty-acre alfalfa field, bought two alpacas, four dairy goats (two mature milkers and two doelings) and our first batch of chicks. We had three horses already boarding at another farm and we prepared the barn and corrals for them. We planted our first small garden in front of the house and enjoyed fresh salads, fresh vegetables and teas. We did not have any surplus food for storage. Our main milking goat, Matilda, was producing two to four litres a day and we were able to make a simple one-step cheese, the East Indian paneer. We rented the remaining 130 or so acres back to the farming family from whom we had purchased it. They farmed soybeans for two years in a row for approximately \$5000 in rental fees. However, they did us a great favour by planting soybeans two years in a row and replenishing the nitrogen in the soil.

In our second year, we built more animal shelters, a dugout to collect rainwater and snowmelt for animals and garden irrigations. We expanded the garden and increased the functionality of the greenhouse as we learned better how to use it. We purchased a purebred Saanen buck and bred our two females doelings who were now of age while continuing to milk our first goat into her second year without losing much productivity.

We researched and purchased the basic equipment for square baling and had two productive cuts from our 20-acre alfalfa field. This was hand-loaded onto a flat-deck trailer and then stacked near the barn and covered with tarps. We baled straw from our neighbours' fields, since they were not going to use it. We bred our two alpaca females who were now of breeding age. We researched and found a fibre mill in Saskatchewan to process our first small batch of alpaca fleece.

In our third year, we seeded the remaining 130 acres to hay with an oat cover crop. We purchased a round-baler and a bale picker and expanded our capacity to store hay with a newly constructed hay shed. We had six baby goats, four doelings and two bucks who we neutered. We researched the options for small-scale raw milk production and farm-gate sales and were not surprised to find that various licensing authorities would make that ambition prohibitively expensive and therefore impossible. We had two female alpaca cria and expanded our alpaca herd by purchasing one female and her baby and trading hay for several more males who would be only usable for fibre and not for breeding. We sent approximately 80 pounds of raw alpaca fibre to be milled and began selling it from home just by word of mouth. We developed our gardens further and built cold frames along the south wall of the house. We reseeded all of the animal pastures in hopes that they would take better, with some success. We built a solar dehydrator and some low-cost grain storage containers.

In our fourth year, we had two cuts of hay and sold 70 acres worth of hay to our neighbouring cattle farmer. We also sold small numbers of square bales to local smallholders. We have produced all of the hay we needed for the winter for all of our animals. We had 20 goat kids of which 10 were females. Most of the buck kids were

sold or given away. We had three male alpaca cria of desirable colours. We acquired a herdsire male alpaca at an extremely reasonable price in exchange for breeding rights back to the woman who sold him to us. We sent over 140 lbs of raw alpaca fleece to be milled and secured a downtown store to sell the yarns on consignment. We hatched three heritage breeds of chicken and built a breeding coop for them. We raised 48 day-old chicks into productive free-range layers and hung a “Fresh Eggs for Sale” sign at the end of our driveway. We met neighbours and passersby who came to buy eggs and were interested in many aspects of the farm. This really got our customer base started. We sold vegetables to a local restaurant. We purchased a cream separator, butter churn, ice cream maker and expanded our cheese production and have become almost self-sufficient in terms of dairy. We filled our freezer and cold pantry with produce from the gardens. We purchased more of our other foods from nearby farms or Farmer’s Market and simplified our eating. We expanded our gardens again and prepared them better in the fall.

Now just entering our fifth year at our farm, we look to our successful farm-families throughout the province for inspiration and guidance and find it aplenty!!

Case Study 2: Women-led Farming

Without doubt, agriculture, especially corporate-style agriculture, is a male-dominated field. I interviewed a woman producer who spoke of her experience as an organic grain and cattle and poultry farmer. Her husband is a full-time professional and is not significantly involved with the farming.

Throughout our interview, many social concerns were expressed: rural

depopulation and the need to foster the younger generation of farmers, concerns about aging rural people, concerns with negotiating family needs with business decisions.

Her recommendations:

- Develop a good business plan and follow it with flexibility. Spend more time with books figuring exact costs and bottom line. Just because you like doing something doesn't mean that it is economically feasible. Make a website, its easy and creates a lot more interest.
- Shared equipment between multiple farmers is possible but difficult - make sure that terms are well established. Look after your machinery and you will have a lot less problems. Slowing down a little bit (while doing field work) saves time in the end.
- Figure out your markets. Being able to produce a quality product and market price that can cover the costs of production and a little bit to live on. For her, finishing her own cattle with her own feed grain and discovering that cattle like legume straw meant reducing her input costs.
- Her recipe for pastured meat chickens: She starts them in a grain bin under heat lamps for three to four weeks. Then she moves them to a pasture fenced with chicken wire and electric fence. This pasture has been seeded to lentil, oats, peas, and wheat using a small seed drill. By the time she puts 300 chicks on the one-acre pasture, the plants are 3 inches tall. The chickens will graze on the greens but the plants will also get to a heading stage. She also rolls Durham wheat and flax and feeds that to them. Four or five five-gallon pails are enough grain for a week. At this time she is not able to get organic chick starter and the processor

close to her is not certified so she is not able to certify her chickens. However, she believes that her customers understand and appreciate her organic values and the quality of her product.

- Buy everything locally to support the community so that these services will remain in the small towns.
- She has used sisal twine for baling and it seems to hold together quite well. She does prefer net wrap for ease of transportation even though net wrap is approximately \$4 per bale more expensive. Sisal is not much more expensive but has to be ordered in.
- Limit what you do.
- Experiment with new things also. Her son created an aerated dugout with rainbow trout. They feed freshwater shrimp to the fish that are grown on small square barley bales submerged in the dugout. They start with caged fingerlings so that they learn to eat twice a day. They grow to one pound by fall and can overwinter.
- Produce your own fertilizers from manure or from planting rotations. Chemicals are too expensive. Input balanced with outputs.
- Having enough labour and knowing what you can do by yourself. Farm labour is hard to come by and expensive at \$15-20 per hour.
- At the suggestion of an OPAM rep, she has had success using Myc Pro3. She under-seeded a hemp crop to red clover and added in mycorrhizal bacteria although it is quite expensive.
- Experiment with inter-cropping: oats and lentils for livestock feed is a good example. Look for seeds that can be mixed and seeded together in the drill such as

flax and wheat. They can also be harvested together and separated in a seed cleaner, once to get wheat out and a second time for flax.

- Make sure to balance work and leisure so that some summertime can be enjoyed.

Case Study 3: Mentorship

Mentorship is a natural component of family farming when multiple generations farming together pass on their techniques and knowledge of the land. I interviewed two couples: parents and adult children who are now neighbours farming certified organic farms. This land has been in the family for four generations. They are finding that they can't produce enough to meet the demands of the growing local, organic food markets.

“We were trying to produce a good crop but the more chemicals you use the more disease and problems. We didn't seem to be gaining anything. We had a beautiful crop but we spent lots of money and had no return. It seemed to be getting worse. Our motivation was economic and we wanted to create a future for our farm. We now want to show that organic can work and it is the way of the future for farming.”

Recommendations:

- Develop winter activities: seed cleaning, dehulling, washing vegetables, pressing oil and milling flour.
- Don't go organic if the reason for change is money. A different philosophy is needed.
- Keep input costs low at \$26 per acre (fish emulsion, molasses).
- Keep a cover crop on all the time and reseed into the crop with a zero-till drill.
- Try out successful experiments of others. Gabe Brown and Gene Goven in North Dakota developed a rotation of winter cereals with an early harvest, then planting

in a “cocktail” crop. Martin Entz developed a pea/oat green manure crop which he then rolls it in a crop roller to kink the stem. This creates a mulch and then he seeds into that.

- Limit diversity. You can do too much and it might hurt your bottom-line later.
- Have more kids.
- Expanded by consumer demand. Start off with wheat and flax for first crops. Then oats mill to make oat flakes. Then they tried spelt even though they were told you can’t grow spelt in Manitoba.
- Double the profit when value added. Grains are 20 cent/pound raw but 70 cent/pound as flour.
- Develop and maintain your own Heritage seed varieties. It’s very hard to get non-corporate seed. Seed is a technology. When you buy seed you sign a contract to sell all the seed back to seed company which means that you can’t save seed. Patents on seeds means that corporations control food supply.
- “Work with mother nature cause it’s going to win. Don’t mess with her.”
- The elder generation farmer would like to pilot his methods for biological farming on other farms. Use green manures, rotations and low-input farming.
- Taking the holistic management course. Getting involved with like-minded group. In their community, 10 farmers get together once a month to trade ideas.
- Market gardening – find your markets, start small and grow slow.
- Use Brix testing to understand and monitor the biology of the soil. Goal of 11 or higher and then you don’t have to worry about potato bugs.
- Intercropping beans and marigolds with potatoes helps to reduce insect pressures.

- Less government intervention.
- Need more objective research and keep the chemical companies out of it.

Research on different kinds of wheat variety. Getting the information out. More research needed on biological farming.

Case Study 4: Community

Many family farmers express the values of community and local economy. I interviewed one couple who have exemplified this activist work by numerous different initiatives including the development of their own family farmstead.

For instance – recently, this couple did the 100 Mile Diet and found that the community was very interested. The media called regularly, keeping track of their progress and strategies. For many people, coffee is a significant barrier to succeeding in the 100-Mile Diet. The couple perfected their dandelion root coffee and offered us their secret to success: the trick is the consistent roasting of smaller sized roots, ground fine and then made in a bodem, like regular coffee. These folks also host WWOOFers (World Wide Opportunities on Organic Farms) on a regular basis, which provides great opportunities for the young people in the program as well as giving the family some much needed help with operations.

Interesting strategies and thoughts from the interview:

- Keep costs of living down by lifestyle choices.
- A strategic process is required to unlink from the expectation of exportation. We need to look toward our neighbours for certain foods, so that regional sustainability is practically possible.

- Organic is crucial for sustainability, attention to soil and surrounding ecology. “Organic requires soul – that you can’t get at a WalMart store.” They like the company Terra Edibles who use the slogan “SANER – Sustainable And Naturally Environmentally Responsible.”
- Need incentives for farmers to downsize and diversify. “When the system self-destructs, sustainable agriculture will be the only way.”
- Follow the consumer drive towards better health.
- “No one is going to take care of the land better is a farmer who is connected to the community for food production.”
- Plan for Succession.
- People are tool-makers and technology is a tool for agriculture.
- Farmer’s number one role is to be attentive to diversity.
- Partner well and/or find a community as it is very hard to do it on your own.
- Farming is about relationships with land, soil, climate, family, community. Have a variety of skills.
- Stay out of debt, or at the very least, keep it very manageable.
- Less interference from government. Why are we not allowed to buy and consume raw milk from our neighbours and eggs from farmers market when we are allowed to eat denatured, irradiated, carcinogenic food from big corporations? Food safety laws are the biggest impediment for food security.
- Government is actively promoting non-sustainable agriculture and feeding the agri-business machine. Example: Irrigation funding for potato farmers.

- Educate the kids who are going to stay rurally. Study in Maritimes shows that farm kids who get educations move farther away. The kids who stay are the kids who drop out. This is the future of our town.
- “Plant lilacs!”

Case Study 5: Community Development Group – The Agriculture Committee of the Turtle Mountain Community Development Corporation.

Two publications put out by the Agricultural Committee of the Turtle Mountain Community Development Corporation are extremely helpful in terms of examples of the creativity of people currently farming small farms and/or dreaming about what their small farm would look like. With these publications as well as numerous ongoing initiatives the Turtle Mountain group directly addresses the issue of rural depopulation and promotes a move towards downsizing in face of the corporate farm model.

The Small Farms Challenge is a compilation of submissions to the contest as well as several articles by one of the driving forces of that community and chair of the Agricultural Committee, David Neufeld. The contest was held in February 2007 and had submissions from 26 participants with a wide variety of submissions. The winners, Dwayne and Shelley Logan, present a compelling and practical example of diversity, simplicity and common sense. Each of the submissions creates a vision of a working small-scale farm for prairie soil and climate.

Successful Small Farms in Southwest Manitoba published in January 2004 presents 20 real case studies that deal with operational, technical, financial, marketing

and planning issues of starting up and managing a small farm. Also helpful is a section of common themes as established by the interviewers.

4.3 Measurement & Assessment of SA

Introduction

Is a practice/ suite of practices/ situation sustainable? This key question has no simple answer. The answer could well be "...it depends...", and indeed, it does depend on a whole host of sub-questions. Assessing sustainability requires detailed information on antecedent conditions and circumstances, current realities in a wide variety of contexts, and educated speculation on future events and/or conditions. These components, while critical to the equation, must also be organized in terms of the temporal scale in which they are operating. There will be information that has relevance to problem solving in short-term solutions as well as long-term solutions, but may not have immediate relevance to each other or to intermediary time scales. Measurement is complicated by the need to establish an appropriate time frame. The one usually chosen is an infinitely long period, which is likely not appropriate because of the uncertainty of future events (Wilson & Tyrchniewicz, 1995). Mazoyer & Roudart (2006) and Wilson & Tyrchniewicz (1995) agree that agrarian systems cannot be analyzed independently of potentially competing upstream activities that provide it with the means of production, nor can they be assessed without consideration of the utilization of its products by downstream activities and consumers. Similarly, spatial scales that range from the field level to local to regional to national to global require different sets of information. There is a huge body of research on the exploration of a wide range of "indicators of sustainability", but most of these indicators are secondary (Passioura, 1999).

The environment, which is constantly changing and evolving by means of a wildly variable set of conditions that are in a state of dynamic equilibrium, is the essential

component supporting agriculture. While there are certain conditions that are reasonably assured at any given moment, over the long-term, some of those core assumptions may not be as static as they appear. No system is infinitely sustainable (Raman, 2006).

Perhaps the first place to start in the task of measuring and assessing the degree to which agricultural practices are sustainable would be to identify some good indicators. Productivity, stability, efficiency, durability, compatibility, environmental appropriateness and equity were the ones that came to mind after some thought, although Bossell (1999) points out that essential indicators are often not obvious or intuitive. Several authors (Raman, 2006; Blum, 1998; Gardner, 1995) have presented similar lists of indicators.

Why do we need indicators? It is through the use of indicators as tools, not unlike the use of a microscope, that we are able to discern the minute and subtle components that make agriculture likely to be persistent into the future. It is through the use of indicators that humanity is able to perceive the enormous quantities of information in natural systems and to condense this into a manageable amount of meaningful information, and subsequently into a small subset of observations informing our decisions and directing our actions. Other components of sustainability aside, if persistence into the future fails to occur, then the system cannot truly be sustainable. Most writers on the topic seem to agree on what the desirable characteristics of sustainability indicators should be; for example, indicators should be consistent (over time), reliable, have capacity to predict, sufficiently informative, relatively easy to measure, and relatively inexpensive to compile (Stonehouse, 2004; Bossell, 1999). Bossell (1999) also suggests that the identification of indicators should always be a participatory process in which all

important concerns are represented so that the views and values of a community or region are accurately represented.

What kinds of indicators are there and what are they indicating? Blum (1998) compresses indicators into two overview groups of which soil characteristics (and related products) are the first and socio-economic and cultural indicators are the second. The socio-economic and cultural indicators are a more complex suite of indicators and include two sub groups that are: geopolitical interests, such as tariffs, market conditions, and costs of labour, energy and raw materials. The second sub-group identified is defined by the farm or local level with cultural and community conditions included. Raman (2005) agrees that the most appropriate level for assessment is at the field or cropping system level, thereby examining the lowest possible level of hierarchy. Blum (1998) concludes by saying that by using these two main groups of indicators, it is possible to establish a systematic approach for the definition of sustainability within a given agricultural region. Bossell (1999) insists that indicator sets be as small as practically possible, without being too small. A single indicator, for instance, cannot be used in isolation (Hansen, 1996; Norgaard, 1991; Geng et al., 1990). Byerlee & Murgai (2001) also agree with this point of view, going on to insist that even an all-embracing indicator cannot be theoretically or empirically robust. Wilson & Tyrchniewicz (1995) suggest that there are two main types of indicators: the economic and the physical.

Evaluation of sustainability, even in the case of a particular resource used in agriculture, is replete with problems. Part of the blame for this difficulty is that evaluation is still in its early stages, particularly because sustainable agriculture is an evolving and adaptive process rather than a goal (Raman, 2006). A number of value

judgments are required since some of the variables do not lend themselves to objective or quantitative measurement, such as social resources. Consequently, measurement of the sustainability of a resource, such as the soil, is difficult over an extended period of time. On the other hand, exact measures may not necessarily be mandatory when attempting to evaluate sustainability since in many situations the degradation is obvious and, as in the case of the soil, should stimulate action to adopt conservation practices (Wilson & Tyrchniewicz, 1995).

“How can you be lost when you don’t know where you’re going” (Maynard & Nault, 2005) is a fitting saying when it comes to indicators. It’s a new field of endeavor but an important one in terms of taking the vagueness and contradictions out of the sustainability concept. How can the rate of improvement be judged if there isn’t an established starting point or baseline, such as the state of water quality in a given river, and an on-going monitoring of that condition? How can farms be judged as economically viable under the parameters of sustainable agriculture if there aren’t indicators to demonstrate that things have or haven’t improved? A considerable amount of work has already been done on identifying what the indicators should be, the next step needs to be to work out the details of the monitoring process – what needs to be benchmarked, how is that to be carried out, and what should be the level of change that should be achieved?

From the preceding, it becomes apparent that there are three essential groups of indicators for sustainability, and for sustainable agriculture. These are the environmental, social and the economic, corresponding exactly to the three pillars of sustainability as discussed earlier. There are also more complex aggregate indicator sets, which will be discussed later.

Environmental Indicators

In no particular order, we will discuss the environmental indicators first. Maynard & Nault (2005) propose that the two main criteria that can be used to judge the environmental sustainability of agriculture are firstly how well the natural resources used to support agriculture are managed and conserved; and how compatible agricultural systems are with the natural systems and processes in which they occur. MacRae et al. (1990) list agri-environmental indicators as being: farm resource management; soil degradation risk; risk of water contamination; agro-ecosystem greenhouse gas balance; agro-ecosystem biodiversity change; and agricultural efficiency and productivity. Sands & Podmore (1993) proposed an environmental sustainability index as an aggregation of sub-indices of soil productivity, ecosystem stability and potential to degrade the environment. Similarly, Maynard & Nault (2005) suggest that there are five major aspects of a farm that should be evaluated, acted upon and monitored. These are livestock facilities and infrastructure; land and nutrient management; soil erosion; energy efficiency; and biodiversity. These are based on the assumption that these are the correct aspects of the farm being assessed, that the assessment is accurate as possible, and that the farmer is actually able to implement the necessary changes. Since the environment supports all agricultural activities, it is reasonable to suggest that indicators of environmental well-being are paramount to other indicators. Jackson & Piper (1989) point out that if native species and habitats are necessary standards against which to judge agricultural practices, then the argument for their preservation may be widened to include the economics of the system. Jahn & Schenck (1991) echo this assessment in stating that they recognize that fish and wildlife are also a measure of land productivity. Most

importantly, their status is an important measure of the land's health and a good indication of whether we are carrying out management activities on a sustainable basis.

Zentner (1981) illustrates a physical measurement of sustainability with reference to the soil resource. He notes that since the soil resource used in agriculture is largely privately owned, producers can be expected to organize their activities in a manner that maximizes their private benefits. On the other hand, society desires to maximize the social benefits. There is a common interest in conserving the soil since failure to do so increases the marginal costs of production and reduces the future streams of private and social benefits. Raman (2006) indicates that soil quality is possibly the most useful determinant for monitoring and evaluating sustainability of agricultural management systems because it represents a holistic measure by which to assess ecosystem health. Sustainable production of healthy and nutritious crops depends on the maintenance of good soil quality. Defining, monitoring, evaluating and then enhancing soil quality is the most credible and fundamental pathway to sustainable agriculture (Raman, 2006). It is not always necessary to monitor the full data set of indicators; only those that are the most sensitive need to be monitored for future action. The link between soil quality and agricultural sustainability seems to be the most practical and logical way to monitor and ensure the sustainability of agriculture because the methodologies are well standardized, databases are available or can be built up, and the information-analyzing technologies are available. Furthermore, there is a wealth of information available in many parts of the world about soil conditions that pre-date the Green Revolution, thus resulting in a practical source of baseline data on the environment.

Agri-Environmental Indicator Project

The Agri-Environmental Indicator Project (McRae et al., 2000) is perhaps the study with the most relevance to indicators of sustainability in the Canadian agricultural sector. This detailed and complex report was undertaken by Agriculture and Agri-Food Canada in 1993 as a project to provide a tool set to farmers, government policy makers, environmentalists and the interested public for decision-making. This report was undertaken as a response to new environmental challenges facing agriculture as a result of “*new production methods and intensified production to meet society’s growing demand for agricultural products*” (p.3). Agri-environmental indicators in this report are defined as measures of key environmental conditions, risks, and changes resulting from agriculture and of management practices used by producers (p.4). The two main criteria used to judge the environmental sustainability of Canada’s agriculture are: how well it manages and conserves natural resources that support agriculture and; how compatible agricultural systems are with natural systems and processes (p.7). The Agri-Environmental Indicator Report is primarily concerned with the assessment of natural capital in agriculture in lieu of obtainable measures of social or economic sustainability. The project utilized a framework to identify indicators called the “Driving Force – Outcome – Response Framework”. This method recognized the driving forces that influence agricultural activities; the outcomes of these activities; and the responses by society to shape and ensure desirable outcomes (p.9).

Six broad groups of indicators were developed for the project that included environmental farm management, soil quality, water quality, greenhouse gas emissions,

agroecosystems biodiversity, and production intensity. The following list outlines these groups and their sub-components:

- 1) *Environmental Farm management*
 - a. *Soil Cover by Crops and Residue*
 - b. *Management of Farm Nutrient and Pesticide Inputs*
- 2) *Soil Quality*
 - a. *Risk of Water Erosion*
 - b. *Risk of Wind Erosion*
 - c. *Soil Organic Carbon*
 - d. *Risk of Tillage Erosion*
 - e. *Risk of Soil Compaction*
 - f. *Risk of Soil Salinization*
- 3) *Water Quality*
 - a. *Risk of Water Contamination by Nitrogen*
 - b. *Risk of Water Contamination by Phosphorus*
- 4) *Agroecosystem Greenhouse Gas Emissions*
- 5) *Agroecosystem Biodiversity*
- 6) *Production Intensity*
 - a. *Energy Use*
 - b. *Residual Nitrogen*

The indicators developed for this report were largely based on a biophysical perspective.

The authors admit that no attempt was made to quantify the costs and benefits of the conditions and changes estimated by the indicators in economic terms and further suggest that other gaps and limitations existing in the framework could be addressed in future bodies of work on the subject (p.19).

Social Indicators

Social indicators are less likely to accurately capture the real picture of sustainability in agriculture, but offer some insights into facets of the social structure of a farm, community, region or nation. Raman (2006) mentions that the social component is almost impossible to quantify. The UNDP Human Development Indicator (HDI) is a composite indicator that includes societal benefits to the economy such as literacy,

standards of living and life expectancy (UNDP, 2008). People, with their multiple concerns as varied members of society are the agents and arbiters of a sustainable agriculture, and their well-being is the most important indicator (Gertler, 1999).

Sustainable community indicators can enable comparisons between communities, but are most valuable when measuring a community within itself over time. An evaluation of six New England communities by Kline (1997) revealed that there are three strong motivations for change in a community: a sense of desperation, a desire to stay in place and a desire to improve quality of life. Kline (1997) goes on to outline some appropriate indicators for sustainable communities: economic security, ecological integrity, quality of life, and empowerment and responsibility. Sullivan (2003) adds that there are some basic indicators of the social component of agricultural sustainability: the farm supports other businesses and families within the community; money circulates within a local economy; there is a net increase in the number of rural families; farm succession is occurring; and college graduates tend to return to their home community. Hence, the goal of community sustainability is to improve, rather than to reach an end point.

Economic Indicators

The next set of indicators is the economic. Several types of economic indicators have been suggested for use in assessing the sustainability of agricultural systems. Usually, these are aggregate indexes, but these unfortunately can conceal serious deficits in systems. Among these are the Index of Sustainable Economic Welfare (ISEW), the Genuine Progress Indicator (GPI) in which the Gross National Product (GNP) is corrected by subtracting rather than adding social negatives like the cost of pollution clean up and adding rather than ignoring the value of unpaid services (Bossell, 1999). An

aggregate indicator that makes sense is the Ecological Footprint, or the almost equivalent Sustainable Progress Index (SPI). It measures the total land area that is required to maintain the food, water, energy, and waste disposal demands per person, per product or per city. This is an excellent summary indicator of the major environmental impacts of economic activity, but it does not – and is not meant to – capture the social dimensions of sustainable development for example (Bossell, 1999). The nuts and bolts of assessing a ‘sustainable agriculture system’ in terms of its economics lies in determining the net value of net output per unit input (Raman, 2006), in other words, the economic efficiency of the system. While there is some utility in aggregate indexes as mentioned above, adding external, unbalanced factors to the equation simply serve to make the calculation exceedingly complicated and the result difficult to interpret. The ‘bottom line’ is whether or not the system is making sufficient capital for those who are operating it to survive in the economic conditions in which they are living. For example, production systems that maintain environmental quality but can neither produce an adequate food supply nor provide sufficient economic rewards to primary producers cannot be regarded as sustainable. Similarly, agricultural systems that maintain relatively high levels of production but employ increasing amounts of inputs to offset the yield-reducing impacts of environmental degradation would be viewed as less than sustainable (Brklacich et al., 1991).

Multi-dimensional Indicators

Many studies into sustainable agriculture cover more than one perspective, indicating that the concept is complex and embraces issues relating to the biophysical,

social and economic environments. Therefore, a cumulative assessment of the sustainability of the system should be the best suited to producing a meaningful answer to the question of whether a system is sustainable or not. Characterization of sustainable agriculture by multiple qualitative indicators and attempts to integrate such indicators are consistent with interpreting sustainability as an ability to satisfy diverse goals (Hansen, 1996). Narrow definitions focusing on one or two perspectives such as resilience to disturbances (Conway, 1985) or environmental protection (IUCN, 1980) appear to be giving way to more broadly based definitions that explicitly consider the relationships among environmental quality, cultural preferences, and economic viability (Brklacich et al., 1991). Total Factor Productivity (TFP) has been proposed as a better measure of sustainability than yield alone for a complex system (Byerlee & Murgai, 2001), although Raman (2006) suggests that sustainability should be assessed holistically with specific reference to its components. These components are expanded upon by including productivity (non-declining), ecological effects, economic viability and social viability. Total Social Factor Productivity (TSFP) and Total Natural Resource Productivity (TNRP) are two such indexes that attempt to account for multiple factors by giving weight to non-economic aspects of sustainable systems. TNRP accounts for positive as well as negative effects to natural resources by using the cost of depreciation in natural or social capital. TSFP includes changes in non-market inputs and outputs and other externalities. Hence, a sustainable system by these definitions is one that presents a situation in which the index is non-declining over time (Raman, 2006). Byerlee & Murgai (2001) take issue with the theoretical assumptions of TSFP because of problems

encountered in measuring and valuing non-market inputs and outputs such as resource degradation and pollution. Certain factors that tend to elevate a measurement of TSFP, such as the adoption of new technologies may simultaneously disguise increased resource degradation within the same region (Byerlee & Murgai, 2001). If there is a consistent, longer-term negative trend in these measures, there is a very good chance that the problem is related to some underlying resource degradation, but this result is of little use in on-the-ground decision-making (Byerlee & Murgai, 2001). All of the above multiple factor indexes have a recurring problem with time scales. Without long-term historical or projective future data, inferences are difficult to make (Byerlee & Murgai, 2001). Despite these difficulties, TSFP has gained widespread acceptance with economists and agronomists as a good measure of a sustainable agricultural system. However, as Hansen (1996) cautions, diverse indicator sets have the potential to be difficult to interpret and do typically fail to provide mechanisms for the diagnoses of the causes of unsustainability in a system, or for evaluating the effects of proposed interventions. Much more attention is needed in the area of defining keystone indicators of the health of agro-ecosystems and their relation to productivity.

Policy Indicators

Wilson & Tyrchniewicz (1995) developed an extensive set of criteria for assessment of the effect of policies upon sustainability of agriculture. These criteria fell into nine general categories: management, conservation, rehabilitation, market viability, internalization of cost, scientific and technological innovations, trade policies, societal considerations and global responsibilities. The merit of the analytical framework was

tested by using it to assess the compatibility of 4 contemporary policies with principles of sustainable agriculture. In these case studies, the primary policy instrument adopted was evaluated according to its impact upon sustainable agriculture. The four policies tested were: *The Western Grain Transportation Act*; *The Farm Products Marketing Agencies Act*; *the Prairie Farm Rehabilitation Act*; and The North American Waterfowl Management Plan. The analysis found that the former two Acts were inconsistent with principles of sustainable agriculture in an overall sense, while the latter two case studies found that the PFRA (with respect to the Permanent Cover Program) and the NAWMP were consistent with sustainable agriculture.

Conclusion

There are numerous proposed methods for the measurement and assessment of sustainability in agriculture. Some of these are very specific in their respective spheres of interest within the three pillars of sustainability, while others are aggregate indexes that attempt to combine and simultaneously interpret qualitative as well as quantitative information. Is there an index that is most appropriate? I believe, as others have stated as well (Hansen, 1996; Raman, 2006; Stonehouse, 2004), that the best possible measure of the sustainability of a sustainable agriculture system is found in a measure that accounts for, in a realistic way, as many factors as possible. This requires that the components of these factors are easily measurable and that the aggregate result is easily interpreted. Personally, I appreciate the set of indicators proposed by Stockle et al. (1994), as they seem to capture the essence of all the required factors without unnecessarily complicating the calculation with a dizzying set of functions in high mathematical language. As pointed out earlier by Bossel (1999), the best system for assessment is usually that which

is the least complicated. This will allow real people who are managing real environments and real farms to assess their actions and those of their community in real time in order to discern real results.

4.4 Conversion from Industrial to Sustainable Practices

Agricultural progress is often embodied in change. Farms that progress are able to adopt new practices and new systems of cultivation and animal breeding, and thereby engender a new cultivated ecosystem. In this way, a new agrarian system emerges. Such a change in an agrarian system is called an agricultural revolution. In the course of time, agrarian systems in a given region can be born, develop, decline, and succeed one another in an evolutionary series characteristic of the region (Mayozer & Roudart, 2006). Literature on the conversion from intensive to organic farming is scarce (Lamine & Bellon, 2009). As Salamon et al. (1998) point out, cross-cultural information indicates that highly productive systems can be sustainable and it is therefore evident that adoption of sustainable systems is more of a social issue than it is a technological one. This work goes on to insist that broadening the adoption context to the farm-family and the community in which the decision-making takes place will help to explain on how adoption of sustainable farming systems are accepted or rejected.

Why Change?

In the western world, most farms are practicing agriculture in the current paradigm of chemical inputs, use of mono-cropping and industrial animals and are petrochemical intensive. The challenge in changing the world order towards systems that are sustainable over the long-term is in the changing itself. There are several questions that producers need to ask themselves in these regards:

1. Am I happy with the way things are at the moment?

2. Do I want to change?
3. Why would I change? Environment/Economics/Health/community/other?
4. Is a change practical?
5. What would I change?
6. Does the change make sense?
7. Can I afford to weather the transition period?
8. How do the proposed changes affect me/my family/ my community?

MacRae et al. (1990) found that the prime motivation for conversion to sustainable practices has been fears about soil and water degradation, and deteriorating human health. Further, in more recent times, a depressed economic situation is making an increasing number of farmers consider alternative practices as a method of cutting costs.

In a study conducted for the Canadian Organic Growers, it was found that concerns about the effects of chemicals on personal health and the impact that conventional farming has on soil quality and the environment was the number one reason that producers were switching from conventional farming to organic farming. A significant portion of the farmers who indicated this reason also reported that health problems within the family had helped them to make the decision to change to organic (Dwwyor et al., 2005). The next most prevalent reason for transitioning to organics was dissatisfaction with conventional practices. Low input agriculture will tend to appeal to farmers who face high debt loads, high interest rates, reduced credit worthiness and an inability to finance large input purchases at the beginning of each growing season (Buttell et al., 1990).

A study in four states (MN, IO, ND, MT) by Hoiberg & Bultena (1995) discovered that the most prevalent reason that farmers adopted sustainable practices were generally focused on the environment, then health, and usually third: economic reasons. Smaller numbers were influenced by personal philosophies or by peer groups, including their families. Generally, these farmers were younger (<30 years) when they made the shift, and very few were over 50 years of age.

Salamon et al. (1995) undertook a study in Illinois and determined the most common reason for a transition to more sustainable practices. The first of these was (for 60% of participants) a family tradition of innovation. Many of these farmers tried out new techniques because of encouragement of family members. The next common reason was an environmental or health trigger. Two-thirds of sustainable respondents indicated that they had shifted practices as a result of their environment or due to some health issue. Others indicated that a desire to live more prudently with a focus on self-sufficiency inspired changes on their farms toward sustainable practices. This group also consisted of a great number of personal innovators. It was also found that as many as 84% of farmers using sustainable practices in this study had a history of undertaking on-farm research or experimentation.

What are the Objectives of Change?

The objectives of change from conventional management to a sustainable system are numerous, yet simple in result. These objectives include the improvement of returns, enhancing the environment and building a strong community. As both Dwyyor et al. (2005) and Kirschenmann (1988) indicate, the building of healthy, fertile soils is a primary focus. Further, the reduction of pests and weeds is an objective that has dramatic

results in the long run, as these factors have a direct bearing on crop yields and quality. The reduction in dependency on chemical inputs is also an objective because of the potential this step has in terms of reducing costs, which lead to a better return. The management of weeds, pests and diseases through natural means are all components of this objective. In the case of transitioning to organic production, the establishment of organic farm management and the preparation for the marketing of organic crops are also important. Both authors above indicate that the establishment of a system that maintains a viable level of income is a primary objective.

All the above objectives are primarily concerned with economic, agronomic or regulatory objectives. In my own transition towards a sustainable farming system, a primary objective was to assure that the environment on my farm was protected and enhanced. This served a diverse purpose in its own right: it improved the health of my family and myself as well as that of our animals; it improved the habitat of wildlife and plants that may come to reside on our land, and it displayed to our neighbours and community a commitment to the ethics of a healthy system. Through these methods, we hope to build increased trust between ourselves and the public, particularly in our local area.

What are the Barriers/Difficulties/Challenges?

There are some considerable barriers to a shift in thinking and the subsequent shift in actions that move a farm from conventional production to a system that may be more sustainable. All too often, there is little in the way of support in a local area for producers who are interested in change. Salamon et al. (1998) as well as MacRae et al. (1990) reflect that this lack of support and the accompanying isolation that is felt can lead

to incredibly stressful situations both within the family as well as within the community. It is common for farmers to feel that neighbours are ridiculing them for their choices, particularly if the farm has made a shift that makes their choices very visible. Bromm et al. (2008) also found that social pressure was a significant barrier to change, as evidenced by the number of producers who spoke about ridicule from their neighbours. For instance, on our farm, we decided that including livestock in our production system was an important step for a variety of reasons. The result was a wonderfully diverse system of paddocks, pastures, hayland and fencing: but very odd looking in a landscape that consisted exclusively of grain and oilseed farms! I remember one neighbour asking me why I would waste such excellent cropland on pastures and hayland. Well, I replied, the tight nutrient cycling that is happening is going to make that land EVEN better and more productive! Altieri et al. (1983) discovered that social complications, rather than technical ones, are likely to be the most significant barriers to transition from high capital/energy systems to labour-intensive, low energy systems.

Aside from social complications that throw up barriers to change, there are obviously barriers that stem from issues of support for change. Certainly, support from our family and neighbours is an important issue, but the lack of support from society at large and government agencies poses a more all-encompassing problem. Salamon et al. (1998) and MacRae et al. (1990) indicate that government support is a major barrier to transitioning from conventional practices to sustainable ones. In the current economic climate in Canada, and particularly on the Prairies, it is difficult to separate oneself from some kind of government support program, insurance or regulation. Without the full weight of the government, at either the Provincial or Federal level, a major shift in

practices can be daunting to producers. There are issues of income, credit, access to useful research, ability to obtain appropriate technology, education, and access to public service (extension) that serve to block or at least slow the process of system reorganization on farms. Altieri et al. (1983) indicate that it is difficult to separate the biological limitations of a sustainable system from these other limiting factors. Pannell (1999) also notes that there is a correlation between the physical distance to information sources (agriculture offices, universities) and the adoption of new strategies. MacRae et al. (1990) suggest that access to region-specific information may make a significant difference in the difficulty of the transition process.

The perception of risk in transition periods also has a detrimental effect on making changes and the rate at which changes are made. Widely accepted technologies and practices tend to be viewed as reliable, although this can obviously be a false assumption. Nonetheless, shifts to methods that are ‘new’ or ‘untried’ have the potential to result in increased farm family stress because more complex management, more information, trained labour requirements, a degree of experimentation and more risk are involved (Salamon et al., 1998). This has the potential to build chronic family stress when risks of change are considered to be greater than those incurred with conventional systems. Hoiberg & Bultena (1995) also reported finding that the perception of risk and lack of support were significant barriers to adoption of new techniques.

Unfortunately, the results of many so-called ‘sustainable’ practices and systems are not as visibly evident to farmers as the results of conventional practices. Under conventional management systems, tillage, spraying, and fertilization often have an immediate and obvious effect: reduced weeds and increased yields/quality. Sustainable

management practices often have a more subtle effect, with increases in soil health, water quality and even enjoyment of life. These are all less visible and require a longer period to manifest. As Carolan (2006) indicates, not all farm operators “see” the benefits of sustainable agriculture in much the same way they do not “see” the detriments of conventional agriculture. Hence, technologies and strategies that are uncertain and whose benefits are less than crystal clear have been found to have lower adoption rates among farmers.

Time is another considerable barrier to adoption of alternative practices. As sustainable agriculture practices are based on several components that relate to inter-generational equity and future benefits, immediate success is not usually a recognized result. Certainly, farmers are concerned with the viability of the farm into the future, particularly when it comes to succession; either through inheritance or through its sale. However, ask any farmer how she/he usually plans and the answer will likely not go much beyond “next year”. Things will be better “next year”. I will plant this particular crop “next year”. Sometimes, when rotations are discussed, “the year after” comes up, but not without suitable disclaimers about what comes first. Indeed, some farmers are literally incapable of considering the future past next year because of the high degree of uncertainty that they experience as routine in their operations.

A study conducted by the Organic Agriculture Centre of Canada (OACC, 2008) concerning the research priorities of organic farmers in Manitoba revealed that some of the most significant barriers to the adoption and growth of the organic industry were issues relating to marketing difficulties, certification and regulation, and agronomic challenges.

What are the Requirements/Steps?

There are a considerable number of articles and publications that have examined the requirements and steps in the transition towards more sustainable practices in farming. Kirschenmann (1988) sees these requirements as being four-fold: the development of a suitable crop rotation; the implementation of a regenerative soil building system; some imagination; and sufficient time to accomplish the goals. Similarly, Dwyyor et al. (2005) outline five steps towards transition. Firstly, to visualize and set goals; second, to evaluate the resources on the farm (human, land base, climate, water, environment, and practices); third, to educate oneself; fourthly, to develop a plan of action; and lastly, take that first practical step.

MacRae et al. (1990) also discuss a similar framework for transition. These authors suggest that the development of an action plan composed of four key elements with a subset of twelve aspects. These are as follows:

1. *Farm Inventory & Needs Assessment*
 - *Physical, Biological & Human Resources*
 - *Assessment of input requirements*
2. *Soil Improvement*
 - *Organic matter management*
 - *Supplemental fertilization*
 - *Manure & slurry mgmt.*
 - *Crop rotation*
 - *Appropriate tillage*
3. *Agronomic changes*
 - *Stocking rate adjustment*
 - *Weed, insect & disease control*
4. *Economics*
 - *Marketing possibilities*
 - *Labour requirements*
 - *Yield projections & financial implications*

It should be noted here that MacRae et al. (1990) developed an extensive description of all the aspects that should be considered under this action plan. I will refer the reader to the original article for more insight as the list is highly detailed.

Horne & McDermott (2001) also outline some required steps towards sustainable agricultural practices. These authors indicate that these eight steps are utilized in their day-to-day research strategy at the Kerr Centre for Sustainable Agriculture in Poteau, Oklahoma. The steps are used to assist staff in the evaluation of proposed projects as well as part of an extension service provided to area farmers. The steps are as follows:

1. *Create and conserve healthy soil.*
2. *Conserve water and protect its quality.*
3. *Manage organic wastes without pollution.*
4. *Manage pests with minimal environmental impact.*
5. *Select livestock and crops adapted to the natural environment.*
6. *Encourage biodiversity.*
7. *Conserve energy resources.*
8. *Increase profitability and reduce risk.*

Pannell (1999) considered the subject of requirements for transition in a somewhat different manner, from the perspective of awareness. In this article, Pannell (1999) indicates that farmers must first be aware of possible innovations and their potential relevance to the farmer. Following that, farmers must recognize that a particular innovation or technique is feasible to attempt, and that it is worth trying. Next is the perception that the change actually promotes the farmers' goals regarding farm practices (particularly economic) as well as lifestyle objectives. Finally, the results must be readily observable in order for the farmer to persist with the strategy.

What is the Time Frame?

There are varying accounts of how long it will take to transition from conventional practices to sustainable ones. In some ways, it depends on the state of affairs on your farm when you first consider moving to something more sustainable. MacRae et al. (1990) advise that a successful transition may take from between three and six years because of the potential effects that residual toxins may have on the ability of natural processes to begin to work correctly. They further point to an initial yield reduction in a period that may last two to three years and then recovery becomes more apparent. However, Lamine & Bellon (2009) indicate that conversion to sustainable practices are an on-going process that may take anywhere from two years to an entire generation. This apparently would ensure the achievement of the dynamic equilibrium necessary to establish the environmental basis for a truly sustainable system. These authors also suggest that there are stages beyond the biological and technical that do not occur automatically in the process. These stages include the conversion of marketing strategies, values and links to various social networks and may require an indefinite time period, depending on the situation.

The most common form of transition is the one that occurs in a farm's move toward organic certification. Typically, this would require three years from the time that the last application of chemical fertilizers or pesticides (Dwwyor et al., 2005).

The Organic Producers Association of Manitoba (OPAM, 2009a) requires that 36 months with no prohibited inputs are required before organic status is offered. In the second year, any broken land is required to be inspected, although pasture and other unbroken land does not require this inspection. There is a one-year transition period for

livestock to become organic breeding stock and this breeding stock cannot be sold for certified slaughter purposes. However, offspring from organic breeding stock may be eligible for organic slaughter. Dairy animals have a minimum one-year transition before milk products are eligible for certification. Poultry must be under organic management beginning not later than their second day of life.

Conclusion

The hardest part about transition is that there is no recipe. Every farm is different, so talking to a number of farmers, and particularly good farmers in your own area, even if they are not organic, is a great idea. Take your time. Start paying attention to the needs of your soil and your animals and then the move to organic is easier (Dwwyor et al., 2005, p.viii). As Wilson & Tyrchniewicz (1995) advise, transition becomes more feasible when there are tangible economic, social and ecological benefits. The years that you spend making the move towards an operation that will last into the future will be worth the wait, even if they are the most difficult. Transitioning to sustainability really does require a change in the mind-set and philosophy of farming, more than a change in techniques or machinery. Some farmers suggest that the transition of the mind will take longer than the transition of the land (Bromm et al., 2008).

Chapter 5

Recommendations and Summary of Key Findings



“Everything happens for a reason... pick while we talk...”
Phillis Cairns in her garden, 2000 (Age 85)

Chapter 5 – Summary of Findings & Recommendations

5.1 Research Outcomes

After much musing and a considerable amount of hunting for themes amongst the bramble bushes, I came to understand that while making good of farming is a tough row to hoe, the impetus is really there. People from all walks of life have discovered some essential and basic tenets to living in such a way that will make the chances of living into the future pretty good.

The results of the survey did not produce a particular definition of what makes a farm or farmer sustainable. There is no particular median age, or minimum of number of acres, or income bracket any more specific than those that we would find in a cross-section of society in general. There is a wide range of people who are interested in improving their sustainability, and for a variety of reasons. Maybe it is just that: the median population is the diverse one! The motivations always came back to those three most important pillars of sustainability, usually in combination. I could pull out the odd example of someone who was more concerned with the money being made, or someone who had an outlook on environmental conservation that made their operation a wee bit financially unrealistic. Some people work well in their community and with their neighbours; others just want their own little piece of paradise and to be left alone to live their life the way they think is right.

Aspects of farming operations that were identified as being the most important to many of the respondents included the health of their soils, the ability to sell what they grow without having to lose the monetary value or integrity to some corporate interest in

the middle, and to be treated in an equitable manner by society; to be recognized for the work that they do in growing food for the masses.

Practices that were identified over and over again in the results included a wide range of old and new, tried and true. Strategic use of crop rotations, natural fertilization programs, grazing animals in ways that mimic natural rhythms, composting, minimizing reliance on anything petroleum-based, selling product directly to friends and members of the community, and just being happy with the simpler things in life!

5.2 Recommendations for Producers

Introduction

Well, I said I was going to write a section that might help farmers make the transition to sustainable practices, or help young folks out with their dream of moving to the country, or facilitate a better community based on rural aspirations. So here is that section. I want to give people who read this all the best information in a way that is easy to use and meaningful. However, as I have discovered, the quantity of information out there is sufficiently huge that I doubt if I could even ever read half of it, let alone summarize it and write it into this document. However, I have learned a thing or two and I have received a wealth of information from the survey respondents that I want to share in the last part of this thesis.

I have pondered how to organize this section so that it is useful and meaningful. The best way I could see how to do this was to do it from the bottom up. Hence, what has come forward from the surveys is perhaps the most important and shall be presented first.

From the Producers who did the Survey

Economic Anecdotes

Where to start? Well, in other sections of this document, I have tended to address issues of the environment or of agriculture first. So, in this section I will address the economics first. I found out a great number of things both expected and unexpected from the participants in terms of the way they make their living and how they obtain enough money to do what they need to do. Some gentle encouragement from the people who helped me with the survey pre-test steered me towards some of the potential questions to ask in the survey about making a living, without actually asking people how much they make. In any case, actual numeric values of income are not really that revealing; some operations bring in an enormous amount of gross revenue in a year but their expenses make it almost inconsequential in the end. Other people make close to no money in a year, but somehow maintain an exciting and rather wealthy existence (I want to be in that category!).

Taking control of your own marketing and selling of product seems to be a strong theme throughout this research. True, some of the respondents make a good go of it by going the usual route of selling crops to elevators or livestock producers as feed, but by and large, most of the people who responded indicated that they preferred to eliminate those “middle-persons” in favour of doing it themselves. Direct marketing is that method. Participants suggested that direct marketing was the best fit for the scale of production, the only way to readily access local markets, and offered some distinct competitive advantages. It was pointed out that direct marketing was the best way for a small operation to be profitable and to survive financially.

“We began direct marketing because we felt no one knew the values and benefits of our products more than we did. Therefore only we could promote them well enough to capture the value we needed.”

In terms of breaking into those local markets, respondents indicated that seizing opportunities to speak to a wide variety of people who are potential customers directly was a sure-fire way to encourage interest in products from the farm. The definition of the potential customer base was an important feature of this method of marketing, in order to take the guess-work out of the process. However, there were some definite suggestions for where to look for those customers too. Promoting the product at Farmers’ markets, on farm websites and through word of mouth had some obvious positive results for many folks. The aspect of keeping it local was also a recurring theme: several producers indicated that all of their product was sold locally. Co-operative groups were another preferred method of selling product.

Social Suggestions

This is a section that I have not found a parallel in any of the literature. There seem to be a lot of suggestions for how to grow crops, or raise livestock, or manage your money, or lobby the government, but very little on how to make your farm community a better place. This is not to say that an exhaustive review of the literature was completed in this regard, but in terms of the guides and manuals and websites and support groups that I encountered, it was an area that lacked something.

Identifying the needs of a particular community in conjunction with an assessment of its potential resources (natural, human, economic) can certainly help with goal setting. Some of these needs are as plain as the nose on your face, but often missed even though they are right under your nose! One particularly poignant identification of community by a participant was:

“A community needs a sense of identity, purpose and common long-term goals. It also needs to be optimistic of the future, and have hope of improvements in the quality of life of its citizens.”

Wow. If I had spent months looking in the literature for a quote like that, I don't think I would have found a more concise and holistic summary of the needs of community.

Thanks. Even though there are incredibly powerful forces at work with the intent of making money off farmers, there is still a sense of optimism and pride in the work that they do. Despair is being given a backseat to a purposeful way of life. Community co-operation provides a structure and a safety net for those who live in those communities.

As one respondent put it:

“Co-operation and help from neighbors and mentors has directly enabled the success of my farm. I think co-operation is the key for future small-scale farms and healthy farming communities.”

Of course, there are several components to creating or maintaining a healthy and vibrant society. I really want to put my two cents worth in here, but this is the section for the participants to say their piece. There are aspects to community that we want to maintain as well as those that we want to eliminate. Is it obvious that the items for maintenance would include those that foster a sense of well-being and equality? This participant indicated that the structures are there, but that we need to continue to work on them:

“Social health must be actively dealing with consumerism, materialism, sexism, racism and class in some way. In our community we have some mild, but positive mechanisms in place that are actively dealing with most of these issues. We need to build on these.”

There were other more philosophical outlooks on community, ranging from those of the local to those of the global. “Act locally and think globally” has become an oft-repeated phrase in the last few years, but how do this relate to farms and small rural communities?

Too often, globalization has been seen to have a detrimental effect on these groups, and has perhaps resulted in people feeling a bit protective of their own small community. However, when we look at the causes of the “evil” part of globalization, it can usually be shown that it is corporate players, rather than real people, who are at the root. There are many things that farmers in the Prairies have in common with farmers in many other parts of the world, and we need to recognize this and play our part in the support of others who suffer similar fates and enjoy similar benefits of being primary producers.

One particularly enlightened respondent gave this recommendation:

Find the middle path in an industrialized first-world nation during a time when third world realities exist. Act in solidarity with people everywhere who chop wood and carry water. ‘Before enlightenment, chop wood, carry water. After enlightenment, chop wood, carry water’.”

And another, perhaps somewhat more minimalist viewpoint:

“Thou shall not commit agriculture. Grow your own food and trade with people you know.”

Agri-Environmental

Farmers will be farmers as they say. And these farmers had a lot to say on the matter. As one would expect, there were a lot of little snippets and tips that were provided by these folks. Not to say that all of these little bits aren’t important, but there is hardly room to put them all in this document. I will try to summarize as best I can, and will try to remember that many of these folks have MANY more years of experience than I do.

The number one recommendation that came out of the surveys by far was the need to conserve, protect and rebuild the soil resource. Almost half of the respondents mentioned this aspect of their strategy specifically, and other by inference. The methods

farmers are using to accomplish this goal of soil care ranged from cover crops to shelterbelts to recycling nutrients and minimizing tillage passes. There is a great deal of literature that supports this point of view and rightly so! The soil is the base of it all and supports and supplies everything that grows on it, in it and above it.

The next most prevalent recommendation was to diversify the farming operation. This was suggested in several different ways, from planting multiple species crops or companion crops, to using good rotations that change all aspects of the crop from year to year to help minimize insect and disease pressures, to running several different kinds of livestock with different tastes for vegetation and grazing preferences. As this producer put it:

“Diversity is highly important. We are able to capture value of our animals (many species) right through to dinner table.”

And another, who had a diversity strategy that lent itself well to the economics of the operation:

“Diversification and flexibility of marketing is critical to our operation. I can sell 20 lambs, or 20 goats, or 20 calves, or 20 pigs in many different ways, but I can only sell 100 calves to one or two places.”

There were many other themes that were more of a personal nature that included keeping it simple, and recognizing personal limits as well as those of your land. In the last generation on many farms, the technological understanding and requirements has increased by a staggering degree. Where once was simple carburetion and closed-loop electronics, there is now computer-controlled diesel fuel injection and lap-top diagnostics. The day of the farmyard mechanic is

passing and with this goes the independence and innovation that farmers came up with in the face of challenges.

“Look around. All my machinery is 25 plus years old. I have two or three of everything, so if I need parts I can just move them from one machine to the next in case of a breakdown. Even with all this old stuff, I lose less time to breakdowns than guys with implements twenty years newer because I can fix my own machines.”

Other producers suggested reduction of machinery use through a number of strategies such as extended grazing, perennial crops, bale and swath grazing and just remembering the cost of fuel! There were a couple of respondents who used horses for horsepower. Imagine that! The tasks for which these mighty animals are used are not as complicated as combining, but easily accomplished simpler tasks that did not require PTO power, such as hauling bales to and from the field, and for skidding logs for firewood and fenceposts. I think that if you like horses and are physically able to handle them and the work they require, use them for simple tasks. It will save fuel and will feel great.

My Recommendations

- Forget about producing commodities; produce what you need for yourself first. Diversify or cooperate with others so that your operation is able to meet the needs of your family, then your community and then the demands of larger society. Once agribusiness sees that it cannot control your every move, it will make what it pays you for your product MUCH more attractive.
- Be skeptical. Ask questions. Don't believe everything you hear or read (or see on TV).

- Ask yourself if JUST farming is the way that you can make a living. If you need to take a huge bank loan to pay for the tools that you think you need to farm exclusively for a living, maybe you should farm a little less and do something or make something else?
- Ask yourself if the lifestyle is really what you want. It is quite likely that farmers of the future will not exactly be wealthy in monetary terms. Maybe if you want a really fancy house and a super-cool car, you should be a...banker?
- Don't go into debt if you can avoid it. The banks don't do anything for you. All they do is charge you for their help. Just look at the returns that stockholders in banks have seen over the years. Where do you think that money came from?
- Perhaps using older, second-hand equipment is the way to go. I would personally never buy a piece of machinery new off the dealership lot. Let someone else lose that immediate depreciation percentage. Similarly, learn how to fix your own equipment as much as possible. Shop rates these days are steep.
- Why let outsiders make all the money off your produce? Take the initiative and arrange for a really solid value-added process to occur right on your own farm. Selling oats for a pittance per bushel only to buy the very same stuff back in the form of cheerios at 50 times the price by weight is.... Questionable?
- Similarly, why should you shoulder the risk that production contracts hand to you? Grow something for a different market that is more flexible. Grow something that YOU think is less risky.
- Make your own rules. Why buy a franchise if you want to do your own thing? Or maybe that's a *farm-chise*?

- Don't put all your eggs in one basket. Sounds like old advice, but it is good advice. If you feel like you need crop insurance on every acre you grow to protect yourself from hail or drought, why not grow some other things that might not be as affected by those calamities? Try a whole bunch of different things all at once. As long as the equipment costs are reasonable, what's the difference what you grow as long as there is a market for the product?
- Don't just think like a farmer. Think like a businessperson as well. If you think you can get a better price for your product from some other avenue, go get it. Don't wait for the consumer to come to you. They don't know how to figure your section-township-range number.
- Get connected! Get the Internet. Get a mobile phone. Don't miss a call from someone who wants to do business with you. Proactively make connections. Go to festivals, events, conferences and talk to everyone you can. Find out what others are doing and borrow some of their good ideas. Work with people, first in your community and then in some of the next closest ones. Don't go too far afield, the fuel costs will hurt.
- Produce what sells, rather than selling what you produce. Start your business thinking with the marketing plan, rather than ending with it.
- Don't do the same thing year after year. Diversify. If grain prices are low, grow forages, and *vice versa*.

5.3 Recommendations for Government

Members of Parliament, Members of the Provincial Legislature and Municipal Council Members, listen up! This investigative piece of research was looking for a lot of things, most of them solutions but some are just ways to change the status quo for the better. So, this part is for you. I have spent an enormous amount of time watching the issues, listening to producers, hearing what educators have said, and observing the different levels of government go about their business. One of the most prevalent themes has been that the government isn't helping, either proactively or reactively. Yes, I think that we live in the greatest country on earth. Yes, I think that our style and system of government is good. However, I also think (and others have echoed this assessment) that elected officials have to some extent forgotten who they are working for and why they are in the position they are. Let me stress the word '*elected*' here. See also, '*public servant*'. Having been on the inside of that system for quite a while, I recognize what's happening. Working in that environment ends up making those who work in it feel insulated. It's sure nice to have job security like that, but it kind of feels like a game that you end up playing with other bureaucrats. Those in government who are the bosses of those in the bureaucracy have very short tenure. They've got four years to make all the changes they can and still save face in the majority of the public's eye, in hopes that they might get elected again. There's something of an "us" and "them" attitude between government and the public.

OK, all this is nothing new. That is a big part of the problem. It has been and will continue to be the same old pattern over and over again unless the public insists that the rules for how governments operate change. Or that the big stick aspect of government is

somehow minimized and more of the decision-making power is actually put back in the hands of the public, for whom the decisions are being made. Now, the likelihood of a complete overhaul in how governments operate is only a distant possibility. I think that the best way to undertake a change in how these things work is for the interested citizens to take up the challenge and make small decisions on their own. Sure, it is a reality in Canada that a huge portion of the population is disinterested, and quite possibly disenfranchised, and quite likely disheartened. Apathy has become as popular as the middle class, particularly with the middle class. The wealthy are the ones who have perhaps the best ability to make change, while the poor (like starving artists and dirt farmers) are those who need change the most and have the least voice with government. There used to be a significant socio-political movement on the Prairies that presented a voice for agriculture. Somewhere along the way, that voice lost its volume and got rationalized into other parties that had that single-minded goal of getting elected again as their primary platform.

This point has come up in this document before: there are two distinct trends working against farmers on the Prairies: over-regulation and under-representation. Does this need much explanation? Farmers are always voting for less regulation. Well, they do tend to get less regulated, but at the same time, the corporate players in the market seem to get even less regulated and less taxed, and still make way more money per dollar spent. Under-representation is an obvious problem for agriculture today. There used to be a really strong farm lobby, and even several farm political groups who were often in power on the Prairies. Now, even when we have a Prime Minister from the Prairies, he is always down in Ottawa, and has his hands full with the problems presented to him by that huge

population in Ontario and Quebec. Why would the Federal government do anything proactive for farmers on the Prairies? We have been muddling along fairly well for over a hundred years and every time the Federal government steps in to make a big change, everyone else in the country is screaming about how much money farmers are costing society.

There are also two opposing viewpoints on how government should be working to make this country the best place it can be for all concerned. The first is reactionary, concerned largely with providing knee-jerk programs to fix problems after they have occurred, like all the income support programs offered to farmers over the years (which keep having a new name, I suppose so that people will think that a new name means a new way of operating), and other examples like regulation of the industrial feeding practices of beef *after* the BSE crisis made raising cows a good way to lose your shirt. The second viewpoint is a system that has investigated the problems with society, including agriculture, industry, energy, community development, and lots of other facets, and makes proactive steps to change the problems before the results are felt by those on the bottom of the food chain (i.e. farmers). As the NFU (2005) suggests, the appropriate action is to solve the problem, not to continue to using band-aids.

Recommendations to Government from Professional Surveys

The recommendations for government contained in the responses to the professional surveys were a diverse group of suggestions from a diverse group of people. Although many of these people were academics, their insights showed that they have had a considerable degree of involvement with agricultural, environmental, economic and

social constructs. Rather than attempt to summarize or categorize, I have decided to list these recommendations, in no particular order, as they were written. They are as follows:

- Provide grants to small and young producers that have a plan to improve their agricultural business.
- Financial incentives for increasing soil health and carbon sequestration.
- More education of producers and consumers about what makes agriculture truly sustainable and how they can work together to create that sustainable agriculture.
- Quit subsidizing harmful practices and put some energy and dollars into making local areas self sufficient in food.
- Partnerships between regulatory agencies and industry would best allow producers to understand regulations and sustainability issues and adopt practices geared to help them (reference National Farm Stewardship Program).
- Government agencies must support small family farms and provide buffers to the ups and downs of markets when food is a commodity.
- One sees piles of leaves in cities just being dumped instead of composted. Civil servants could reverse this. One sees hundreds of trucks hauling topsoil from the country to the city where it is used to spread on lawns (instead of composted leaves perhaps). Every load of topsoil removed from the country is one load that is taken out of food production. This should be stopped.
- Develop public policies that reward sustainable practices. For example, I have suggested to Manitoba Crop Insurance that they should reduce premiums for farmers that do not grow wheat on wheat and have a good crop rotation. How about penalizing farmers that allow their land to erode instead of helping

municipalities clean out their ditches after a bad wind storm? Go with the Liberals
Green Plan: reward green practices while penalizing polluting practices.

- Develop legislation that deals with domestic food policy; develop programs that encourage producers to adopt sustainable agricultural practices ie; direct farm payments for fragile lands to be put in permanent cover; realistic reimbursement for farmers that are improving the soil (developing organic matter) thus capturing more carbon and reducing green house gas emissions.....I could go on and on.
- Provide more incentives and training and technical assistance to farmers.
- A significant increase in public research investment.
- Farmers do not want to have to rely on government programs to sustain their ranch. All they really require is a fair market price for their products which will keep up with the rate of inflation.
- Discourage chemical industry from biasing research in universities. Encourage chemical industries to provide more funding towards holistic, sustainable and organic agriculture. Provide incentives to the latter and tax the chemically produced produce, just like taxing tobacco to help pay for increasing health care caused by the use of chemicals and consumption of chemically produced produce.
- Invest in public educational and informational materials.
- Fund and assist farmers markets with start up funding and prevent restrictive legislation; restrict water use; restrict pesticide use; restrict GMOs; require that farms develop environmental management plans that include regional goals and targets -- so that people are working together and see their cumulative impact and

reduce it; require and enforce animal rights so that there is no abuse (animals are given an environment); reintroduce bison, wild turkeys, etc free-range in parks; develop a go local campaign; provide some start up and staff costing for a large scale good food box geared towards low-income similar to that of CHEP that uses local foods; encourage urban and peri-urban agriculture; allow very small scale animal husbandry in city (e.g., chickens).

- Regulatory measures have their place in society but an incentive approach can have more impact on the landscape in the long term.

My Recommendations for Government

As a farmer myself, I have a great deal of perspective on what really makes a farm tick. I see what other farmers are doing out here on the landscape and what seems to work and what is certainly not working. I see the problems that farmers encounter and have attempted to understand why these problems exist. My own recommendations for government include simple aspects of what governments are here to do:

- More assistance and support for farmers to accomplish what they and others have identified as strategies to improve the sustainability of farming as an occupation, a way of life and as an economic activity. I realize the reality of limitations to budgets, and funding, and of legislation in view of constraints such as NAFTA. But when farmers are asking for help in figuring out how to make a go of making food for our country and for the world, wouldn't it just make good sense to provide the help they are requesting? Funding must be more accessible, with fewer requirements for it to really make a difference. Given, I am not looking for loans that would simply provide a cheap way for me to make more money.

However, if I have identified a way to change my operation that will reduce its impact on the environment, or improve its economic efficiency, or that helps build new linkages towards the goal of a better rural community, why should that cost me the same rate of interest as a loan to a business that is only concerned with expansion in the name of profit?

- Another example is that of crop insurance. As a farmer, I am expected to put my entire life on the line every year with the goal of producing a crop for consumption by others. I am not necessarily growing a crop that will only feed my family and myself. Then, if the weather is bad and the crop fails, I get nothing for it unless I am paying premiums into crop insurance.
- Honest and realistic pricing of agricultural products. I saw one example of how a bushel of oats is worth pennies and a bushel of Cheerios is worth many dollars. Sure the breakfast cereal is a value-added product, but General Mills is able to obtain that bushel of oats for such a low price, process it and re-sell it for such a mark-up that it hardly makes it worthwhile for the farmer to grow it. If our government had some realistic control over minimum prices for grains, I think farmers would close the gap and make a more realistic living from growing products. Food in the developed world is just too cheap. Pay more or grow your own!
- Less regulation. Honestly, is there really a correlation between, for instance, legislation for commercial dairy and the reality of small-scale dairies? Governments need to think about scale. Sure, the big corporate operations need regulation for the protection of the public good, but what about the small-scale

folks who have that ethic built in to their every move? Education in matters relating to food safety would be a much more effective way of dealing with small-scale producers and their operations. Say, for instance, a requirement to take a short course in food handling? Perhaps the standard course offered by the city is not entirely appropriate for this situation, but could the Department of Agriculture not develop something that would work in this regard? I would take such a course and I know that many others would value the opportunity to take something of that nature.

- Realistic research and support for that research. Sure, research into the minutia of any number of aspects of agriculture is valuable, but so much of it is lost on the average farmer. I know that for myself, picking up a research paper that comes out of some of the research stations across the country, or something that is the result of studies conducted at the University is often a bit over my head. What about research into practical realities of farming? And why is it so easy for big corporate interests to get funding for research and not so for farmers who would like to try something innovative? There are several studies I have thought of in recent years that would make fascinating research projects, but the hoops I would have to jump through to get funding to undertake them has made me dismiss the idea of ever doing it in a way that would produce accessible results to the greater farming community. Do we really need to know what Monsanto thinks is the best way to grow canola, again? I think that they have proved their point, and in doing so have also proved quite conclusively that they really don't have the best interests of the farmer or the general public at heart. What really matters to them

is what they can report at their next shareholder meeting in terms of dividends.

- Revive the opportunities of the old Homestead Act: free land for anyone who can make a go of farming; offer un-used Crown lands, tax sale lands, etc.
- Finally, as I have advocated again and again in a variety of situations over the years, the time for talk is fading and the time for action is NOW. It is a great thing that there are so many people who are interested in the topic of sustainable agriculture and all its facets. We can study this and have focus groups and do research and hold conventions but, if we don't start DOING something about it NOW, where will we be in another generation? How do we do something about it? Well, that comes back to the points above.

5.4 Future Research Directions

In the prairies, a sustainable agricultural system must be able to maintain or improve production, conserve resources and produce no negative impacts on the environment, while simultaneously building a supportive community. Many issues have been suggested in the literature as being important research directions for the development of sustainable agriculture systems. Unfortunately, agribusiness interests appear to be paramount in the development of new technological packages while basic research on the sustainability of agriculture is neglected (Gertler, 1999). The attractiveness and profitability of research on issues and technologies that largely benefit big business has securely taken the reins of research out of the hands of farmers and tossed them to corporations. The presence of agribusiness corporations on university campuses is questionable in its ethics, at least in as far as conflict of interest issues. How can we direct objective research in our public institutions if the sponsor of the research is

a corporation that has a financial interest in mind? Typical of the Canadian research situation is the specialization of research facilities, with research itself becoming more market driven, and intellectual property and patenting issues restricting the dissemination of research. This is of particular concern to the progression of sustainability in agriculture because there is a need for systems information rather than just new applied technologies (Maynard & Nault, 2005).

It stands to reason that the sponsors of research should also be those who provided the research institutions themselves, i.e. the government, on behalf of the citizenry. Therefore, it would seem that there is a continuing role for government in research that is designed to benefit the public at large, rather than private corporate interests. There is undeniably a need for continued research onto increasing production, but this must be carefully balanced with the broader goals of system stability and food security. A well-rounded research program would therefore include agricultural ecology, long-term studies of agricultural alternatives, the environmental and social impacts of new systems of production, and research on the efficacy of practices that have been developed and refined in the hands of experienced and observant farmers (Gertler, 1999).

The real nuts and bolts of the direction of future research in agriculture in Canada must start at the beginning; the definition of criteria for sustainable agriculture production systems for local or regional units, and on the governing principles of biological systems as they relate to agroecosystems; and the development of criteria for the definition of ecologically stable and harmonic landscapes (Blum, 1998). We have to have a point in the continuum of sustainability to start the process. This simplification seems perhaps

somewhat unnecessary, but without a concise definition of all the related terms and a good baseline, it will be difficult to see what progress is made later.

Jackson & Piper (1989) point to the suitability of issues such as productivity, diversity, and stability of agroecosystems being well suited to hybrid research agendas. Indeed, the research that agriculture is about to embark upon cannot possibly be undertaken by any one discipline: it is multi-faceted and extraordinarily complex. Interdisciplinary teams that are equipped with highly-educated people who are well experienced in what is actually happening on the landscape will be needed to even decide where to start looking at issues such as the assessment of ecologically tolerable bearing capacities of landscapes, in view of the competition from other forms of land use and the definition of crucial links between agricultural and other socio-economic and technical production systems (Blum, 1998).

What Should We Research Today? (And Tomorrow)

Bird, Bultena & Gardiner (1995) found through consultative sessions in the Northwest Area Foundation's Sustainable Agriculture Initiative a wide range of areas of research interest that were highlighted by study participants. These included 1) whole-farm management that would go beyond the management of specific fields or crops and address the integration of multiple management problems. The next area of research interest was in 2) crop and livestock integration that would answer the questions relating to how crop and livestock operations can be better integrated to meet the environmental and economic goals of sustainability. 3) Crop protection was of course another area of interest. Pest management is a world-wide issue and participants were interested in having work done in the areas of strip cropping, crop diversity, crop architecture, field

margins, or landscape structure to disrupt the feeding patterns of pests and to improve habitat for their natural enemies. This included weed biology, weed ecology and weed response to different soils, nutrients and tillage practices. In the face of ever-increasing prices of inputs, 4) fertility management and the improved use of manure and legumes as a nitrogen source, improved availability of effective soil nitrate tests, and the development of nitrogen tests that account for nitrogen retained in OM in the soil were high on the list. 5) Soil maintenance strategies, such as winter cover crops that optimize the sustainability of the whole farm system, the means to measure, evaluate, and improve soil quality, including soil structure, soil biological activity, and effects of micronutrients came up again and again. In North America where so much of production agriculture is focused on livestock production, 6) the refinement of management-intensive grazing strategies, making grass or forage based farming more feasible, and the development of low capital investment hog and poultry operations that are profitable and address various societal concerns were of great interest. 7) New crops and crop quality are always a topic of interest and speculation with farmers. This group indicated that they would like to see research on the development of new crops that reconcile biological and economic sustainability, or improve management options for high-value crops that do so. Also within this topic was the desire to obtain more information on new plant species for their fit into existing systems and their potential economic viability, the evaluation of the effects of management practices on crop quality and the development of sustainable systems that meet the long-term needs of a growing population.

A study was conducted by Archer et al. (2008) utilizing an expert panel made up of nine representatives from a wide variety of scientific institutions that included rural

sociologists, agricultural economists and other agricultural and food system experts to ascertain the key issues in various social and political influences on agricultural systems. Research needs identified by the expert panelists included: the relationship between agricultural policy and health; risk behaviour on farms; the connections between obesity and the cost of healthy foods; the needs of limited resource farmers and the rural poor; the continual pressure on farms to become larger and more integrated towards the industrial buyer; and the opportunity for niche producers to serve more discriminating consumers.

The Organic Agriculture Centre of Canada conducted a survey and study of research needs as identified by organic producers in Manitoba (OACC, 2008). This study revealed that the top priorities as identified by the participants were managing soil fertility/quality/health; animal health and nutrition; managing weeds; and crop rotations. The lowest score in the rankings of research priorities was specialized equipment for organic systems. The OACC survey has considerable relevance to this study as it focused specifically on issues within Manitoba. The OACC also conducted this same survey in the other Prairie Provinces and in other parts of Canada, with varying results.

There are numerous areas of research needs that have been identified by a wide range of articles. There are those that focus on specific aspects of cropping systems and agronomy, such as Geng et al. (1990) who indicated that water-related aspects of production were an issue of high research need, Hassebrook and Bird (1995) who point to research on crop diversity, rotations and genetics as well as land use strategies; Zentner et al. (2001) who outline research results from numerous long-term field trials of rotations

intended to increase the sustainability of dry-land farming; and Nazarko et al. (2004) who examined Pesticide Free Production as an alternative cropping system for Manitoba.

Other authors have focused on the economic aspects of research into sustainable agriculture. Articles such as those from Belcher et al. (2003), Zentner et al. (2002a and 2002b), and Lerohl (1991) have taken a detailed look at the economics of production with an eye for sustainability.

Funding for Research: My Two Cents Worth, if I had two Pennies to Rub Together...

As Maynard & Nault (2005) point out, the demise of a nationally operated extension service has left in its place a loose network of programs, services, organizations and institutions providing some information and services to farmers. At the same time, an increasing component of this service is undertaken by private agri-business firms that also supply inputs to these farmers. This may not be the best choice for objectivity in advice if the “extension” representatives are also trying to sell product to farmers. Further, there is an increased presence of agri-business corporations undertaking research on universities or funding that research. This is obviously of benefit to the corporate bodies, as they get the best of the minds and the best of the facilities that public institution dollars have to offer. However, the results of privately-funded research coming out of public institutions has a distinct lack of objectivity, and ultimately has one goal in mind; to make increased profits for the corporation. Hardly the way that farmers are likely to get good quality research that is focused on realistic issues that they are confronting on a daily basis. I cannot realistically see a corporate entity funding research that would help to reduce the use of chemicals or narrow the income gap between producers and processors.

I would recommend that any research that is conducted on public institution campuses by a corporate entity be severely curtailed, or eliminated. Unfortunately, as the government has reduced funding for public institutions in recent years, this would likely mean that research would simply not happen in a timely fashion. Perhaps then, a tempered model would be that corporations wishing to utilize universities for research would be required to unconditionally deposit funding into a research account held in trust by the university for research into issues of which topics are identified by producers and non-corporate bodies in the agri-food sector. Maynard & Nault (2005) describe a similar system utilizing levies on commodities as a way to procure sufficient funds to expand research and extension efforts for sustainable agriculture practices. Hassebrook & Bird (1995) echo this suggestion in saying that public funds should be targeted towards the development of information and technologies for the public good. The NFU (2009), always a wealth of information and advocacy for farmers across the country, proposes that all government research dollars should go towards alternative, sustainable, organic, or chemical-alternative agriculture. This is because, as they note, chemical agriculture research is already well funded by large transnational corporations.

5.5 Final Discussion

The present state of agriculture in the developed and rapidly developing countries is one with several problems beyond soil erosion, fossil-fuel dependency, chemical contamination of the countryside, and genetic narrowing of our major crops. Family farms are being lost and rural communities are in decline — both consequences of the loss of capital from rural areas; this "cleverer-than-nature" approach rewards primarily the suppliers of inputs. Beyond the government subsidies to the suppliers of inputs (with

the farmer laundering the money), cited by our institutions for stabilizing our so-called food production system, is the looming problem of biotechnology (Jackson & Piper, 1989). In the future, sustainability in agricultural land use has to be reached on increasingly reduced areas and will only meet the challenge of sufficient production by intensification. In general, a more holistic approach to land use is needed, including ecological, socio-economic and technological aspects, thus enabling science to develop more comprehensive scenarios for sustainable development (Blum, 1998). Further, it will be necessary to reduce the economic and social barriers that inhibit entry into farming, especially for Aboriginal peoples, new immigrants, youth, and women. Breaking down barriers to entry into farming will also require experimentation with new organizational arrangements under which more people can participate in farming. Various models of multi-operator, multifamily production cooperatives, partnerships and joint ventures demonstrate the potential of organizational innovations beyond the single-family farm (Gertler, 1999). The requirements of sustainable agro- ecosystems clearly are not only biological or technical, but are also social, economic, and political and illustrate the requirements of a sustainable society. Ecological change in agriculture cannot be promoted without comparable changes in all other related areas of society. The final requirement for ecological agriculture is an attitude toward nature of coexistence, not of exploitation (Altieri et al., 1983).

What society desperately needs for its agriculture is an holistic and real process for change. This involves input from every available quarter, or at least everyone who is interested. This has the potential to build the best possible democratic solutions for issues that every citizen faces, whether they know it or not. I am not going to get into a huge

discussion of a potential framework here, because that is not what this thesis is for, at least in the short run. However, I see great potential for new structures on the Canadian Prairies in terms of our human, natural and social capital. There is good evidence that cooperative arrangements can have a profound effect on how society works, particularly if you can leave out the corporate players. Sure, they have the legal status equal to that of an individual, but they really aren't. They are just big organizational arrangements that have one thing in mind: to make money. Who are they going to make it from? Well, you, of course. In a cooperative arrangement, farmers, rural citizens and urbanites who want to, could be banded together to produce, process and distribute food and all sorts of products that are perfectly reasonable to expect to be able to produce in 'cottage' industry. We can have systems that utilize equitable allocation of resources, tools and distribution rights through the cooperative use and maintenance of aspects of the system such as machinery-sharing, collective landownership, community commercial kitchens, collaborative housing projects and intensive food production, and truly effective self-governance bodies and lobby groups. This will not be easy to implement, but once it's on its way, keeping it going will be as natural as breathing. This will provide mutually symbiotic relationships and arrangements for a bottom-up structure to society. And from what I've read in my lifetime, it seems that paradigm shifts are a rarity. They seem to only happen in the event of a calamity. Most of the time, change is a slow and steady process because it is initiated by people, from the bottom up; it is more like a paradigm shuffle, or maybe leaching!

5.6 Personal Reflections & Hopes

This study has taken a while and has cost me a few nights sleep, but all in all, it has provided me with some very satisfying results and new insights. I started out with a grand plan in mind to cover every possible aspect and every available nuance, and ended up covering only the most important of aspects and the nuances disappeared! Where this research took me is no surprise in itself, but what I discovered will continue to amaze me throughout my life. It is difficult to separate the research from the learning from the living now, as my life is increasingly consumed by the quest for a better way and a better life. I always knew, somehow, that my road through agricultural lands would be more than just farming. The research has become a deeper understanding of the world and of life's processes, happily leading towards some kind of personal epiphany and small-town utopia. The disconnect I felt throughout my twenties, maturing and living deep in the heart of the city strengthened my desire to live and work in a brighter place. The dreariness has lifted, like the clouds blowing off into the east after a storm.

I sometimes think quietly to myself about how I learned the things I learned that have sent me on this path. I think about the love and roots that my grandparents had for their land, for their place in life, for what they did to make the lives of those around them better. I realize that the peace that they felt came not from just religion, but from a spirituality that grew from their surroundings and their vocations. I can remember having some of the most poignant moments of my life sitting on top of a bale, or gazing over the river valley, or listening to the crickets chirping in the unbelievable darkness of the prairie night. How I long for those moments! But, somehow, I have re-created some of those times, some of those memories in my every day life.

I don't remember specifically when I realized how wonderfully important the world around me must be, but when I did, I made a motion to do something about it. The first manifestation of that intuition was the pursuit of peace in the world. This was followed by a keen interest in the natural wonders and the common sense of the environment. I followed this path without really knowing where it was taking me and discovered that a significant part of that was growing things. Then, I had the chance to get into agriculture in my own way, with friends who had the same thoughts, and suddenly I remembered! When I was a young boy, most of my friends wanted to be firemen, or policemen, or maybe doctors. But

Figure 5-1 – Aurora Farm, 2008



for myself, all I ever wanted was to be a farmer. Suddenly, there it was. I could be a farmer, without having to do it in a way that bothered my conscience.

There is a wealth of knowledge in agrarian societies. I have found numerous books, many studies and countless articles written by people who are truly interested in making the world a better place for all concerned. There is a true culture to agri-culture. Farming is a way of life, rather than just a way to make a living. A great deal of thinking and learning and research have occurred in this realm and rarely is it wasted. I see a

brighter future for people who want to live in a holistic manner with the earth, working with the earth to coax it to make what we need. Emergence truly is the method to employ: we need to let the earth make what it is able, without forcing it to bend to our will at the moment. The earth will let us know what it is capable of, in the long run.

Figure 5-2 – Cairns’ barn @ NE30-10-23W1 (ca. 1921)



Epilogue

It is time. Time for humanity to realize that something has gone terribly wrong. Time to wake up and smell the yerba matte. There is no time to lose, no time like the present; we are running out of time to continue with our collective inaction.

Stores here in Canada practically give away 15 pound bags of potatoes. I bought one today for \$2.98, no tax. That's... let's see... 20 cents a pound!?!? How is possible that food can be so cheap? It is as if the price of certain fresh foods has not increased in a generation. Perhaps that sheds some light on the demise of the Western Canadian farmer.

Our great country gives wheat away as foreign aid. Millions of tons of wheat shipped to the ports in the east and the west, loaded on huge ocean-going ships that consume unrealistically immense quantities of fuel, floated half-way around the world, unloaded into belching trucks and trains to be distributed to the poor of the poorest countries.

Wheat is sold out of Canada for less than it costs to produce it. Period. We grow more wheat in a year than we could possibly consume in a decade. And then we give it away. There are fewer and fewer people who know how to grow wheat every year. Surprised? We shouldn't be. Who in their right mind would even want to grow something in which there is no national pride, no sustainable livelihood, no hope?

Yet, there is another piece to the puzzle that is often missed entirely. There are millions of people who do not get enough food. They cannot grow enough food for themselves and are missed in the global accounting of who really needs food. These are the people who sometimes grow coffee, cocoa, bananas, tobacco and other cash crops for us here in the regions of plenty. Countries who invest so much in an agriculture that

provides nothing for their very own populace, an agriculture that encourages the destruction and over-consumption of natural resources as if they were endless, an agriculture that provides dineros for the pockets of the wealthy and leaves no cushion of safety for those who need safety in their food supplies.

I would venture to say that most, and I mean most... 99.999% of Westerners have no concept of what it means to be hungry. That same group quite likely has no clear picture of what it means to live in a region that is food poor. Some folks might have seen pictures of destitute, starving souls in some far off land, victims of war, pestilence or famine. Or all three. Rod Black stumbling over some cue cards about what some little kid's name is, Sally Struthers whining about how bad it all is. Guess what? It's way, way worse. Inconceivable for most of us.

Sometimes, the symptoms we see on the television or in the newspaper are just the tip of the proverbial iceberg. Sometimes, those symptoms are the result of some specific natural disaster, or social difficulty, or a little war. But what Rod and Sally don't show us are the people who live in regions that are mismanaged by their own governments. Regions that are ignored and exploited for what little they may have to offer and then abandoned to the vagaries of the weather and desperation.

Inequities of distribution, inequities of availability, inequities born of discrimination and miseducation. How is it that we in the Western world can turn such a blind eye to the situations of other humans? There are so many possibilities for equity, equality and equitability. Where shall we go from here?

For those who are interested and take the time to do a bit of sniffing around, solutions to many local, regional and global problems are not that difficult to locate. Trouble is, there is an immense corporate culture that has a monopoly on media and “popular” thought and they stand directly in the way of folks who want to find these desperately required solutions. A new world order based on greed, capitalism, consumerism, materialism and petrochemicals has a chokehold on common sense. And on common values, common ground, and of course, common folk.

Listen carefully. The “winds of change” are blowing and they sound like the howl of a blizzard. Ever been trapped outside in a blizzard? When the temperature is -30°C and the wind is 50km/h? You can’t even breathe. The winds of change are all too similar to a blizzard. Whatever doesn’t take shelter or find a way to adapt quickly will surely perish. It would seem that humankind has found a way to take shelter; by hiding behind the trappings of technology. A very few, wonderfully gifted and filled with hope, have learned that a new adaptation is at hand.

To work with the Earth and learn (or maybe just re-learn) her secrets has only recently gone out of fashion. Within a century, we have, as a species, gone from scarcely knowing the Earth to thoroughly dominating it. We have moved from an agrarian society by-and-large to an information society. We have moved from mechanical technology to subatomic nanotechnology. We have moved from the country to the city. And not the least, we have gone from a species OF the Earth to a species ON the Earth.

While I do point out the evils of technology and hyper-modernity, I do not discount the advances that technology has afforded us. At the very least, technology has given us the ability to recognize the mistakes we have made and are continuing to make.

Now we can easily do scientific tests for a host of factors that point to the quality of the environment around us. These tests can be a little disturbing though, so mature readers only please. Even within the scope of our ability to perform these tests on our habitat, within that so very short time frame, the baseline for most persistent chemicals has increased by orders of magnitude. These are the substances that sometimes get talked about in the back pages of newspapers and rarely in newsstand magazines. These are the substances that kill life, slowly but surely. We have been convinced by the corporate monsters that without these “miracle” substances and techniques, we would be in dire straights indeed. Trouble is, there hasn’t been nearly enough investigation into the effects of most of these substances. Sure, we know what things they will kill, we know what their expected half-life is, we know what their LD₅₀ is supposed to be, statistically speaking at least. How ever did humankind manage before the corporate chemical monster dreamt up the latest product?

A most frightening fact when it comes to agro-chemical use is that it is growing exponentially. How could it be, you ask? When we already use chemicals on so many fields? Well, it is much like drug abuse, or alcohol abuse... the more you use, the more you need to make it felt in the system.

Think back to your grandparent’s time, or maybe to your great-grandparent’s. That’s not that long ago. How did they manage? The further back you think, the less likely it is that folks would have had chemical advantages, or even to some extent, mechanical advantages (pardon the double entendre). Success was truly measured by how well a job you did of being a steward of the land you worked. By how well you were one with the Earth. For those who were failures were those who could not or would not blend

harmoniously with the natural forces encountered in attempts to **make a living**. This term certainly had different connotations back in the day, no?

Now, in the face of oil limits, humankind is still blindly running headlong into the embrace of technology for the answer to the ever-increasing problems of environmental quality and its deadly children, trace contaminants, instability and inequity. As Albert Einstein so profoundly intoned a hundred years ago, the kind of thinking that got us into the problem is not the kind of thinking that will get us out. Indeed, a drastic turnaround is needed. Perhaps even a paradigm shift in the way humankind thinks about how it acts as a species of the Earth. For without the Earth, we have nothing; we are nothing.

I see a light. An extraordinary light it is. It is guiding folks down a dark road toward a brighter, greener place.

Little can be done if we do not or cannot work together. It is time for a social revolution with no precedence. Let there be a time in the not-so-distant future when we look at all humanity as part of the web of life. Where there are no extraneous parts and there are always thoughtful reasons for what is decided. Harmony, peace, and food for all.

Oh, and a little piece of advice for the big multi-nationals like Monsanto, Cargill and all your buddies:

Don't run roughshod over all the little farmers... without them you guys would have nothing!

VIVA LA REVOLUCION!!

Literature Cited

- Advisory Panel on Food Security, Agriculture, Forestry and the Environment. (APFSAFE) **1987** *Food 2000: Global Policies for Sustainable Agriculture*. Report to the World Commission on Environment and Development. Zed Books, London, UK.
- Agriculture and Agri-Food Canada (AAFC) **2009** *Prairie Grain Roads Program*. Available online at: <http://www4.agr.gc.ca/AAFC-AAC/display-afficher.do?id=1181145691035&lang=eng> (Accessed 2 March 2009).
- Agriculture and Agri-Food Canada (AAFC) **2006** *Sustainable Development Strategy 2007-2009: Making Progress Together*. Public Works and Government Services Canada, Ottawa, ON, Canada. Catalogue No. A22-166/2007E.
- Altieri, M.A., D.K. Letourneau & J.R. Davis **1983** Developing Sustainable Agroecosystems. *BioScience* 33(1): 45-49.
- Ayoub, J. & L. Dignard-Bailey **2008** *Photovoltaic Technology Status and Prospects: Canadian Annual Report 2007*. CANMET Energy Technology Centre, Natural Resources Canada, Varennes, QC, Canada.
- Beingessner, P. **2004** *Rail Line Study Report*. North East Regional Economic Development Authority, Nipawin, SK, Canada.
- Bird, E.A.R., & B.J. Johnson **1995** "Future Research Needs", In: *Planting the Future: Developing an Agriculture that Sustains Land and Community* (Eds.) E.A.R. Bird, G.L. Bultena, and J.C. Gardner, Iowa State University Press, Ames, IA, USA.
- Blum, W.E.H. **1998** "Sustainability and Land Use." in *Sustainability in Agricultural and Rural Development*, (Eds.) G.E. D'Souza & T.G. Gebremedhin, Ashgate Publishing Company, Brookfield, VT, USA.
- Bossell, H. **1999** *Indicators for Sustainable Development: Theory, Method, Applications*. International Institute for Sustainable Development, Winnipeg, MB, Canada.
- Briggs, D.J. & F. M. Courtney **1989** *Agriculture and Environment: The Physical Geography of Temperate Agricultural Systems*. Longman Scientific & Technical, Essex, UK.
- Brklacich, M., C.R. Bryant, & B. Smit **1991** Review and Appraisal of Concept of Sustainable Food Production Systems. *Environmental Management* 15(1): 1-14.
- Bromm, J., B. Frick, & A.M. Hammermeister **2008** *Saskatchewan Best Organic*

Management Practices: Farmers' Perspectives. University of Saskatchewan, Saskatoon, SK, Canada.

Buttel, F.H., G.W. Gillespie, Jr. & A. Power **1990** "Sociological Aspects of Agricultural Sustainability in the United States: A New York Case Study" *In: Sustainable Agricultural Systems*, (Eds.) C.A. Edwards, R. Lal, P. Madden, R.H. Miller & G. House, Soil and Water Conservation Society, Ankeny, IA, USA.

Byerlee, D. & R. Murgai **2001** Sense and sustainability revisited: the limits of total factor productivity measures of sustainable agriculture systems. *Agricultural Economics* 26:227-236.

Canadian General Standards Board (CGSB) **2006** *Organic Production Systems General Principles and Management Standards*. Publication No. CAN/CGSB-32.310-2006. Canadian General Standards Board, Gatineau, QC, Canada.

Carolan, M. **2006** Do You See What I See? Examining the Epistemic Barriers to Sustainable Agriculture. *Rural Sociology* 71(2): 232-260.

Carson, R. **1962** *Silent Spring*. Fawcett Publications, Inc., Greenwich, CT, USA.

Cook, C.D. **2006** *Diet for a Dead Planet: How the Food Industry is Killing Us*. The New Press, New York, NY, USA.

Connelly, N.A., T.L. Brown, & D.J. Decker **2003** Factors affecting response rates to natural resource-focused mail surveys: Empirical evidence of declining rates over time. *Society and Natural Resources* 16: 541-549.

Conway, G. **1985** Agroecosystem Analysis. *Agricultural Administration* 20:31-55.

Conway, G. **1998** *The Doubly Green Revolution: Food for All in the Twenty-First Century*. Cornell University Press, Ithaca, NY, USA.

Corselius, K., S. Wisniewski & M. Ritchie **2001** *Sustainable Agriculture: Making Money, Making Sense*. The Institute for Agriculture and Trade Policy & Fires of Hope, Washington, DC, USA.

Creswell, J. W. **1994** *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. (2nd Edition) Sage Publications: Thousand Oaks, CA, USA.

Cruikshank, K. **1991** *Close Ties: Railways, Government, and the Board of Railway Commissioners, 1851-1933*. McGill-Queen's University Press, Montreal, QC, Canada.

D'Souza, G.E., J. Ikerd & L. Kemmet **1998** "Sustainability and Size: Are Small Farms

- More Sustainable?" *In: Sustainability in Agricultural and Rural Development*, (Eds.) G.E. D'Souza & T.G. Gebremedhin. Ashgate Publishers Inc., Brookfield, VT, USA.
- Duval, J. **2008** *Transition from an Agronomist's Point of View*. Organic Growers of Canada Inc., Ottawa, ON, Canada. Available online at: http://www.cog.ca/gainingground_AgronomistsPointofView.htm (Accessed 18 March 2009).
- Dwyyor, L., E. Heise, A. Macey, K. Simmons, & J. Wallace (Eds.) **2005** *Gaining Ground – making a successful transition to organic farming*. Canadian Organic Growers Inc., Ottawa, ON, Canada.
- Edwards, A.R. **2005** *The Sustainability Revolution: portrait of a paradigm shift*. New Society Publishers, Gabriola Island, BC, Canada.
- Environment Canada (EnvCan) **2009** *Narrative Descriptions of Terrestrial Ecozones and Ecoregions of Canada*. Available online at: http://www.ec.gc.ca/soer-ree/English/Framework/Nardesc/canada_e.cfm (accessed 9 January 2009).
Note: No copyright permission required for this material.
- Fairbairn, B. **2003** *The role of farmers in the future economy*. Centre for the Study of Co-operatives, University of Saskatchewan, Saskatoon, SK, Canada.
- Felsot, A.S. & K.D. Racke **2007** "Chemical Pest Control Technology: Benefits, Disadvantages, and Continuing Roles in Crop Production Systems". *In: A.S. Felsot & K.D. Racke (Eds.) Crop Protection Products for Organic Agriculture: Environmental, Health, and Efficacy Assessment*. American Chemical Society, Washington, DC, USA.
- Filson, G.C. **2004** "Introduction" *In: Intensive Agriculture and Sustainability: A Farming Systems Analysis*. (Ed.) G.C. Filson, UBC Press, Vancouver, BC, Canada.
- Food and Agriculture Organization (FAO) **1995** *World Agriculture Towards 2010*. (Ed.) N. Alexandratos. Food and Agriculture Organization and John Wiley & Sons, Chichester, NY, USA.
- Gardner, J.C., K. Jamtgaard, & F. Kirschenmann **1995** "What is Sustainable Agriculture?" Ch. 3 *In: Planting the Future: Developing an Agriculture that Sustains Land and Community*. (Eds.) E.A.R. Bird, G.L. Bultena, & J.C. Gardner, Iowa State University Press, Ames, IA, USA.
- Gertler, M.E. **1999** "Sustainable Communities and Sustainable Agriculture on the Prairies", *In: Communities, Development & Sustainability Across Canada*. (Eds.) J.T. Pierce and A. Dale, UBC Press, Vancouver, BC, Canada.
- Gertler, M.E. **2003** "Innovation, Durable Communities, and Long-Haul Economies". *In*

Farm Communities at the Crossroads: Challenge and Resistance, (Eds.) H.P. Diaz, J. Jaffe, and R. Stirling. Canadian Plains Research Centre, University of Regina, Regina, SK, Canada.

Glaser, B.G. **1992** *Emergence vs. forcing: Basics of grounded theory analysis*. Sociology Press. Mill Valley, CA, USA.

Gold, M.V. **1999** *Sustainable Agriculture: Definitions and Terms*. Special Reference Briefs Series no. SRB 99-02. Agricultural Research Service, United States Department of Agriculture, Beltsville, MD, USA.

Government of Manitoba (MBGov) **1994** *The First Farmers of the Red River Valley*. Manitoba Department of Culture, Heritage & Tourism, Historic Resources Branch, Winnipeg, MB, Canada.

Government of Manitoba (MBGov) **2007a** *Manitoba Agriculture Yearbook 2006*. Manitoba Department of Agriculture, Food and Rural Initiatives, Policy & Management Division, Knowledge Management Centre, Industry Intelligence Section, Winnipeg, MB, Canada.

Government of Manitoba (MBGov) **2007b** *Farm Practices Guidelines for Pig Producers in Manitoba*. Manitoba Department of Agriculture, Winnipeg, MB, Canada.

Government of Manitoba (MBGov) **2007c** *Manitoba Agricultural Profile, 2006*. Manitoba Agriculture, Food and Rural Initiatives, Knowledge Management, Industry Intelligence Section, Winnipeg, MB, Canada.

Government of Manitoba (MBGov) **2009** *Quick Facts – Industry and Resources*. Available at: <http://www.travelmanitoba.com/default.asp?page=132> (accessed 9 January 2009).

Government of Manitoba (MBGov) **2009b** *Manitoba Water Stewardship: Conservation Districts*. Available online at: <http://www.gov.mb.ca/waterstewardship/agencies/cd/index.html>. (Accessed 10 February 2009).

Gray, R. **1991** Economic Measures of Sustainability. *Canadian Journal of Agricultural Economics* **39**: 627-635.

Geng, S., C.E. Hess, & J. Auburn **1990** Sustainable Agricultural Systems: Concepts and Definitions. *Journal of Agronomy and Crop Science* **165**: 73-85.

Gregson, B. & B. Gregson **2004** *Rebirth of the Small Family Farm*. Acres USA, Austin, TX, USA.

Grewell, J.B., C.J. Landry & G. Conko **2003** *Ecological Agrarian: Agriculture's First*

Evolution in 10,000 Years. Purdue University Press, West Lafayette, IN, USA.

Hansen, J.W. **1996** Is Agricultural Sustainability a Useful Concept? *Agricultural Systems* **50**: 117-143.

Harwood, R.R. **1990** “The History of Sustainable Agriculture” In Clive A. Edwards, Rattan Lal, Patrick Madden, Robert H. Miller, and Gar House (Eds.) *Sustainable Agriculture Systems*. Soil and Water Conservation Society, Ankeny, IA, USA.

Hecht, S.B. **1995** “The Evolution of Agroecological Thought” In: *Agroecology: The Science of Sustainable Agriculture (Second Ed.)* (Ed.) M.A. Altieri, Westview Press, Boulder, CO, USA.

Hetherington, K. **2005** *Cultivating Utopia: Organic Farmers in a Conventional Landscape*. Fernwood Publishing, Black Point, NS, Canada.

Hoiberg, E.O. & G.L. Bultena **1995** “Adoption of Sustainable Agriculture” Ch.9 In: *Planting the Future: Developing an Agriculture that Sustains Land and Community* (Eds.) E.A.R. Bird, G.L. Bultena, and J.C. Gardner, Iowa State University Press, Ames, IA, USA.

Holmes, M. & A. Macey **2008** *Canada’s Organic Market*. Canadian Organic Growers Inc. (COG), Ottawa, ON, Canada.

Honadle, G. & J. VanSant **1985** *Implementation for Sustainability: Lessons from Integrated Rural Development*. Kumarian Press, West Hartford, CT, USA.

Horne, J.E. & M. McDermott **2001** *The Next Green Revolution: Essential Steps to a Healthy, Sustainable Agriculture*. The Haworth Press Inc., Binghamton, NY, USA.

Huang, W, & N. Uri **1999** *The Economic and Environmental Consequences of Nutrient Management in Agriculture*. Nova Science Publishers, Inc., Commack, NY, USA.

Ikerd, J.E. **1993** The need for a systems approach to sustainable agriculture. *Agriculture, Ecosystems and Environment* **46**: 147-160.

Ikerd, J.E. **2001** “Hallmarks of Sustainable Farming Systems.” In: *The Best of... Exploring Sustainable Alternatives; an Introduction to Sustainable Agriculture*. (Ed.) Hart Haidn, Canadian Centre for Sustainable Agriculture, Saskatoon, SK, Canada.

Industry Task Force II on 2,4-D Research Data (ITFII) **2008** *Welcome Page*. Available online at: <http://www.24d.org/>. (Accessed 4 February 2009).

International Union for Conservation of Nature and Natural Resources (IUCN) **1980**

World Conservation Strategy: living resource conservation for sustainable development IUCN-UNEP-WWF, Gland, Switzerland.

International Food Policy Research Institute (IFPRI) **1997** *World Food Prospects: Critical Issues for the Early Twenty-First Century*. (Eds.) P. Pinstруп-Andersen, R. Pandya-Lorch, and M.W. Rosegrant, International Food Policy Research Institute, Washington, DC, USA.

Jackson, James **1970** *The Centennial History of Manitoba*. McClelland and Stewart Limited, Toronto, ON, Canada.

Jackson, W., and J. Piper **1989** The Necessary Marriage Between Ecology and Agriculture. *Ecology* 70(6): 1591-1593.

Jahn, L.R. & E.W. Schenck **1991** What sustainable agriculture means for fish and wildlife. *Journal of Soil and Water Conservation* 46(3): 251-254.

Kendrick, J. **2008** *Organic: from niche to mainstream*. Catalogue No. 96-XIE2007000. Statistics Canada, Ottawa, ON, Canada.

Kidd, C.V. **1992** The Evolution of Sustainability. *Journal of Agricultural and Environmental Ethics* 5(1): 1-26.

Kirschenmann, F. **1988** *Switching to a Sustainable System: Strategies for Converting from Conventional/Chemical to Sustainable/ Organic Farming Systems*. The Northern Plains Sustainable Agriculture Society, Windsor, ND, USA.

Kirschenmann, F. **1991** Fundamental fallacies of building agricultural sustainability. *Journal of Soil and Water Conservation* 46(3): 165-168.

Kirschenmann, F. **2002** *A Revolution in Agriculture*. Presentation at the Glynwood Center in Cold Spring, NY, for the Connecting Communities, Farmers and Food conference, May 3, 2002.

Kishi, M. **2005** "The Health Impacts of Pesticides: What Do We Now Know?" *In The Pesticide Detox: towards a more sustainable agriculture*. (Ed.) Jules Pretty, Earthscan Publishing, Sterling, VA, USA.

Kline, E. **1997** "Sustainable Community Indicators: How to Measure Progress." Ch.12 *In: Eco-City Dimensions: Healthy Communities, Healthy Planet*. (Ed.) M. Roseland, New Society Publishers, Gabriola Island, BC, Canada.

Kramer, R.A. **2007** "Economic Valuation of Ecosystem Services" Ch. 11 *In The Sage Handbook of Environment and Society* (Eds.) J. Pretty, A.S. Ball, T. Benton, J.S. Guivant, D.R. Lee, D. Orr, M.J. Pfeffer & H. Ward, Sage Publications, Los Angeles, CA, USA.

- Krebs, C.J. **1994** *Ecology: The Experimental Analysis of Distribution and Abundance*, (4th Edition). HarperCollins College Publishers, New York, NY, USA.
- Lamine, C. & S. Bellon **2009** Conversion to organic farming: a multidimensional research object at the crossroads of agricultural and social sciences. A review. *Agronomy for Sustainable Development* 29:97-112.
- Leopold, A. **1949** *A Sand County Almanac*. Ballantyne Books, Oxford University Press, New York, NY, USA.
- Lerohl, M.L **1991** The Sustainability of Selected Prairie Crop Rotations. *Canadian Journal of Agricultural Economics* 39: 667-676.
- Lovins, L.H. **2005** *Energy and Sustainable Agriculture*. Presentation to The John Pesek Colloquium on Sustainable Agriculture, March 9, 2005.
- MacEwan, G. **1979** *Between the Red and the Rockies*. Western Producer Prairie Press, Saskatoon, SK, Canada.
- MacEwan, G. **1980** *Grant MacEwan's Illustrated History of Western Canadian Agriculture*. Western Producer Prairie Press, Saskatoon, SK, Canada.
- Macey, A. **2007** *Retail Sales of Certified Organic Food Products in Canada, in 2006*. Organic Agriculture Centre of Canada (OACC), Truro, NS, Canada.
- Macey, A. **2008** *Certified Organic Production in Canada 2006*. Canadian Organic Growers Inc. (COG), Ottawa, ON, Canada.
- MacRae, R.J., S.B. Hill, G.R. Mehuys & J. Henning **1990** Farm-scale Agronomic and Economic Conversion from Conventional to Sustainable Agriculture. *Advances in Agronomy* 43: 155-197.
- Madeley, J. **2002** *Food for All: The Need for a New Agriculture*. Fernwood Publishing Ltd., Halifax, NS, Canada.
- Manning, E.W. **1986** *Towards Sustainable Land Use: A Strategy*. Lands Directorate, Environment Canada, Minister of Supply and Services Canada, Ottawa, ON, Canada.
- Maynard, H. & Nault, J. **2005** *Big Farms, Small Farms: Strategies in Sustainable Agriculture to Fit All Sizes*. Agricultural Institute of Canada, Ottawa, ON, Canada.
- Mazoyer, M. & Roudart, L. **2006** *A History of World Agriculture: from the Neolithic Age to the Current Crisis*. Monthly Review Press, New York, NY, USA.

McCrorie, J.N. **1995** “Canada Eats Crow”. *Canadian Dimension*, Vol. 29, Issue 4.

McRae, T., C.A.S. Smith, & L.J. Gregorich (Eds.) **2000** *Environmental Sustainability of Canadian Agriculture: Report of the Agri-Environmental Indicator Project*. Agriculture and Agri-Food Canada, Ottawa, ON, Canada.

Monsanto Corporation **2005** *Backgrounder: History of Monsanto’s Glyphosate Herbicides*. Available online at:
http://www.monsanto.com/monsanto/content/products/productivity/roundup/back_history.pdf (Accessed 13 March 2009).

Morton, W.L. **1957** *Manitoba: A History*. University of Toronto Press, Toronto, ON, Canada.

Murchie, R.W., Wm. Allen and J.F. Booth **1936** *Agricultural Progress on the Prairie Frontier*. Vol. 5 of 9 in the series “Canadian Frontiers of Settlement”. The MacMillan Company of Canada Limited, Toronto, ON, Canada.

Murray, S.N. **1967** *The Valley Comes of Age: A History of Agriculture in the Valley of the Red River of the North, 1812-1920*. North Dakota Institute for Regional Studies, Fargo, ND, USA.

National Farmers Union (NFU) **1998** *Western Canadian Branchline Abandonment and Retention: Seeking a Least-Cost System for all Participants*. The NFU Third Submission to the Second Phase of the Grain Transportation Review, Ottawa, ON, Canada.

National Farmers Union (NFU) **2005a** *Solving the Farm Crisis: A Sixteen-Point Plan for Canadian Farm and Food Security*. National Farmers Union, Saskatoon, SK, Canada.

National Farmers Union (NFU) **2005b** *The Farm Crisis and Corporate Profits*. National Farmers Union. Saskatoon, SK.

National Farmers Union (NFU) **2009** *National Farmers Union Policy on Sustainable Agriculture*. Saskatoon, SK, Canada, Available online at:
<http://www.nfu.ca/sustag.htm> (Accessed 23 February 2009).

Nazarko, O.M., R.C Van Acker, M.H. Entz, A. Schoofs, & G. Martens **2004** Pesticide Free Production: Characteristics of farms and farmers participating in a pesticide use reduction pilot project in Manitoba, Canada. *Renewable Agriculture and Food Systems* 19(1): 4-14.

Neufeld, D. (Ed.) **2004** *Successful Small Farms in Southwest Manitoba*. The Agriculture

Committee of the Turtle Mountain Community Development Corporation,
Boissevain, MB, Canada.

Neufeld, D. (Ed.) **2007** *The Small Farm Challenge*. The Agriculture Committee of the
Turtle Mountain Community Development Corporation, Boissevain, MB,
Canada.

Neufeld, D. **2008** *Brooding Over the Next Generation of Prairie Farmers: Making Space
for Our Practical-Minded Youth*. Canadian Centre for Policy Alternatives,
Winnipeg, MB, Canada.

Norgaard, R. B. **1991** Sustainability: three methodological suggestions for agri-cultural
economics. *Canadian Journal of Agricultural Economics* 39: 637-645.

Organic Agriculture Centre of Canada (OACC) **2008** *Research Needs Assessment of
Manitoba Organic Farmers*. University of Manitoba, Winnipeg, MB, Canada.

Organic Food Council of Manitoba (OFCM) **2007** *Down to Earth: Guide to Organics in
Manitoba*. Boissevain Recorder, Boissevain, MB, Canada.

Organic Producers Association of Manitoba (OPAM) **2009a** *Exploring Certification
Options 2008*. Available online at: <http://www.opam.mb.ca/> (Accessed January 26,
2009).

Organic Producers Association of Manitoba (OPAM) **2009b** *History*. Available online at:
<http://www.opam.mb.ca/>. (Accessed 5 March 2009).

Paarlberg, D. & P. Paarlberg **2000** *The Agricultural Revolution of the 20th Century*. Iowa
State University Press, Ames, IA, USA.

Pannell, D.J. **1999** Social and economic challenges in the development of complex
farming systems. *Agroforestry Systems* 45: 393-409.

Papendick, R.I., L.F. Elliot, & R.B. Dahlgren **1986** Environmental consequences of
modern production agriculture: how can alternative agriculture address these
issues and concerns?. *American Journal of Alternative Agriculture* 1(1): 3-10.

Passioura, J.B. **1999** Can we bring about a perennially peopled and productive
countryside? *Agroforestry Systems* 45: 411-421.

Patriquin, D.G. **2001** "Systems for Sustainable Agriculture: Approaches, Tradeoffs and
Needs." In: *The Best of... Exploring Sustainable Alternatives; an Introduction to
Sustainable Agriculture*. (Ed.) Hart Haidn, Canadian Centre for Sustainable
Agriculture, Saskatoon, SK, Canada.

- Pierce, J.T. **1994** Towards the Reconstruction of Agriculture: Paths of Change and Adjustment. *Professional Geographer* 46(2): 178-190.
- Pretty, J. **1998** *The Living Land: Agriculture, Food and Community Regeneration in Rural Europe*. Earthscan Publications Ltd., Sterling, VA, USA.
- Pretty, J. **2007** “Sustainable Agriculture and Food Systems” Ch. 32 *In The Sage Handbook of Environment and Society* (Eds.) J. Pretty, A.S. Ball, T. Benton, J.S. Guivant, D.R. Lee, D. Orr, M.J. Pfeiffer & H. Ward, Sage Publications, Los Angeles, CA, USA.
- Pretty, J. **2008** Agricultural sustainability: concepts, principles and evidence. *Philosophical Transactions of the Royal Society B* 363: 447-465.
- Qualman, D. **2001** *The Farm Crisis and Corporate Power*. Canadian Centre for Policy Alternatives, Saskatoon, SK, Canada.
- Qualman, D. & N. Wiebe **2002** *The Structural Adjustment of Canadian Agriculture*. Canadian Centre for Policy Alternatives, Ottawa, ON, Canada.
- Racz, G. **1992** “Effects of Agriculture on Water Quality: Previous and Ongoing Studies related to Sediments, Nutrients, and Pesticides” – Manitoba. *In: National Workshop Proceedings – Agricultural Impacts on Water Quality: Canadian Perspectives (April 23-24, 1992)*. (Eds.) P. Milburn, W. Nicholaichuk, & C. Topp. Canadian Agricultural Research Council, Ottawa, ON, Canada
- Raman, S. **2006** *Agricultural Sustainability: Principles, Processes, and Prospects*. Food Products Press, Binghamton, NY, USA.
- Regehr, T.D. and K. Norrie **2009** *Crow’s Nest Pass Agreement*. Available online at: <http://www.thecanadianencyclopedia.com/index.cfm?PgNm=TCE&Params=A1SEC819041>. (Accessed 25 February 2009).
- Salamon, S., R.L. Farnsworth & D.G. Bullock **1998** “Family, Community and Sustainability in Agriculture” Ch. 5 *In: Sustainability in Agricultural and Rural Development*, (Eds.) G.E. D’Souza & T.G. Gebremedhin, Ashgate Publishing Company, Brookfield, VT, USA.
- Sands, G. R. & T.H. Podmore **1993** “Development of an environmental sustainability index for irrigated agricultural systems.” *In: Integrated Resource Management & Landscape Modification for Environmental Protection. Proceedings of the International Symposium, 13-14 December 1993*, (Ed.) J. K. Mitchell. American Society of Agricultural Engineers, Chicago, IL, USA.
- Savory, A. & Butterfield, J. **1999** *Holistic Management: a new framework for decision-making*. Island Press, Washington, DC, USA.

- Sell, R. S., G.A. Goreham, G.A Youngs Jr., & D.L. Watt **1995** *A comparison of sustainable and conventional farmers in North Dakota*. Agricultural Economics Miscellaneous Report no. 175. Department of Agricultural Economics, Agricultural Experiment Station, North Dakota State University, Fargo, ND, USA.
- Shaykewich, C., Holliday, N, Jeffrey, S, Kennedy, A., Mooney, S. & Woodbury, B. **1994** “Weather, climate and prairie agriculture”. In: J. Elliot, I. Morrison, I. and D. Kraft (Eds.) *Sustainability of Canada’s agri-food system: A prairie perspective*. Winnipeg: International Institute for Sustainable Development.
- Sheldrick, W.F. **1987** *World Nitrogen Survey*. World Bank Technical Paper, Industry and Finance Series, No. 59, The World Bank, Washington, DC, USA.
- Sheremata, D. **1995** “Carving up a dead Crow.” *Alberta Report/News magazine*, Vol.22, Issue 20. May 1, 1995.
- Starky, S. **2006** *Capital Cost Allowance*. Document No. PRB 06-06E. Library of Parliament, Parliamentary Information and Research Service, Economics Division, Ottawa, ON, Canada. Available online at: <http://www.parl.gc.ca/information/library/PRBpubs/prb0606-e.htm>. (Accessed 4 March 2009).
- Statistics Canada (StatsCan) **2004** *Farm Environmental Management in Canada Survey*. Catalogue No. 21-021-M2004002. Available online at: <http://www.statcan.gc.ca/pub/21-021-m/2004002/4144650-eng.htm>. (Accessed 4 February 2009).
- Statistics Canada (StatsCan) **2006** “Study: Canadian agriculture year-end review 2005”. *The Daily*, Monday, June 5, 2006. Available online at: <http://www.statcan.gc.ca/daily-quotidien/060605/dq060605b-eng.htm>. (Accessed 25 February 2009).
- Statistics Canada (StatsCan) **2008a** *2006 Census of Agriculture: Farm Population and total population by rural and urban population, by province*. Ottawa, ON, Canada. Available online at: <http://www40.statcan.gc.ca/101/cst01/agrc42a-eng.htm> (Accessed 27 January 2009).
- Statistics Canada (StatsCan) **2008b** *Historical Statistics of Canada*. Ottawa, ON, Canada. Available online at: <http://www.statcan.gc.ca/pub/11-516-x/sectionm/4057754-eng.htm> (Accessed 27 January 2009).
- Statistics Canada (StatsCan) **2008c** *Selected Historical Data from the Census of Agriculture – Section2: Agricultural perspectives from seven censuses, Canada and provinces: census years 1976 to 2006*. Available online at: <http://www.statcan.gc.ca/pub/95-632-x/95-632-x2007000/t/4185575-eng.htm>

(Accessed 27 January 2009).

Statistics Canada (StatsCan) **2008d** *Farm operators by sex and age, by province (2001 and 2006 Census of Agriculture)* Available online at:

<http://www40.statcan.gc.ca/101/cst01/agrc18a-eng.htm>. (Accessed 11 February 2009).

Statistics Canada (StatsCan) **2008e** *Number of households and average number of persons per household, Canada, 1881 to 1976*. Available online at:

http://www.statcan.gc.ca/pub/11-516-x/sectiona/A248_253-eng.csv. (Accessed 11 February 2009).

Statistics Canada (StatsCan) **2008f** *Hog Statistics Fourth Quarter 2008*. Catalogue No.

23-010-x. Available online at: [http://www.statcan.gc.ca/pub/23-010-x/23-010-x2009001-eng.pdf&t=Hog Statistics](http://www.statcan.gc.ca/pub/23-010-x/23-010-x2009001-eng.pdf&t=Hog%20Statistics). (Accessed 24 February 2009).

Statistics Canada (StatsCan) **2008g** *Table 1-8 Off-farm income and net operating income of farm families by province, unincorporated sector – Manitoba*. Statistics on

Income of Farm Families. Product No. 21-207-X. Available online at: <http://www.statcan.gc.ca/pub/21-207-x/2008000/5005973-eng.htm>. (Accessed 2 March 2009).

Statistics Canada (StatsCan) **2009** *Selected agricultural data, selected livestock data, Canada and provinces, census years 1921 to 2006*. Available online at:

<http://www.statcan.gc.ca/pub/95-632-x/2007000/t/4129740-eng.htm>. (Accessed 24 February 2009).

Stockle, C. O., R.I. Papendick, K.E. Saxton, G.S. Campbell, & F.K. van Evert **1994** A framework for evaluating the sustainability of agricultural production systems. *American Journal of Alternative Agriculture* 9(1&2): 45-50.

Stonehouse, D.P. **2004** Sustainability Issues in the Agri-Food Sector in Ontario, Canada. *Journal of Sustainable Agriculture* 23(3): 109-124.

Stozek, T.E.P. **2008** *BSE, Farmers and Rural Communities: Impacts and Responses Across the Canadian Prairies*. Master of Environment Thesis, University of Manitoba, Winnipeg, Manitoba.

Sullivan, P. **2003** *Applying the Principles of Sustainable Farming*. Appropriate Technology Transfer for Rural Areas (ATTRA). Available online at:

<http://www.attra.ncat.org/attra-pub/PDF/Transition.pdf>. (Accessed 17 November 2008).

Thompson, D. (ed.) **1995** *The Concise Oxford Dictionary of Current English* (9th Edition). Oxford University Press, Oxford, UK.

Chapter 5: Recommendations and Summary of Key Findings

- United Nations Development Program (UNDP) **2008** *Questions about the human Development Index (HDI)*. Available online at: <http://hdr.undp.org/en/statistics/faq/> (Accessed 16 March 2009).
- van Loon, G.W., Patil, S.G., & Hugar, L.B. **2005** *Agricultural Sustainability: strategies for assessment*. Sage Publications Inc., Thousand Oaks, CA, USA.
- Warnock, J.W. **2003** "Industrial Agriculture comes to Saskatchewan". In *Farm Communities at the Crossroads: Challenge and Resistance*, (Eds.) Diaz, H.P., J. Jaffe, and R. Stirling. Canadian Plains Research Centre, University of Regina, Regina, SK, Canada.
- Whitcomb, E. **1982** *A Short History of Manitoba*. Canada's Wings, Stittsville, ON, Canada.
- Williamson, S. & D. Buffin **2005** "Towards Safe Pesticide Management in Industrialized Agricultural Systems" Ch. 14 In: *The Pesticide Detox: towards a more sustainable agriculture*. (Ed.) Jules Pretty, Earthscan Publishing, Sterling, VA, USA.
- Wilson, A. & A. Tyrchniewicz **1995** *Agriculture and sustainable development: policy analysis on the Great Plains*. International Institute for Sustainable Development (IISD), Winnipeg, MB, Canada.
- Wilson, S.J. **2008** *Ontario's Wealth, Canada's Future: Appreciating the Value of the Greenbelt's Eco-Services*. The David Suzuki Foundation, Vancouver, BC, Canada.
- Wooding, S. **2006** *Cattle Crisis*. Fitzhenry and Whiteside Limited, Markham, ON, Canada.
- World Bank **1997** *Rural Development: From Vision to Action*. Study and Monograph Series 12. Environmentally and Socially Sustainable Development Department, World Bank, Washington, DC, USA.
- World Commission on Environment and Development (WCED) **1987** *Our Common Future*. Oxford University Press, Toronto, ON.
- Yestrau, M. **2008** *Holistic Management: A Western Canadian Perspective*. Master of Environment Thesis, University of Manitoba, Winnipeg, Manitoba.
- Zentner, R. **1981** *Economics of Soil Conservation in Western Canada*. Research Branch, Agriculture Canada Research Station, Swift Current, SK, Canada.
- Zentner, R.P., C.A. Campbell, V.O. Biederbeck, P.R. Miller, F. Selles, & M.R. Fernandez **2001** In Search of a Sustainable Cropping System for the Semiarid

Canadian Prairies. *Journal of Sustainable Agriculture* 18(2/3): 117-136.

Zentner, R.P., G.P. Lafond, D.A. Derksen, & C.A. Campbell **2002a** Tillage Methods and crop diversification: effect on economic returns and riskiness of cropping systems in a Thin Black Chernozem of the Canadian Prairies. *Soil & Tillage Research* 67: 9-21.

Zentner, R.P., D.D. Wall, C.N. Nagy, E.G. Smith, D.L. Young, P.R. Miller, C.A. Campbell, B.G. McConkey, S.A. Brandt, G.P. Lafond, A.M. Johnston, & D.A. Derksen **2002b** Economics of Crop Diversification and Soil Tillage Opportunities in the Canadian Prairies. *Agronomy Journal* 93(2): 216-230.

Zmaczynski, R. **1985** *The Effect of the Haber Process on Fertilizers*. Available online at: <http://www.princeton.edu/~hos/mike/texts/readmach/zmaczynski.htm>. (Accessed 4 February 2009)

NOTE: All photographic images presented in this document are the personal property of the author or of the author's immediate family. No Permission was or is required for these images to be presented in this document.

Appendix A: The Survey

Sustainable Farm Practices Survey

Persons involved in agriculture are those who should have the most direct and meaningful input into the direction that agriculture is taking now, and into the future. The purpose of this survey is to collect information concerning sustainable agricultural practices in order to encourage producers and to help lobby the government for appropriate support for programs aimed at enhancing the sustainability of Canadian prairie farms. This survey will:

- Provide you with an opportunity to comment on current conditions.
- Help further research into practices that will assist farmers in becoming more sustainable.
- Develop recommendations that will be submitted to Federal & Provincial Agriculture Departments.
- Contribute to a practical guide of sustainable practices for farmers and persons interested in farming as a lifestyle or career choice.

Please answer as many questions as you wish. If you do not know the answer or if you choose not to answer, the remainder of your answers will still be included in the survey results.

Anonymity is assured. The release of information collected through this survey will be in general terms only; no specifics will be attached to your name. If you choose to participate in the detailed personal interview, you will be consulted as to what information you are comfortable with being made more public.

Please return this survey to the researcher in the enclosed self-addressed, stamped envelope or fax it to (204) xxx-xxxx. If you have any questions, concerns or suggestions, please contact Kurt Dorward at (204) xxx-xxxx or by email at xxxxxxxxx@yahoo.ca.

Your ideas, opinions and perspectives are important to this study, and also important to many readers. Thank you for your time.

Section 1: Contact Information (optional)

Farm Name: _____

Names of Principle Individuals: _____

Mailing Address: _____

Telephone: _____ Fax: _____

Email address: _____

Section 2: Farm Operation

2-1 What do you raise on your operation?

Livestock	Number
Beef Cows/ cow-calf pairs	
Steers	
Heifers	
Feeders	
Bulls	
Dairy cows	
Horses	
Hogs – pastured/ barns (circle one)	
Sheep – meat / fibre (circle one)	
Goats – meat / fibre / dairy (circle one)	
Chickens – eggs / meat (circle one)	
Turkeys	
Geese/ Ducks	
Bison	
Ratites (Emus, Ostriches, Rheas)	
Camelids (llamas/ alpacas)	
Other (please specify)	
Crops	Acres
Wheat	
Barley	
Oats	
Other Cereals (please specify)	
Corn	
Canola	
Flax	
Pulses	
Vegetables	
Fruits (please specify)	
Herbs/ Spices (please specify)	
Bedding Plants	
Forages/ Hay	
Other	
Total Area	

2-2 Do you produce any value-added products on-farm? ____ Yes ____ No

If yes, what do you produce?

Chapter 5: Recommendations and Summary of Key Findings




2-3 Do you have a specific marketing plan? ____ Yes ____ No

What is your marketing plan?

2-4 How do you sell your products?

Canadian Wheat Board	<input type="checkbox"/>
Marketing Board	<input type="checkbox"/>
Co-op	<input type="checkbox"/>
Farm Gate Sales	<input type="checkbox"/>
Farmers' Market	<input type="checkbox"/>
Direct Marketing	<input type="checkbox"/>
Internet Marketing	<input type="checkbox"/>
Off-board/elevator	<input type="checkbox"/>
Production Contracts	<input type="checkbox"/>
Auction Sales	<input type="checkbox"/>
Other (please specify)	<input type="checkbox"/>

2-5 Organic Status

Status		Years
Certified Organic	<input type="checkbox"/>	
Transitional	<input type="checkbox"/>	
Non-certified Organic	<input type="checkbox"/>	
Organic Intentions	<input type="checkbox"/>	
No	<input type="checkbox"/>	

2-7 Are any of the following applicable to your operation?

Alternative Agriculture	<input type="checkbox"/>
Bio-dynamic Farming	<input type="checkbox"/>
Eco-Village	<input type="checkbox"/>
Eco-Farm	<input type="checkbox"/>
Community Supported Agriculture (CSA)	<input type="checkbox"/>
Permaculture	<input type="checkbox"/>
Holistic Management	<input type="checkbox"/>

Chapter 5: Recommendations and Summary of Key Findings

2-8 How many hours of labour are required for your operation in one year.

_____ Hours

2-9 Do you hire casual labour, contract labour, work-trade or salaried employees?

____ Yes ____ No

2-10 How many hours of labour per year are provided by non-family members?

_____ Hours

2-11 Which of the following methods do you utilize on your farm? (Check all that apply)

Conservation/Minimum Tillage	<input type="checkbox"/>
Zero-tillage	<input type="checkbox"/>
Precision Agriculture Technologies	<input type="checkbox"/>
Rotational Grazing	<input type="checkbox"/>
Swath Grazing	<input type="checkbox"/>
Bale Grazing	<input type="checkbox"/>
Summerfallow	<input type="checkbox"/>
Companion Planting	<input type="checkbox"/>
Cover Crops	<input type="checkbox"/>
Long-term crop rotation plans	<input type="checkbox"/>
Perennial Polycultures	<input type="checkbox"/>
Pesticide Free Production	<input type="checkbox"/>
Holistic Management	<input type="checkbox"/>
Delayed first hay cut	<input type="checkbox"/>

2-12 What size is your operation?

Owned _____ acres

Rented from others _____ acres

Rented out _____ acres

2-13 Do you operate a greenhouse for your own use or for producing plants for sale?

Yes _____ No _____

If Yes, what do you produce?

Section 3: Environment

3-1 As the first of the three pillars of sustainability, the natural environment supplies nutrients, water and other critical components for agriculture. In the recent past, all too often, environmental concerns and agriculture have been seen to be odds. Please answer the following questions by rating your agreement or disagreement.	Strongly Agree/ Yes	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree/ No	Don't Know/ Not applicable
I/we consider a healthy environment to be of utmost importance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Climate change is a concern for our operation.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Some farm-source pollution in the name of continued operation is acceptable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we minimize the use chemicals that have been shown to be harmful to aspects of the environment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we practice methods that minimize the use of petroleum and petrochemicals because of the damage that the by-products may do to the environment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we are aware of environmental damage to our farmland due to pollution over our lifetime.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we have completed the Environmental Farm Plan (EFP) process. (Y/N)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we have submitted application for / received assistance under the EFP grant program.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we employ methods that minimize the impact of livestock on the environment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we have in place, practices that protect water resources.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3-2 Which of the following practices do you currently have in place that help to protect the environment?

Riparian setbacks _____ Grassed Runways _____ Contour Planting _____
 Permanent Cover _____ Shelterbelts _____ Others (please specify) _____

3-3 Do you own/ maintain a woodlot? Yes _____ No _____ If so, what size? _____ acres

3-4 If your operation is within a Conservation District, do you participate in the programs it offers? Yes _____ No _____ Which programs? _____

3-5 Do you have any Conservation agreements or easements on your lands? Yes _____ No _____
 If so, what are the circumstances? _____

Chapter 5: Recommendations and Summary of Key Findings

3-6 Does any of your land share a border with a Special Conservation Area or Wildlife Management Area? Yes _____ No _____

3-7 Do you require water for anything more than household use? Yes _____ No _____
If Yes, for what do you require water? _____

3-8 What is your water source? Pipeline _____ Well _____ Creek/River _____ Lake _____

3-9 Is the source of good quality? Yes _____ No _____

3-10 Do you irrigate? Yes _____ No _____ If yes, how many acres?

Section 4: Economics

4-1 The bottom line is very important to all farmers. Balancing the economics of an agricultural operation with environmental and social components has the potential to increase the likelihood of long-term sustainability. Please answer the following questions concerning the economic sustainability of your operation using the scale provided.	Strongly Agree/ Yes	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree/ No	Don't Know/ Not Applicable
If severe adverse conditions occurred for more than one year, our operation would likely be able to persist.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we have sufficient savings to cover costs of a completely failed year.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If prices of the products from our farm fell drastically, I/we would be able to shift production to another sector without a large capital outlay.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Our income varies considerably from year to year.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we have a financially stable operation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If a sudden increase in price, or drop in availability of petroleum based products (fuel, lubricants, fertilizers, pesticides) occurred, our operation would be able to transition to a different operating strategy in a timely manner.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we are receiving or have received money from production insurance or income support programs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
From which program(s) have you received support?								
Do you have a professional accountant who looks after your financial management?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Chapter 5: Recommendations and Summary of Key Findings

4-2 Direct marketing of farm products has seen resurgence in recent years. This includes farm gate sales, farmer’s markets and marketing co-ops. Please answer the following questions if you are involved in some form of direct marketing. If you do not participate in direct marketing, please indicate why you do not.	Strongly Agree/ Yes	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree/ No Don't Know/	Not applicable
I/we practice direct marketing as a method of maximizing profits.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am involved in a farmers’ market on a regular basis.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we practice direct marketing by means of a marketing co-op.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we find that direct marketing is an effective practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we started in direct marketing because of poor performance from sales (elevator/CWB/single desk marketing boards etc.).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Please use this space to provide further comments concerning direct marketing.								

Section 5: Society

5-1 A healthy, vibrant community that is concerned with social justice and equality has been identified as a key component of a sustainable agri-culture. Please answer the following questions on the scale.	Strongly Agree/ Yes	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree/ No Don't Know/	Not applicable
I/we consider a healthy community to be essential.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we believe that we live in a healthy rural community.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we rely on other members of our community for support of one kind or another.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Friends or neighbours have helped us or received help from us in farming in recent years.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Social justice is important to me/us.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The population of our community has declined over the last two generations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Healthy rural communities are an essential for continued success of family farms.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Chapter 5: Recommendations and Summary of Key Findings

Please use this space to provide further comments concerning social issues in your community that contribute to its sustainability.

Section 6: Sustainability

6-1 Canada’s agricultural community is facing a crisis. While there are many strategies to overcome this crisis, there are fewer actual solutions being presented to producers. Federal and provincial governments have a leading role in finding solutions.	Strongly Agree/ Yes	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree/ No	Don’t Know/ Not applicable
A government representative has proactively contacted you to ascertain your needs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A government representative has asked for your input into solutions in your community.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A government representative has contacted you to advise you of potential problems in your region.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Government programs have given you solutions to specific problems.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Government programs have made your farm more stable in terms of economics.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Government programs have made your community more viable and better equipped to deal with crises.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Agricultural assistance/ income support/ insurance programs are important solutions to farm crisis issues.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Extension programs have provided you with realistic solutions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Upon encountering an agricultural problem, I/we would contact a private agronomist.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Chapter 5: Recommendations and Summary of Key Findings

6-2 Changes in farming practices are typically initiated by the farm manager personally and are usually informed decisions. Please indicate your opinion on the following statements.	Strongly Agree/ Yes	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree/ No	Don't Know/ Not applicable
I/we would change practices if it were pointed out that current methods were un-sustainable for our operation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Changes are not necessary for maintaining sustainability within my/our working lifetime.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we consider change to be a positive force in the betterment of our operation and quality of life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adaptability is a key component of our farm management plan.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we have diversified our operation to ensure its stability.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A succession plan is a crucial part of farm management.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6-3 In your opinion, what three practices on your farm contribute the most to your long-term sustainability and why (please attach separate page if more space is required): 1. 2. 3.								

6-4 Personal choices in practice on farms often defines the degree of sustainability realized. To what degree have your choices of practice helped your farm operation to become more sustainable?	Strongly Agree/ Yes	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree/ No	Don't Know
My choices in techniques have improved the sustainability of this operation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My choices in techniques have improved the profitability of this operation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My choices have been influenced by a desire to be more environmentally sensitive.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My choices have been influenced by a reaction to market trends or crises.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My choices have been influenced by a desire to be more profitable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 7: Practical Strategies for Sustainability

7-1 Technology Technology has provided increasing numbers of advantages to farmers over the years, ranging from instrumentation to machinery to chemicals. Please indicate your opinion for the following statements.	Strongly Agree/ Yes	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree/ No	Don't Know
My/our farm operation has been improved by technological solutions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
While making my/our operation more efficient, technology has increased the complexity of decision-making.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
There are technological aspects of my/our operation that I/we would discontinue if a better option were available.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I/we consider my/our operation to be "high-tech".	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My/our recent technology choices have been influenced by extension programs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My/our recent technology choices have been influenced by advertising.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My/our recent technology choices have been influenced by sales people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GPS technology has improved the efficiency of our operation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My/our choice when purchasing new equipment is usually based on their efficiency/emission ratings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improvements in capabilities of implements has improved the profitability of our farm.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7-2: Alternative Energy

1. Does your farm utilize alternative energy sources? Yes _____ No _____
2. What portion of your annual electrical requirement is produced/replaced using these systems (%)?
3. What portion of your annual heating requirements is met with these systems (%)?
4. What type of heating system do you have in your home? _____

Energy Source	Y/N	Percentage of electrical	Percentage of heating
Photo-voltaics (solar panels)		%	%
Passive Solar		%	%
Wind Power		%	%
Micro-hydro		%	%
Bio-fuels (pellets etc.)		%	%
Wood-fired appliances		%	%
Geo-thermal		%	%

If you do not utilize any of the above alternative energy systems, please indicate why not.

7-3 Animal Power

Does your farm utilize animal power for some or all of our draught or other requirements? Please specify to what degree animals (horses, oxen, mules, llamas, goats) are used for farm operations.

In the face of drastically increasing petroleum prices, would you consider using animal power for some of your on-farm tasks in the future? If yes, expand on what animals you would use and in what capacity.

Yes

No

7-4 Manure Management

If you raise animals, how do you manage the manure produced?

7-5 Food and Material Self-sufficiency

Being completely self-sufficient or even to a certain degree is a strategy that contributes to sustainability. Please indicate your opinion in regards to the following statements.		Strongly Agree/ Yes	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree/ No	Don't Know/ Not applicable	
I/we grow fruits/ vegetables on our farm that provide a significant portion of our annual requirements.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
I/we raise animals that are used to provide a significant portion of our annual protein (meat) requirements.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
I/we raise animals that produce secondary products that we consume (eggs, milk).		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
I/we raise animals that produce fibre (sheep, alpacas, llamas, goats, rabbits) that we use directly for production of clothing and/or fabrics.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
I/we attempt to raise sufficient products to minimize our purchased grocery requirements.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
I/we make some or all of our own clothes.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
I/we recycle (metal, fabric, wood, biomass, paper, plastic, etc.).		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
If you have unique strategies for recycling, please share them with us!										
I/we compost our kitchen wastes; barn waste, spoiled crops/garden products; deadstock.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
How do you use your compost?										
Please check of any of the following household tools that you have/use in your operation.										
Butter Churn	<input type="checkbox"/>	Sewing Machine	<input type="checkbox"/>							<input type="checkbox"/>
Cream Separator	<input type="checkbox"/>	Serger	<input type="checkbox"/>							<input type="checkbox"/>
Spinning Wheel	<input type="checkbox"/>	Dehydrator	<input type="checkbox"/>							<input type="checkbox"/>
Loom	<input type="checkbox"/>	Others? (please specify)	<input type="checkbox"/>							<input type="checkbox"/>

Chapter 5: Recommendations and Summary of Key Findings

7-6 YOUR Strategies

Please describe some or all of the strategies that you have employed/ are using/ intend to use that you think are innovative and have helped you move toward long-term sustainability. This could include techniques, inventions, practices, equipment etc.

8. Demographics

8-1 What is your age?						
8-2 What is your gender?						
8-3 How many years have you been farming/ranching?						
8-4 How many years/ generations has your family been farming/ranching?						
8-5 How many people live on your farm/ranch?						
8-5 How would you define your work situation? (Check one)						
Full time farmer/rancher						<input type="checkbox"/>
Mostly farming, some non-farm/ranch work						<input type="checkbox"/>
About equal amounts of off-farm/ranch work and farming/ranching						<input type="checkbox"/>
Mostly non-farm/ranch work, some farming/ranching						<input type="checkbox"/>
All non-farm/ranch work						<input type="checkbox"/>
Retired farmer/rancher						<input type="checkbox"/>
Other (please specify)						<input type="checkbox"/>
8-6 What is your highest level of education and in what discipline?						
8-7 What is the legal land description of your home quarter?						
LSD	Quarter	Section	Township	Range	Meridian	

THANK YOU for your input!